Construction Manual

M 41-01

Washington State Department of Transportation
Construction Office
Transportation Building 47354
Olympia, WA 98504-7354

Important

A current *Construction Manual*, as of June 1, 1996, should consist of the following:

Subject	***Page***	***To***	***Page***	***Revision Date***
Table of Contents				None
Chapter 1	Table of Contents			June 1996
Chapter 1	1-1		1-97	June 1996
Chapter 2	Table of Contents			June 1996
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Chapter 8	Table of Contents			June 1996
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Chapter 9	9-1		9-71	June 1996

WSDOT Test Methods listed on page 9-70.

Test Methods 102 to 119	January 1994
Test Methods 609 to 613	August 1988
Test Methods 705 to 713	January 1994
Test Methods 714 to 716	August 1988
Test Methods 720 to 801	January 1994
Test Method 802	November 1993
Test Methods 803 to 914	January 1994

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Chapter 10	Table of Contents			June 1996
Chapter 10	10-1		10-23	June 1996
Chapter 11	11-a		11-h	June 1996
Chapter 11	11-1		11-94	
Index				June 1996

If your manual does not include any of the above revisions, you may underline the needed sections on this sheet and return it to your regional or Olympia Service Center representative who, in turn, will order the required quantities from:

Engineering Publications
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Foreword

This manual has been published to provide our engineering personnel engaged in construction work with a convenient guide for the procedures and methods that are acceptable for the construction of state highway projects under engineering supervision of the Washington State Department of Transportation. Included, also, are detailed guidelines for the documentation of work received and the keeping of records which are essential to proper accounting for the adequacy of work and the payments made.

The *Construction Manual* is not intended as a textbook of highway engineering, but rather as a reference book of instructions consistent with the *Standard Specifications*. It is essential that the user has a thorough understanding of the specifications as well as this manual. It is the intent of this manual to interpret and clarify established general policies applicable to the work and to furnish basic guides for dealing with problems that arise during construction operations.

It is recognized that it will not be possible to accomplish precise and complete adherence to all instructions because of the variance of project conditions that will be encountered, but it is expected that the need for variance from the guiding principles will be minimal.

Many of the instructions herein contained are general in character and are not to be construed as replacing, modifying, or superseding any of the provisions of the specifications, plans, or contract.

All engineering personnel involved with construction inspection should study and become familiar with the contents of this manual and should follow its techniques as closely as practicable.

JOHN F. CONRAD
Assistant Secretary for Field
Operations Support Service Center

METRICATION

Throughout this manual, metric (SI) units are used as the primary unit with English units following in parentheses. Metric conversion of English units is generally in accordance with ASTM E 380 and AASHTO guidelines. In some cases, metric conversion has been rounded to a practical value rather than a precise conversion. Industry standard metric values have been adopted where available.

A project designated METRIC or ENGLISH in the contract documents shall be administered in the designated units to avoid the confusion and inaccuracies that can result from conversion.

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1-1 General Information

1-1.1 Purpose and Scope of Manual

This manual is published primarily for the guidance of engineers and inspectors assigned to the construction of highways and bridges.

Standard recognized and approved engineering practices are described. The instructions are intended to effect uniformity of methods and results, to establish standard requirements, to serve as a guide for those engaged in this class of engineering work, and to prescribe approved methods of engineering and inspection practice on contracts awarded by the Washington State Department of Transportation (WSDOT).

Each employee having charge of engineering and inspection work should be familiar with these instructions and should carefully study them in connection with the *Standard Specifications* in order that uniform methods and results will prevail among all Regions of WSDOT.

One method for any employee to suggest changes in policy or the way WSDOT does business is to propose or recommend changes to the *Standard Specifications*, General Special Provisions, and this *Construction Manual* by submitting DOT Form 420-012. A copy of this form is shown in Chapter 11 of this manual. All employees are encouraged to submit recommendations that will improve WSDOT.

1-1.2 Definition of Terms

In the interpretation of this manual, any words or terms shall be construed the same as set forth under "Definitions and Terms" in Section 1-01 of the *Standard Specifications*. If conflict occurs between the instructions in this manual and the specifications, the latter shall prevail.

1-1.3 Department Organization

1-1.3A Legislature

The 1977 Legislature established the Washington State Department of Transportation (WSDOT). All authority and functions of the Highway Commission, the Washington Toll Bridge Authority, and the Aeronautics Division were transferred to the new department. Policy making authority was vested in the Transportation Commission while administrative authority was vested in the Secretary of Transportation.

1-1.3B Transportation Commission

The seven members of the Transportation Commission are appointed by the Governor for staggered six-year terms. The Commission is vested with authority to establish policy for WSDOT and to approve and propose to the Governor and to the Legislature the biennial budget for WSDOT. The Commission reviews and authorizes all departmental requested legislation and exercises continuing review and control of WSDOT's operating budget.

1-1.3C Secretary of Transportation

The Secretary of Transportation is appointed by the Commission and subject to the Commission's policy guidance and serves as chief executive officer of WSDOT with the full administrative authority to direct all of its activities.

1-1.3D Deputy Secretary for Operations

The Deputy Secretary for Operations is the principal assistant to the Secretary of Transportation for operations matters.

In the absence of the Secretary, the Deputy Secretary for Operations is authorized to act on all operations matters except those specifically reserved by statute for the official action by the Secretary of Transportation.

The Deputy Secretary for Operations exercises general supervisory control over the Assistant Secretaries in charge of major functional areas at the Olympia Service Center and the Regional Administrators.

1-1.3E Assistant Secretary for Field Operations

The Assistant Secretary for Field Operations reports to the Deputy Secretary for Operations and is responsible for all matters pertaining to contract ad and award and execution of all construction contracts, except those executed by the Regional Administrators and the Director of Washington State Ferries. The Assistant Secretary for Field Operations is responsible for administration, through the Regions, of all WSDOT contracts, except those executed by the Director of Washington State Ferries. The Assistant Secretary for Field Operations is responsible for all materials, laboratory, and soils functions affecting design, construction, and research; all highway maintenance activities; and the Equipment and Facilities Office.

Field Operations Support Service Center

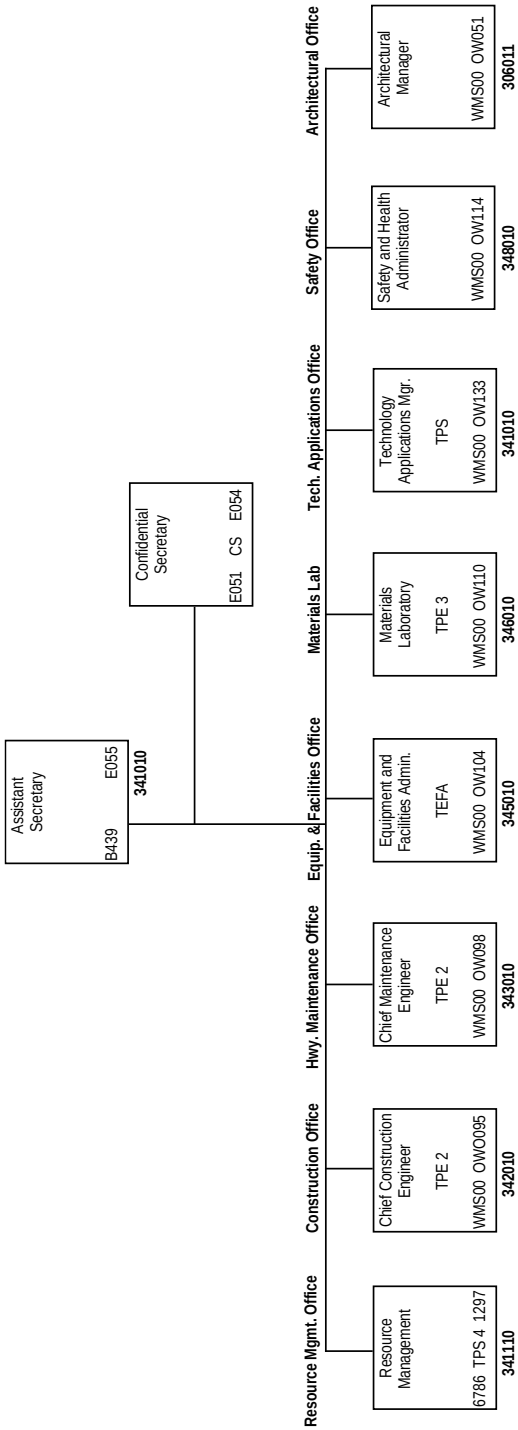


Figure 1-1

The Assistant Secretary for Field Operations is responsible for certifying all Federal-aid construction projects to the Federal Highway Administration (FHWA). This responsibility includes the determination as to federal participation in changes on a project.

The Assistant Secretary for Field Operations is assisted by five principal assistants. See the Table of Organization.

1-1.4 Olympia Service Center Construction Office

1-1.4A Chief Construction Engineer

The Chief Construction Engineer reports to the Assistant Secretary for Field Operations and is responsible for WSDOT contractual construction projects except those contracts executed by the Director of Washington State Ferries. The Chief Construction Engineer is responsible for all matters pertaining to contract administration; represents the Assistant Secretary in managing the performance of the contract, and acts for the Assistant Secretary in approval of increases, decreases, changes of work, materials incorporated, authority to accomplish work by force account, extensions of time, and assessment of liquidated damages. The Chief Construction Engineer is responsible for providing direction to the Region and the Olympia Service Center construction personnel investigating construction claims. The Chief Construction Engineer approves claims settlements.

The Chief Construction Engineer establishes WSDOT policy relative to inspection and documentation and ensures uniform interpretation and enforcement of the *Standard Specifications* and contract provisions throughout the State. The Chief Construction Engineer is assisted by three principal assistants for construction. See the Table of Organization (Figure 1-2).

1-1.4A(1) Administration

The Construction Engineer, Administration, acts for the Chief Construction Engineer in setting contracting requirements and policy and responding to questions from the regions on issues covered in Division 1 of the *Standard Specifications* and Chapters 1 and 10 of the *Construction Manual*. These include, but are not limited to, time extensions, external civil rights contract changes, prevailing wage issues, documentation, and claims resolution. The Construction Engineer, Administration, also represents WSDOT on task forces with contractor organizations and other public agencies, and at the legislature regarding public contracting issues. The Construction Engineer, Administration, is assisted by:

- The Assistant Construction Engineer, Administration, who handles prevailing wage issues, and represents the Construction Office on external civil rights issues.
- The Documentation Engineer, who provides oversight on contract documentation and resolves deficiencies with materials workmanship. Also assists with prevailing wage issues.
- The Specification Engineer, who is responsible for maintaining the *Standard Specifications* and the *Construction Manual*. Also coordinates the final acceptance of contracts and is the CCIS System Manager.
- The Claims Engineer/CCIS Trainer, who assists in the review of contract claims and provides training on the use of CCIS.

1-1.4A(2) Roadway

The Construction Engineer, Roadway, acts for the Chief Construction Engineer in matters of highway construction, such as grading, drainage, surfacing, paving, signing, guard rails, illumination, traffic signals, landscaping, rest areas, and other projects as assigned.

Subject to the approval of the Chief Construction Engineer, the Construction Engineer, Roadway, is responsible for establishing practices of construction, engineering, and contract administration within these fields for the purpose of establishing uniformity between the Regions. Duties include inspecting projects, evaluating reasons for contract changes, approving change orders, conducting or assisting in contract negotiations, investigating complaints and claims, and providing recommendations on major changes to the Chief Construction Engineer.

The Construction Engineer, Roadway, is assisted by two Professional Engineers.

1-1.4A(3) Bridges

The Construction Engineer, Bridges, acts for the Chief Construction Engineer in matters for bridges and related structural construction, and other projects as assigned.

Subject to the approval of the Chief Construction Engineer, the Construction Engineer, Bridges, is responsible for establishing practices of construction, engineering, and contract administration within the area of bridge and related structural construction for the purpose of establishing uniformity between the Regions. Duties include inspecting projects, evaluating reasons for contract changes, approving change orders, conducting or assisting in contract negotiations, investigating complaints and claims, and providing recommendations on major changes to the Chief Construction Engineer.

The Construction Engineer, Bridges, is assisted by two Professional Engineers.

Field Operations Support Service Center

Construction Office

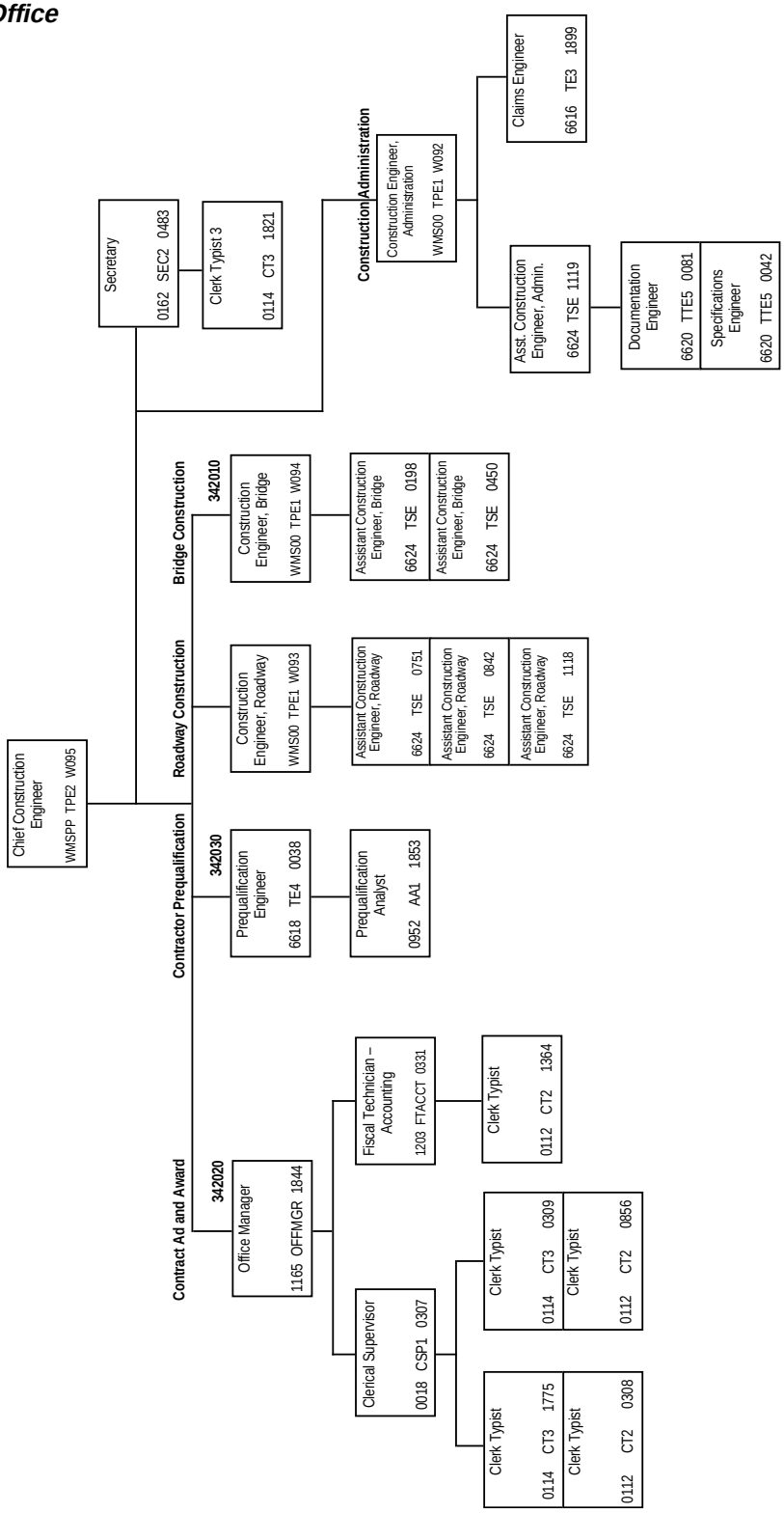


Figure 1-2

1-1.5 Materials

The Materials Engineer acts for the Assistant Secretary for Field Operations by directing the materials testing, inspecting, and acceptance functions of WSDOT. Subject to the approval of the Assistant Secretary for Field Operations, the Materials Engineer; formulates and recommends policies and procedures; directs operating methods to be followed in providing precontract soils, foundation, and materials analysis and testing; recommends and/or approves Pavement Designs; furnishes counsel and technical assistance to the Regional Operations/Construction Engineer in conducting required materials tests and analysis and provides for periodic review of these test methods and procedures to ensure their conformance to established policies, procedures, and methods; and provides a program that verifies the uniformity of all testing and sampling procedures.

The Materials Engineer is assisted by a staff of Professional Engineers, administrative personnel, engineers, and technicians.

1-1.6 Region Organization

1-1.6A Regional Administrator

The Regional Administrator represents the Secretary in a geographic area, organizes and supervises a staff of personnel which perform administrative duties and supervise location, design, construction, and maintenance of the highway system within the Region.

1-1.6B Regional Operations/Construction Engineer

In supervision of construction, the Regional Administrator is assisted by a Regional Operations/Construction Engineer. The Regional Operations/Construction Engineer assigns Project Engineers with appropriate supporting personnel; attends plan-in-hand reviews; reviews reports and recommendations then transmits them with appropriate comments, recommended changes, and agreements; provides training and guidance to the Project Engineers and principal assistants; makes final inspections of projects; and recommends acceptance of projects. It is the responsibility of the Regional Operations/Construction Engineer to ensure that sufficient personnel are provided on all projects (including applicable city or county Federal-aid projects) at all times to ensure adequate inspection, documentation, and quality controls.

1-1.7 Relationship With Other Agencies

1-1.7A Federal Highway Administration

Various acts of Congress have made funds available from the Federal government to the State, counties, and municipalities for the construction of highways, roads, streets, and bridges. These funds are subject to applicable Federal law, Executive Orders, regulations, and agreements.

The FHWA approves all programs for Federal highway funds and, where Interstate funds are involved, approves individual project plans and specifications. In accordance with the Construction Monitoring Plan, which is part of the WSDOT/FHWA Stewardship Plan, project type and size determine whether FHWA, the Olympia Service Center Construction Office, or Region will conduct the final inspection to verify substantial compliance with the approved Federal-aid program.

1-1.7B Cities and Counties

1-1.7B(1) General

Federal-aid funds are available to cities and counties for construction of certain roads, streets, and structures. Federal regulations require that WSDOT provide assistance for all Federally funded projects and that the State retain responsibility for construction, final inspection, and acceptance of these projects.

After the award of a contract for the construction of a city or county sponsored Federal-aid project, or other project over which WSDOT has supervisory authority, the Regional Administrator and the Olympia Service Center Construction Office shall administer the project in the same manner as other Federal-aid projects and in accordance with departmental policies.

1-1.7B(2) WSDOT Testing Facilities

The Materials Engineer will allow the use of WSDOT testing facilities by local agencies for both WSDOT and local ad and award projects.

1-1.7B(3) Project Engineer on WSDOT Ad and Award Projects for Local Agencies

On local agency Federal-aid projects which are advertised and awarded by WSDOT, the Regional Administrator will appoint a WSDOT Project Engineer. The Project Engineer will administer the project in the same manner as other Federal-aid projects and in accordance with departmental policies.

The Project Engineer may elect to use qualified local agency staff to supplement WSDOT staff to perform the construction engineering.

The local agency will appoint a Project Coordinator. This Coordinator will be the contact person for the Project Engineer.

The Project Engineer shall notify the Local Agency Project Coordinator and the Regional TransAid Engineer of the time and place of the preconstruction meetings, discussions.

See Section 1-24C for changes in work.

1-1.7C Coast Guard Bridge Construction Progress Reports and Proposed Permit Modifications

Whenever construction work is performed in navigable waterways, it is necessary to obtain a construction permit from the Coast Guard. One of the requirements of the construction permit is regular submission of Bridge Construction Progress Reports. Two copies of the report should be prepared by the Project Engineer sufficiently in advance of the first working day of the month and transmitted to the Olympia Service Center Bridge and Structures Engineer. A copy of each report must be forwarded by the Project Engineer to the Olympia Service Center Construction Engineer, Bridges.

The Bridge Construction Progress Reports shall be made in the form of a print of the Coast Guard Bridge Permit exhibit sheet. The print shall be marked in green to show construction progress of permanent work, in red to show work scheduled for completion in the next mouth, and blue to show current location of falsework supports and other temporary obstructions to navigation, such as anchor lines or moored barges. Supplemental sketches may be required for clarity. The forwarding memo to the Olympia Service Center Bridge and Structures Engineer should include information about any activities planned for the next month that could affect waterway users.

When a Coast Guard permit modification is proposed (by the Contractor or WSDOT), it shall be submitted to the Bridge and Structures Engineer for processing through the Coast Guard. The time required for approval/disapproval of the proposed permit modification is variable and depends on the nature and significance of the modification. Up to six months may be required.

When all construction obstructions to navigation have been removed, the Project Engineer shall report that fact immediately to the Bridge and Structures Engineer indicating the date removal was completed.

Upon completion of all permitted bridge work, a final report indicating the date of completion and certifying that the bridge has been constructed in compliance with the Coast Guard Bridge Permit shall be submitted by the Project Engineer to the Olympia Service Center Bridge and Structures Engineer.

1-1.7D Other Federal, State, and Local Agencies

The location and construction of highways often involves areas or features that affect the jurisdiction of other agencies. It is the policy of WSDOT to cooperate with these agencies, to recognize and comply with their regulations, and to avoid usurping authority delegated to them. On contractual work, the Project Engineer shall require the Contractor to comply with all Federal and State rules and regulations governing the work and shall cooperate with local authorities to ensure that the Contractor complies with local laws, ordinances, and regulations.

1-1.8 Public and Employee Relations

Matters concerning highway locations, right of way, construction, and maintenance of the State system involve innumerable contacts with the public. If the public confidence in WSDOT is to be maintained on a high plane, it is important that all transportation personnel be courteous, patient, and attentive to reasonable requests and inquiries of the public. It is obvious that transportation needs can be met best when there is strong public sentiment to promote the objectives of WSDOT, and good public relations go far in obtaining that result.

No effort should be spared to reduce traffic inconvenience to a practicable minimum but not to compromise worker safety. Requests for legitimate information should always be answered in a frank and truthful manner, having in mind that after a pertinent policy has been determined there is no valid reason to withhold known facts from persons entitled to them. An indecisive, evasive, or ambiguous answer is most disconcerting to an individual or civic organization sincerely seeking legitimate information.

The Communications and Public Involvement Office was created to care for numerous requests by individuals and others for highway information, and to promote good public relations by other means of publicity. The Manager of the Communications and Public Involvement Office disseminates important news happenings and plans to newspapers, periodicals, and radio and television stations by news releases to inform the public about current highway developments.

Division heads, and particularly the Regional Administrators, can cooperate in public relations work by furnishing the Manager of the Communications and Public Involvement Office news and pictorial material of general interest, or which may be acceptable for the biennial or other reports. The Regional Administrators may furnish news matter and give interviews to local publications when the information is consistent with known policy and when it will promote good public relations.

1-1.9 Safety and Accidents

1-1.9A Safety

Safety is not optional in WSDOT. No employee will be permitted to disregard applicable safety and health standards of the State Department of Labor and Industries and other regulatory agencies.

Since WSDOT employees on transportation construction projects are exposed to great hazards, they must take adequate and constant safety precautions.

Each supervisory employee is charged with the responsibility of providing safety leadership at all times and safety enforcement when necessary. Supervisors shall give thorough instructions to employees under their jurisdiction on the safe use of tools, materials, and equipment and the safe prosecution of work on construction projects.

A Fall Protection Plan (Form DOT 750-001) is required to be on site at any time an employee is exposed to a fall hazard in excess of 3.05 meters (10 feet) from the bottom of their feet to the surface below. The form shall be filled out by the crew leader and reviewed and signed by the employee. For example: (1) made out by the chief inspector and signed by the inspectors, or (2) made out by the survey party chief and signed by the members of the survey crew. The form must be available on site for each fall hazard. However, the form may be made out for a specific piece of equipment if the equipment carries the fall with it; such as, articulating boom aerial lift or other aerial vehicle. In addition, all employees exposed to a fall shall be trained (see the Regional Safety Officer for training) and shall be provided with fall restraints (something to keep them from the fall), or fall arrest (something to arrest the fall if it happens).

The employee shall ensure that an area is safe before entering it for the purpose of inspection. For example, a deep trench must be adequately shored and braced before entering it.

WSDOT employees working around aggregate production and processing plants must be particularly careful for both themselves and others to avoid accidents. The adequacy of foundations for storage hoppers, effectiveness of stairways and railing, hazards from moving belts or gears, dangers from falling or flying materials, exposure to hot materials, and other similar features are to be reviewed by the Project Engineer and desirable or necessary corrective measures called to the attention of the Contractor or producer. Such correction must be completed before WSDOT personnel will be permitted to proceed with entry or work upon the premises.

The employee must at all times watch for backing trucks and not depend upon hearing alone for warning. The noise of plants and other equipment often make it impossible to hear trucks approaching and the truck driver's vision area is restricted when backing a truck. Constant vigilance is a life or death matter.

Parking WSDOT vehicles too close to the path of construction equipment, behind standing equipment, or in other hazardous locations is not permitted. Construction equipment is continually becoming larger, heavier, and faster which in turn increases the hazards. Safety methods and practices must keep pace if we are to hold accidents to an absolute minimum.

Where traffic is maintained in a construction job, care must be taken by inspectors and others not to step onto the traveled portion of the roadway into the path of cars and trucks. Employees shall not ride on the running board of trucks or equipment or to jump on or off moving equipment.

Where the engineering crew is working in conflict with traffic, the work area should be marked with proper signs and traffic control devices and the crew should be protected by a certified flagger with "STOP" and "SLOW" hand signal paddles.

A survey crew exposed to traffic situations should become familiar with the instructions and the traffic control layouts contained in the *Traffic Control Guidelines for Survey Operations* booklet. These booklets may be obtained from the Olympia Service Center Engineering Publications Office at SCAN 705-7428.

Whenever signing and traffic control devices are necessary; they shall be used in conformance with the *Manual on Uniform Traffic Control Devices*, as adopted by WSDOT.

WSDOT employees working on foot in the highway right of way and other areas exposed to vehicular traffic must comply with the following:

1. Wear reflective vests, except that during daylight hours, orange clothing equivalent to "Ten Mile Cloth" or hunter orange may be worn in lieu of reflective vests.

2. Wear white coveralls at night. Note: In snow or fog conditions, the white coveralls may be removed.

3. When rain gear is worn during the hours of darkness, it shall be white or yellow.

4. Wear reflective vest, and always as the outer garment.

Exceptions to requirements 1 through 4 above are: (1) when personnel are out of view of and not exposed to traffic, (2) when personnel are inside a vehicle, or (3) where it is obvious that such apparel is not needed for the employee's safety from traffic.

5. White or yellow hard hats must always be worn when on foot in the highway right of way and in all areas where there is a danger of head injuries. Hard hats worn at night should have reflectivity.

6. Flaggers must always wear traffic vests and white or yellow hard hats during both daytime and nighttime operations.

When the engineering crew is working under the protection of the Contractor's flaggers and signs, other signs may not be needed, but "STOP" and "SLOW" hand signal paddles should be available for use in special situations.

During blasting operations, employees are instructed to seek cover at least 150 meters (500 feet) from the location of the blasting. Particular caution must be exercised when working around mudcapping operations.

When employees are injured on the job to the extent that the services of a doctor are required, the Regional Safety Officer shall be notified immediately.

The Washington Industrial Safety and Health Act requires that every foreman, supervisor, or other person in charge of a crew have a valid first aid card.

1-1.9B Vehicle Accidents

Complete attention to all safety rules will help reduce accidents to a minimum. This includes safety to the traveling public as well as to the Contractor's personnel and WSDOT employees. Since accidents occur on completed facilities that are engineered with maximum safety in mind, it is obviously necessary to take extra safety precautions for traffic through and around construction operations.

First aid kits shall be kept in all equipment and shall be restocked as soon as possible after use. First aid shall be performed, whenever required, in accordance with standard first aid practices and instructions.

Information necessary to report any vehicle accident is contained in S.F. 136, Vehicle Accident Checklist, and should be readily available and completed at the scene of the accident.

Accidents involving personal injury to the employee or the public or involving considerable property damage, must be reported to the Regional Safety Officer immediately. Form S.F. 137 must be completed by the driver and the driver's supervisor and mailed within two working days to the Risk Management Section in the Olympia Service Center Administration Section. If the accident involves a personal injury, the Risk Management Section must be notified by phone immediately at SCAN 234-2101.

Any evidence connected with an accident, such as names of witnesses, measurements, photographs, condition and location of traffic control devices, condition of roadway, and other pertinent information, should be observed and recorded whether it appears that WSDOT may be involved in the accident or not. This information is often very useful at a later date if WSDOT is involved in a claim.

1-1.10 Archaeological and Paleontological Salvage

It is the national and State policy to preserve historical and prehistorical objects such as ruins (including Indian ruins), sites, buildings, artifacts, fossils, or other objects of antiquity, that may have significance from a historical or scientific standpoint.

If there is a probability of encountering historical objects, the contract may have a special provision concerning this possibility and outlining salvage procedures.

On a construction project, when it appears that significant historic or prehistoric objects have been or are about to be encountered, the Engineer should immediately take steps to preserve them and should notify the Regional Administrator.

The Regional Administrator will advise the Olympia Service Center Construction Office of the facts on any pertinent cultural resource discovery. If warranted, the Olympia Service Center Construction Office will contact and inform Eastern Washington University, the State Historic Preservation Officer (SHPO), and FHWA of the discovery, and arrange an on-site meeting of the appropriate parties if either FHWA or SHPO believes it necessary. If it is determined that a meeting will be held, the actions detailed in the Memorandum of Understanding between FHWA and the Heritage Conservation and Recreation Service (HCRS) will be taken.

1-1.11 Construction Work in International Boundary Strip

The International Boundary Commission of Washington, D.C., by treaty with Canada, has the exclusive jurisdiction of the 6.1-meter (20-foot) boundary strip, 3.05 meters (10 feet) on each side of the International Boundary. Any construction work within this strip must be with permission of the International Boundary Commission (IBC). Boundary monuments are not to be moved or disturbed without the approval of the IBC.

It is expected that permission will be obtained from the IBC during the design stage of a project. However, it will be the responsibility of the Project Engineer on construction to ascertain that permission has been obtained. The Regional Administrator shall be immediately notified if on construction, it is found that permission has not been obtained to relocate boundary markers or perform construction work in the 6.1-meter (20-foot) strip.

1-2 Contract Administration

1-2.1 Proposal and Award of Contract

1-2.1A Contract Proposal and Bids

When the design of a project has been completed, public notice is served that WSDOT is ready to accept bids for accomplishing the work involved, and a specified date and time for opening bids is announced. Complete plans and specifications governing the work are made available for study, and contract proposal forms are furnished to prospective bidders on request, provided they have been prequalified by WSDOT for the type and quantity of work involved.

When a project is advertised for bids, the Project Engineer should have the project limits posted with signs as illustrated in Figure 1-3 when prospective bidders may have difficulty determining the project limits.

Section 1-02.4 of the *Standard Specifications* requires that all requests for explanation or interpretation of the contract documents be submitted in writing. Any information provided to a prospective bidder must be provided to all prospective bidders if the lack of such information would be prejudicial to the other prospective bidders. If such a request is received, immediate and swift action is necessary to avoid delaying the scheduled bid opening date. All questions from prospective bidders should be referred to the Project Engineer listed in the "Notice to All Planholders" for a response unless the question is general in nature and definitely does not fall in the category that may be prejudicial to other bidders. Accordingly, all requests for explanation or interpretation of the contract plans or any of the contract provisions must be scrutinized by all WSDOT personnel involved in fielding questions from prospective bidders. The Project Engineer will coordinate the effort to determine if the requested information needs to be addressed by an addendum. If the person fielding the question has any doubts that the request falls in the category that may be deemed to be prejudicial, that person must immediately address the issue by:

1. Advising the prospective bidder to follow the provisions of the specifications for making the request in writing to the Project Engineer showing the project, if the request is verbal;

2. Advising the prospective bidder that the issue in question will be reviewed to determine if a response is necessary to all bidders;

3. Orally notifying WSDOT's personnel that would be involved in the decision making process of the issue in question; and

4. Ensuring that all appropriate WSDOT personnel are cognizant of the issue, i.e., the Project Engineer showing the project to prospective bidders, the Regional Operations/Construction and Project Development Engineers, the Chief Construction Engineer, and the Olympia Service Center Plans Office.

1-2.1B Award and Execution of Contract

Bids for the contract are opened at a public meeting and award of the contract is made to the lowest bidder deemed responsible by WSDOT after all bids have been checked. The successful bidder must furnish a contract bond in the full amount of the contract price conditioned for faithful performance of the contract. The successful bidder is normally allowed 20 days after the date of award to sign the documents necessary to enter into a contract with WSDOT, and to return these documents to the Secretary of Transportation. After these documents are returned to WSDOT, the contract must be approved and executed by the Secretary of Transportation, Deputy Secretary for Operations, Assistant Secretary for Field Operations, or the Director of Washington State Ferries. No proposal shall be considered binding upon WSDOT prior to the date of execution by WSDOT.

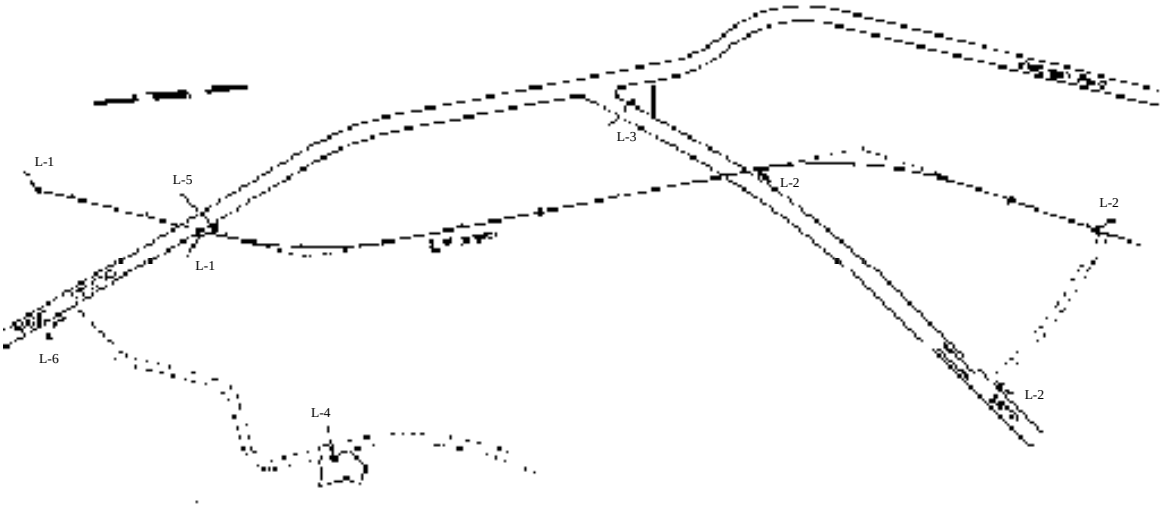
No work shall be performed within the project limits or WSDOT furnished sites prior to the execution of the contract by WSDOT and any work performed outside these areas, or any material ordered prior to WSDOT execution, shall be at the risk of the Contractor.

In order to affect a timely notification to the Contractor regarding execution of the contract and authority to proceed, the following procedure is used:

1. Immediately after execution of the contract documents by WSDOT, the Olympia Service Center Accounting Office will notify, by phone, the office administering the contract (i.e., the Regional Operations/Construction Engineer's Office, the Manager of Terminal Engineering, or the Architecture Office). The Accounting Office also notifies the State Department of Revenue, State Department of Labor and Industries, and other interested parties that the contract has been executed.

2. The Regional Operations/Construction Engineer or a representative will call the Project Engineer's office as soon as notification is received. The Project Engineer will call the Contractor and give notification of the execution date. The date, time, and method of notification in all instances is to be recorded in the project diary. This procedure should also be followed for Ferries and Architecture projects, as well as WSDOT awarded city and county projects.

3. The Olympia Service Center Accounting Office will mail the Contractor a fully executed copy of the contract following the telephone contact.



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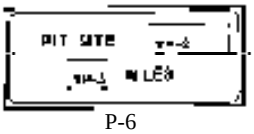
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P-3

P-5

Notes:

This plan is typical. Any particular project shall be signed to meet the physical conditions.

The centerline of the project on new locations shall be flagged at control points with lath with yellow flagging attached on top.

M6-1 Directional Arrow signs shall be installed as necessary.

See *Sign Fabrication Manual* for sign specifications.

Figure 1-3

1-2.1C Preconstruction Meetings, Discussions

As soon as practicable after a contract is awarded, the Project Engineer shall arrange to meet with the Contractor for the purpose of discussing the project and pass on a variety of information. Depending upon the complexity of the project, this information can be passed on in any combination of the following methods:

Information packets provided to the Contractor

Letters transmitting information

Informal meetings

A single multipurpose formal meeting

Several formal meetings with different purposes

All information exchanged shall be documented in the project records, by formal meeting minutes, by file copies of letters, or by diary entries.

The nature, amounts, and methods of communication with the Contractor shall be left to the Project Engineer. As a minimum, the following subject areas shall be covered during the preconstruction time period:

A. CONTRACTOR-WSDOT RELATIONSHIPS. The Project Engineer should begin to develop a positive and effective relationship with the Contractor as soon as a contract is awarded. This would be a good time to introduce the concept of "Partnering" if it has not already been introduced on the job. The Project Engineer must create the environment of a cooperative approach to the contract and start to develop a team consisting of both the Contractor's and WSDOT's project people.

The level of authority delegated to each member of the Project Engineer's staff should be discussed with the Contractor.

Discussions of the Contractor Performance rating procedures should be conducted and the Contractor should be advised that there will be an opportunity for evaluation of WSDOT construction process as well (see Chapter 1-2.8F of this manual).

B. ENVIRONMENTAL COMMITMENTS. If there are commitment files for the project, these should be made available and discussed with the Contractor. Any references in the *Standard Specifications* or the special provisions to environmental requirements or permits should be discussed. The Contractor's responsibility to obtain any local agency permits should be discussed. If rock crushers are involved in the project, the State Department of Ecology registration requirements should be discussed (WAC 173-400). In addition, a written record of this discussion should be sent to the regional office of the State Department of Ecology so that they are aware of the timing and location of the rock-crushing operation.

C. ORDER OF WORK AND SCHEDULES. Almost immediately in the process, the Project Engineer needs to find out the Contractor's plans for prosecuting the work. This will allow the Engineer to set up crews, arrange for special inspections, and plan the review of submittals. The contract requirements for sequencing and durations can be discussed and the need for a timely submittal of the formal schedule can be addressed.

D. SUBCONTRACTORS AND LOWER TIER SUB-CONTRACTORS. The Project Engineer needs to become aware of the Contractor's plans to delegate portions of the work to subcontractors. These plans must conform with the condition of award, if any, related to disadvantaged, minority, or women's business enterprise participation. The Project Engineer should explain the paperwork process involved in subcontractor and lower tier subcontractor approval, including the prevailing wage rate documentation requirements (see Chapter 1-2.6 of this manual).

WSDOT/Contractor/Subcontractor relationships should be explored. The Project Engineer should remind the Contractor that there is no contractual relationship between WSDOT and the subcontractors. All subcontractor correspondence with WSDOT should pass through the Contractor. It will also be necessary for the Contractor to be represented at the job site, even when there is only subcontractor work in process.

E. UTILITIES, RAILROADS, AND OTHER THIRD PARTIES. If the project affects or is affected by third party organizations, the Project Engineer must advise the Contractor about the relationships with the third parties and the expectations they hold regarding the actions of both WSDOT and the Contractor. The Project Engineer may wish to arrange face-to-face meetings with representatives of affected third parties. In the case of utilities, reference should be made to the underground locator services and the requirements to utilize them (see RCW 19.122). If WSDOT has agreed to notification time limits, these should be communicated to the Contractor. If special insurance is required by any agreements with third parties, then these requirements should be pointed out to the Contractor.

F. SAFETY AND TRAFFIC CONTROL. The Contractor's safety program should be discussed. Chapter 1-2.2I(3) of this manual contains a checklist for review of the safety program.

The Project Engineer should describe WSDOT's traffic requirements. The on-site people who will be responsible for Traffic Control for both WSDOT and the Contractor should be identified and their authorities clearly stated. The

Manual on Uniform Traffic Control Devices shall control all signing on the project. If the Contractor chooses to use these, they must be formally adopted in writing as required in Section 1-07.23(3)C of the *Standard Specifications*. If the Contractor wishes to use some other traffic control scheme, then that plan must be submitted and approved in advance. Flaggers should be included in the plans. When Flaggers are utilized, they shall have a current flagging card and shall be equipped with hard hats, vests, and standard stop/slow paddles.

The Contractor and the Project Engineer should establish communication with the State Patrol and local police agencies. Police advice about traffic control should be sought. Arrangements for all police agencies to notify the project office about accidents near, or in, the construction area should be established.

WSDOT has an interest in safe operations on the job and the Project Engineer should make clear that this interest will be protected. As part of a discussion of specific safety requirements of the particular work, safety considerations for WSDOT personnel, such as fall prevention, closed spaces, hazardous materials, and work around heavy equipment should be addressed. The need for control of speed on all construction equipment should be emphasized.

Off-site hauling can pose a safety hazard to the public. WSDOT will cooperate with law enforcement agencies in the enforcement of legal load limit requirements and the covered load regulations. The Project Engineer should discuss this with the Contractor before any hauling begins.

G. CONTROL OF MATERIALS. Discuss the need for approval of all sources of material and the need to request this approval early. Cover the sampling, catalog cut/standard shop drawing, and certification requirements associated with source approval. Include discussion of further sampling and certifications needed for acceptance of materials whose source has been approved. Describe the inspection process for fabricated materials including shop drawing approvals and notification requirements for fabrication inspectors. Advise the Contractor that materials requiring certifications may be accepted at the Contractor's risk and request. Payment for work on items using materials without certifications will be withheld until all necessary materials documentation is submitted and approved.

H. OTHER SUBMITTALS. Discuss any other submittals that will be needed during the contract. This may include Falsework and Forming Plans, Traffic Control Plans, Temporary Water Pollution/Erosion Control Plans, Schedules, Installation or Operating Procedures, or other Contractor-initiated items requiring WSDOT review and/or approval.

There are requirements for a number of submittals which, if not satisfied in a timely manner, could delay the initial progress payment. These include the Statement of Intent to Pay Prevailing Wages, the Public Liability and Property Damage Insurance Certification, the Progress Schedule, and the Training Plan. There may be others depending on the work required in the contracts. The Project Engineer should remind the Contractor of these requirements and the potential for delayed payments.

I. EQUAL EMPLOYMENT OPPORTUNITY AND TRAINING. Address the contract requirements for employment of protected groups. Advise the Contractor that performance in this area will be monitored. Identify the training hours included in the project and discuss the Contractor's plan for compliance. Emphasize the importance of achieving adequate and meaningful training. Describe WSDOT's procedures for approving, first, the training program and second, the actual trainees to fit into the program. Remind the Contractor of the obligation to identify training in a monthly request for payment (see Chapter 1-2.7 of this manual).

Describe the EEO and Training reports that will be required of the Contractor.

WSDOT has agreed to include the OJT Supportive Services contractor in any precontract discussions of training. The WSDOT EEO/Training officer should also be included in these discussions.

J. WAGE RATE ADMINISTRATION. Advise the Contractor of the requirement to pay prevailing wage rates as identified in the Contract. Advise the Contractor to deal directly with the Washington State Department of Labor and Industries (L&I) for approval of the Statement of Intent to Pay Prevailing Wages (SI) and Affidavit of Wages Paid (AWP) and that:

1. L&I will approve the SI and AWP.
2. The SI and AWP will be on L&I's forms.
3. The forms will be obtained from L&I.
4. The contractors, subcontractors, lower tier subcontractors, suppliers, manufacturers, and fabricators that are required to submit SI and AWP will pay the approval fee directly to L&I.
5. A copy of the approved forms will be given to the Project Engineer (SI, before payment can be made for the work performed and all AWP, before any retained percentage can be released).

If payrolls are required, establish submittal deadlines in accordance with Section 1-07.9(5) of the *Standard Specifications*. Describe the wage rate interview process. Describe the required job site posters and provide them to the

Contractor. See Chapter 1-2.6 of this manual. It is required for all Federal-aid contracts that the Contractor shall be advised that the contract comes under the Davis-Bacon and Related Acts **and** the Contract Work Hours and Safety Standards Acts. As indicated in Chapter 1-2.6C of this manual, the U.S. Department of Labor may conduct investigations to ensure compliance with these Acts.

K. FORMS. The Project Engineer should provide a description of all required forms and should give the Contractor an initial supply. Future needs for additional forms for this contract should be satisfied by the Project Engineer upon request by the Contractor. Emphasize once again that all form submittals should be routed through the Prime Contractor.

Summary

To summarize this discussion of preconstruction meetings and conversations, the Project Engineer is responsible for getting the information to the Contractor and into the files, and is free to select the most effective method for doing so. A formal preconstruction conference may or may not be the best solution. Perhaps one meeting will be adequate or several may be required. The entire preconstruction communication may be covered in a short meeting between the Project Engineer and the Contractor. The key is effective communication, getting the right message to the necessary people. This responsibility is not limited to preconstruction. More meetings may be required as people change, as new facets of the work are imminent, and as the project goes into a second or third season. A checklist is included for tracking the completion and documentation of the various preconstruction communications. See Figure 1-4.

1-2.2 Project Engineer's Relationship and Responsibilities

1-2.2A Assignment

The Regional Administrator will appoint a Project Engineer to act as the duly authorized representative of the Secretary of Transportation for the contracted project. After the execution of the contract by WSDOT, the Region shall provide the Contractor with written notification of the name and address of the Project Engineer. The Contractor shall be instructed to send all correspondence and forms to the Project Engineer. A copy of this notice shall be provided to the Olympia Service Center Construction Office.

The Project Engineer is responsible for the enforcement of the contract specifications and provisions and the completion of work according to the plans. The Project Engineer supervises the work of WSDOT personnel assigned to the project and ensures that they perform their work in accordance with the specifications and WSDOT policy. The Project Engineer is responsible for keeping complete and accurate records of construction data and work progress, preparing progress and final estimates, and preparing other records necessary for a complete documentary record of the project, including a performance evaluation of the Contractor (see Chapter 1-2.8F).

Project Engineers are advised that any material change in the plans for any structure or any feature of the work must not be made without obtaining approval through the Regional Operations/Construction Engineer. This rule must be followed explicitly. All revisions must be reviewed to ensure compliance with environmental or other commitments made by WSDOT to individuals, committees, or other agencies through the environmental and design processes. Approval of the Olympia Service Center Construction Office must be obtained before work involved in such a change is started. The requirements of Chapter 1-2.4C(8) of this manual must be followed.

The Project Engineer should review the project on a regular basis with the Regional Maintenance personnel so they may have an opportunity to address any maintenance problems that may arise.

1-2.2B Responsibility as Public Employee

The Project Engineer should be familiar with all Federal, State, and local laws, ordinances, and regulations which in any manner may affect those employed by the Contractor on the work, the material, or equipment used on the project, or which in any way affect the conduct of the work.

In the event the Project Engineer should discover any provisions of the contract, plans, or specifications inconsistent with any law, ordinance, or regulation, the inconsistency shall be reported immediately to the Regional Operations/Construction Engineer in writing. The Project Engineer should at all times comply with all laws, ordinances, and regulations. Failure to do so, may result in the Attorney General's inability to authorize defense if cited for a violation.

1-2.2C Relationship With the Contractor

The Project Engineer must be familiar with the conditions of the contract, special provisions, and specifications for the work. The Project Engineer shall attend to any reasonable request of the Contractor, i.e., furnishing grades, stakes, plans, etc., whenever necessary and within reason; and, in general, do all things requisite to enable the Contractor to work to advantage and without delay, but the Project Engineer shall not set any stakes or furnish to the Contractor any plans which are the responsibility of the Contractor to set or provide. The Project Engineer shall see that the Contractor performs the work in strict accordance

Preconstruction Communication Checklist
Contract Number: _____
Project Engineer: _____
Contractor: _____

Subject	Communication Type (Letter, Min. of Mtg., Info. Packet, Diary) Completed (Date)	File Location
A. Contractor-WSDOT Relationships	_____	_____
1. General Discussion	_____	_____
2. Contractor Performance Ratings	_____	_____
B. Environmental Commitments	_____	_____
1. Commitment Files	_____	_____
2. Contract Provisions	_____	_____
3. Rock Crushers	_____	_____
C. Order of Work and Schedules	_____	_____
1. Discuss Plans for Prosecution	_____	_____
2. Formal Schedule Required	_____	_____
D. Subcontractors and Lower Tier Subs	_____	_____
1. General Discussion	_____	_____
2. Condition of Award	_____	_____
3. Paperwork Process	_____	_____
4. WSDOT/Prime/Sub Relationship	_____	_____
5. Correspondence through Prime	_____	_____
6. Prime represented on site	_____	_____
7. WSDOT will address sub concerns	_____	_____
E. Utilities, Railroads, and Other Third Parties	_____	_____
1. Existing Agreements described	_____	_____
2. Commitments, Obligations, Notices	_____	_____
3. Underground Locater Service	_____	_____
4. Insurance requirements	_____	_____
F. Safety and Traffic Control	_____	_____
1. Discuss Contractor's Safety Program	_____	_____
2. Traffic Control Requirements	_____	_____
3. Police Relationships	_____	_____
4. Job-Specific Safety Concerns	_____	_____
5. Off-site Hauling Restrictions	_____	_____
G. Control of Materials	_____	_____
1. Source Approvals Needed	_____	_____
2. Acceptance Procedures	_____	_____
3. Fabricated Items	_____	_____
4. Installation without Certifications	_____	_____
H. Other Submittals	_____	_____
1. Job-Specific List and Discussion	_____	_____
2. Delay of 1st Progress Payment	_____	_____
I. Equal Employment Opportunity and Training	_____	_____
1. Contract EEO Requirements	_____	_____
2. Contract Training Requirements	_____	_____
3. Training Plan/Trainee Appr. Process	_____	_____
4. Monitoring and Reporting	_____	_____
J. Wage Rate Administration	_____	_____
1. Prevailing Rates Required	_____	_____
2. Payrolls, Wage Rate Interviews	_____	_____
3. Davis-Bacon investigations	_____	_____
K. Forms	_____	_____
1. Describe Req. Forms, Provide Supply	_____	_____

Figure 1-4

with the contract provisions, plans, and specifications. Absolute integrity on the part of all employees is essential.

The attitude of the Project Engineer and inspectors toward the Contractor and the Contractor's personnel should be one of cooperation, consistent with the requirements of the specifications. The Project Engineer must remember that the Contractor has rights under the contract as well as WSDOT, and that those rights must be respected. The Contractor is generally trying to fulfill the contract honestly, and errors or difficulties which may arise are usually due to a lack of information or a misunderstanding. If the Project Engineer shows the intent to cooperate in every way to facilitate the Contractor's operation, the Contractor will generally meet the Project Engineer halfway. When trouble occurs, the Project Engineer should make every effort to determine the cause of the trouble and make the necessary corrections. If violations or misunderstandings of the specifications arise that cannot be settled promptly, the Project Engineer must notify the Regional Operations/Construction Engineer immediately (see Section 1-04.5 of the *Standard Specifications*).

1-2.2D Relationship With FHWA and Other Federal, State, and Local Agencies

Construction work on contracts financed in whole or in part with Federal funds will be subject to final inspection and final acceptance according to the criteria contained in the Construction Monitoring Plan. The Construction Monitoring Plan became effective June 23, 1994, and is part of the WSDOT/FHWA Stewardship Plan. Project type and size determine whether FHWA, the Olympia Service Center Construction Office, or Region will conduct the final inspection. Final inspections will be performed on all federal-aid projects anytime after 90 percent completion but no later than 30 days after physical completion. Final acceptance reports will be completed on all interstate projects subdelegated to WSDOT and will be completed by the Olympia Service Center Construction Office as soon as all project requirements have been met.

In carrying out construction work in forested areas, the Project Engineer shall see that the Contractor complies with all Federal and State forest rules and regulations governing the protection of forests and the carrying out of the work within the national and State forests. The Contractor shall take all reasonable precautions to prevent and suppress forest fires. The Project Engineer shall report to the nearest forest fire warden at the earliest possible moment the location and extent of any fire and shall take immediate steps to control the fire if practicable.

Construction work in or near streams, rivers, or other bodies of water may require a permit from the State Department of Fish and Wildlife. Present understanding between WSDOT and the agency is that for each project requiring a Hydraulics Project Approval (RCW 75.20.100), a permit will be issued to WSDOT only and not to its Contractor. One representative for the agency will be assigned to coordinate requirements with the Project Engineer. The permit will only cover work provided in the contract and will not cover work, such as operations in Contractor sources or waste sites. When a Hydraulics Project Approval has been obtained for the project, the Project Engineer shall provide copies of the permit to the Contractor and ensure it is properly posted at the work site at all times work is in progress. The Project Engineer should ensure that both the intent and the specific provisions of the permit are rigidly enforced. If the Contractor's method of operations, weather conditions, design changes, or other factors affect waters of the State in ways not anticipated or represented in the Hydraulic Project Approval, the Project Engineer will work with the assigned representative and the Contractor to modify the existing permit or obtain one as appropriate.

Other agencies responsible for such things as flood control, land development, stream navigation, pollution, etc., may be affected by the work also, and the Project Engineer should determine that the Contractor has complied with all regulations in effect. When the Contractor is required to obtain approval from other agencies, the Project Engineer shall confirm that approval was received by obtaining a copy of the approval if written approval was given. If a representative of the agency visits the project, the Project Engineer or an inspector should accompany the representative on the visit.

The Mine Safety and Health Administration, Metal and Non-Metal Mine Health and Safety, 117 107th Avenue NE, Bellevue, Washington 98004, must be notified at the beginning and closing of all mining operations. This includes surface mining such as our normal pit site operations. Notification is required for all crusher operations and for all pits and quarries, including borrow pits which are separated from the roadway under construction. The Project Engineer is responsible for this notification for WSDOT furnished pits and shall submit the required report as soon as the date of opening or closing can reasonably be determined. The Contractor is responsible for notification for all pits and quarries not furnished by WSDOT.

The Bureau of Mines reports are in addition to reports required by the Department of Natural Resources.

1-2.2E Relationship With Public and Private Utilities

The Project Engineer should notify public utility companies, individuals, and others owning or maintaining structures within the limits of the highway right of way

which require adjustment, sufficiently in advance of the work so as not to interfere with the Contractor's operation. The Engineer should arrange for removal or adjustment of the structures so as not to delay or interfere with the Contractor's progress.

In general, when a public utility has an installation on a highway right of way and it becomes necessary to move it in order to make room for new construction, the public utility is required to do the work at its expense.

The employees of public utilities are employed on routine work and operate on a budget. It requires considerable time to reorganize to make extensive changes in their facilities and make funds available for the extra cost involved. This may result in a serious delay to the work on our contract and cause the Contractor additional expense. Utilities therefore should be notified of the proposed work at the earliest possible date. They should have been given prints of the preliminary plans, prior to awarding of the contract, showing grade lines and right of way to enable them to prepare plans and estimates for making the necessary changes. The Project Engineer should determine that plans for the work have been made, that the relocated facilities will be clear of the construction, and that the utilities coordinate with the Contractor's operations to the fullest extent possible.

When utilities are known to exist within the limits of the project that may be affected by the construction, the Project Engineer and the Contractor should become familiar with all the requirements of RCW 19.122, Underground Utilities. Copies may be obtained for discussion purposes, at the Preconstruction Meetings and Discussions, from the Regional Office, or from the Olympia Service Center Construction Office.

The approximate locations of most existing underground utilities are shown on the contract plans. However, the existence of underground utilities sometimes is not known ahead of time. RCW 19.122 requires that not less than two business days nor more than ten business days before commencing any excavation, the excavator shall provide notice of the scheduled excavation to those owners of utilities known to, or suspected of, having underground utilities within the area of the proposed excavation. Upon receipt of this notice the owner of the underground utility shall provide the excavator with reasonably accurate information as to the location of its underground utilities by surface-marking.

An excavator, who in the course of excavation contacts or damages an underground utility, shall notify the owner or operator of the utility.

If the excavator discovers underground utilities which are not identified, the excavator shall cease excavating in the vicinity of the utility, identify the utility, and immediately notify the owner or operator of the utility.

1-2.2F Responsibility for Coordination of Railroad Agreements

When railroads are involved within the project limits, an agreement covering the work involved is usually entered into between WSDOT and the Railroad Company. The Project Engineer should immediately, upon notice of involvement with a railroad, obtain a copy of the Railroad Agreement or contact the Olympia Service Center Utilities/ Railroad Engineer to determine the status of the agreement, and make sure it contains all elements needed to accommodate the construction of the project. If an agreement has not been made with the railroad, the Project Engineer should monitor the development and processing of the agreement that is prepared by the Olympia Service Center Utilities/ Railroad Engineer. The Project Engineer should ensure proper notice is provided to the railroad company and that such notice is acknowledged by them. The Project Engineer should work with the Olympia Service Center Utilities/Railroad Engineer to resolve conflicts with the Railroad Company and prevent delays to the Contractors operations.

1-2.2G Responsibility for Railroad Encroachment Insurance

Projects which include work on railroad right of way generally require special insurance protection. The details of these requirements in each case are specifically set forth in the special provisions of the contract and, since the requirements vary, particular attention must be given to all provisions. It is the responsibility of the Project Engineer to enforce the provisions.

The required insuring documents are to be furnished by the Contractor (usually through the Project Engineer) to the Olympia Service Center Accounting Office who will (a) review the documents and (b) obtain approval of the insuring documents from the railroad company.

Written notification of approval by the railroad company will be furnished the Project Engineer by the Olympia Service Center Accounting Office as soon as approval is obtained. No work shall be started on railroad property until the necessary approvals have been obtained.

The railroad insurance must be maintained until the date of physical completion of the project unless otherwise stated. However, the Contractor may make a written request to be relieved of the responsibility to continue all or part of the railroad protective liability insurance before the completion date under certain conditions. The details

and conditions of this relief are specifically set forth in the special provisions of the contract. If the Contractor should make such a request, the Project Engineer shall contact the Olympia Service Center Utilities/Railroad Engineer for guidance and to coordinate this effort with the railroad.

1-2.2H Responsibility for Coordinating Work With Other Contracts

When two or more Contractors are working in the same area, the Project Engineer will call the Contractors' attention to the provisions of the *Standard Specifications* that the Contractor shall not cause any unnecessary delay or hindrance to the other contractors on the work, but shall cooperate with other contractors to the fullest extent.

Progress schedules and plans for all contractors involved should be reviewed by the Project Engineer to detect possible conflicts which might be resolved before delay of work or extra costs result.

1-2.2I Responsibility for Enforcement of Safety and Health Requirements

1-2.2I(1) General

It has been a long-standing policy that all contractors doing work for WSDOT must provide safety controls for protection of life and the health of the Contractor's employees and other persons, for prevention of property damage, and for the avoidance of interruptions in the performance of the work under contract.

As the owner-contracting agency, WSDOT has the responsibility for enforcement of the provisions of the contract; however, provisions and regulations which are by law the fundamental responsibility of other agencies, both from the standpoint of interpretation and enforcement, should be monitored by WSDOT with proper recognition to the responsibilities and authorities of the other agencies involved. WSDOT shall cooperate fully with the responsible agency. Any violations noticed by WSDOT will be brought to the attention of the Contractor for correction. WSDOT will also notify the responsible agency (if that action is deemed necessary) and utilize such sanctions as are consistent with contract terms in assisting the responsible agency in enforcing laws, rules, and regulations.

The Contractor is obligated by laws to comply with both State and Federal safety regulations. State regulations are administered by the Washington State Department of Labor and Industries under the Washington Industrial Safety and Health Act (WISHA). Federal regulations are administered by the Occupational Safety and Health Administration (OSHA) and the Mine Safety and Health Administration (MSHA) of the U.S. Department of Labor which has jurisdiction over Federal safety requirements for pit and quarry operations to the point where materials leave the quarry area or go into a batch plant. Inspectors from any or all of the agencies listed herein may review the Contractor's operations at any time. (See Section 1-07.1 of the *Standard Specifications*.)

To fulfill our obligations to monitor contract operations in accordance with the above, the following procedures shall be followed on both Federal-aid and non Federal-aid contracts.

1-2.2I(2) Precontract Preparation

1. The Project Engineer shall obtain the WISHA manuals, particularly Safety Standards for Construction Work WAC 296-155, General Safety and Health Standards WAC 296-24, and General Occupational Health Standards WAC 296-62, and shall review them with the key field WSDOT inspectors to ensure reasonable familiarity to the extent that they can recognize important requirements.

2. The Contract Plans and contract provisions shall be reviewed to identify those aspects of the work meriting special attention from the standpoint of potentially dangerous types of work and hazard eliminations.

1-2.2I(3) Preconstruction Duties

As part of the required Preconstruction Meetings and Discussions (see Chapter 1-2.1C), the following points should be covered and made a matter of record.

1. The contractual obligation of the Contractor for complying with State and Federal construction safety standards. (See Section 1-07.1 of the *Standard Specifications*.)

2. Availability of the safety standards that apply to the contract.

3. The accident prevention program of the Contractor — organization, staff, names of responsible individuals, meetings, training, reports, etc. The following checklist questions should be answered specifically.

   a. Does the Contractor have a definite Safety Program?

   b. Does the program have the active and continued support of company management?

   c. Has responsibility for safety been assigned to a specific top company official? Is there a staff for full time safety work?

   d. Does the Contractor's program include frequent safety inspections of operations on the project? Does this include subcontractor operations?

e. Does the Contractor train employees to recognize and to avoid unsafe conditions and practices related to their individual work assignments? Are periodic safety meetings held with employees? What frequency?

f. Are all occupational injuries and illnesses investigated by the Contractor, recorded and reported?

g. Does the Contractor keep currently informed on the applicable safety regulations and standards?

h. Will the required posters be prominently displayed on a bulletin board at the work site? (See Chapter 1-2.2K of this manual for list of required posters.)

i. Does the Contractor have a written Confined Space Entry Procedure if confined spaces will be entered during performance of work under the contract?

j. Does the Contractor have a written respirator protection program if respirators must be worn in performance of work under the contract?

k. Does the Contractor have a written Hazard Communications Program which provides Contractor, subcontractor, and WSDOT employees with the hazards of chemicals to which they may be exposed?

l. Does the Contractor have a written Fall Protection Work Plan for all areas where fall hazards of 3.05 meters (10 feet) or more exist?

4. The Contractor is responsible for seeing that subcontractors comply with safety regulations.

5. The Contractor's plans for meeting specific safety requirements and for eliminating potentially critical hazards on the project.

6. Discussion of WAC 296-24-233, Part 7 and 8 regarding safety in backing trucks — particularly on paving projects.

1-2.2I(4) Construction Surveillance

When construction starts, and throughout the construction period, project personnel in their observation of operations should be alert to note any violations of the applicable safety requirements. The following listing, based on the Federal construction safety standards and applicable State codes and regulations, indicates some of the principal requirements that must be met.

1. FIRST AID AND MEDICAL SERVICES. Ref. WAC 296-155-120 and 125.

The Contractor must provide readily accessible first aid kits; and telephone numbers of doctors, hospitals, and ambulances must be conspicuously posted. All supervisory personnel and personnel in charge of crews must have a current first aid training certificate.

2. HOUSEKEEPING. Ref. WAC 296-15S-020.

Scrap and used materials — scattered debris and combustible scrap — that would constitute hazards to employees must be cleared from work areas.

3. NOISE EXPOSURE. Ref. 296-155-145 and 296-62-090.

If effective means cannot be provided to lower noise level exposure to permissible levels, personal protective equipment in the form of ear plugs or ear muffs must be provided and worn. Warning signs must be posted at entrances to or on the periphery of all well defined work areas in which employees may be exposed for any period of time to continuous noise above 115 dba or for impulse or impact noise measured at or above 140 dba peak.

4. HEAD PROTECTION. Ref. WAC 296-155-205.

Employees must wear hard hats or hard caps when they are:

a. Working on or adjacent to the traveled portion of roadways.

b. In Contractor's hard hat zones.

c. While operating heavy equipment not equipped with enclosed cabs.

d. Where there is danger of head injury from impact, falling, or flying objects.

e. Where there is danger of contact with a high voltage electrical source. Such head protection must meet the specifications contained in the American National Standards Institute (ANSI) Z 89.1 or Z 89.2.

5. TRAFFIC VESTS OR WORK VESTS. Ref. WAC 296-155-200.

Employees whose duties expose them to the danger of moving vehicles shall wear vests of highly visible materials or equivalent distinguishing apparel.

6. EYE AND FACE PROTECTION. Ref. WAC 296-155-215.

Employees subject to hazards from physical, chemical, or radiation agents must be provided eye and face protection.

7. FOOT PROTECTION. Ref. WAC 296-155-212.

Substantial footwear, made of leather or other equally firm material, must be worn by employees subject to a danger of injury to the feet through falling or moving objects, or from burning, scalding, cutting, penetration, or like hazard.

a. The soles and heels of such footwear shall be of a material that will not create a slipping hazard.

b. Footwear that has deteriorated to a point where it does not provide the required protection shall not be used.

Tennis shoes or thin soft soled athletic shoes, open-toed sandals, slippers, dress shoes, or other similar type shoes shall not be worn.

8. FALL RESTRAINT SYSTEMS. Ref. WAC 296-155-24510.

When employees are exposed to a hazard of falling from a location of 3.048 meters (10 feet) or more in height, a fall restraint or fall arrest system (see item 9) shall be provided, installed, and implemented according to the following requirements.

a. Fall Protection Work Plan

(1) A written fall protection work plan must be developed and implemented for each work area where employees are assigned and are exposed to fall hazards of 3.048 meters (10 feet) or more.

(2) The fall protection work plan must meet the requirements of WAC 296-155-24505 and be available at the job site for inspection by State L&I.

b. Fall restraint protection means a device approved in accordance with WAC 296-155-24510 and any necessary components that function together to restrain an employee in such a manner as to prevent that employee from falling to a lower level. Fall restraint protection shall consist of one or more of the following, as dictated by the situation and WAC 296-155-24510:

(1) Standard guardrails as described in WAC 296-155-505(6), or

(2) Safety belts and/or harness, meeting ANSI standards, and attached to securely rigged restraint lines, or

(3) A warning line and safety monitor system meeting requirements of WAC 296-155-24515(3) and WAC 296-155-24521 when working on low pitched roofs or walking/working surfaces with unprotected sides and edges.

(4) A warning line and safety monitor system is prohibited on surfaces exceeding a 4 in 12 pitch and on any surface whose dimensions are less than 1.143 meters (45 inches) in all directions.

c. Components of the system must be compatible and checked prior to use.

9. FALL ARREST SYSTEMS. Ref. WAC 296-155-24510.

a. A Fall Protection Work Plan as outlined in item 8a above must be developed and implemented.

b. Fall arrest protection means the use of multiple, approved, (per WAC 296-155-24503), safety equipment components, such as body harness, lanyards, deceleration devices, droplines, horizontal and/or vertical lifelines, and anchorages, interconnected and rigged as to arrest a free fall.

c. Fall arrest protection shall consist of:

(1) An approved, (per WAC 296-155-24503), Class III full body harness with approved components and rigging meeting the requirements of WAC 296-155-24510(3)(a), or

(2) Safety nets installed as required and meeting the requirements of WAC 296-155-24510, or

(3) Catch platforms meeting the requirements of WAC 296-155-24510.

d. Safety harnesses, lanyards, lifelines, and droplines, independently attached or attended shall be used while performing the following types of work when other equivalent type protection is not available:

(1) Work in hoppers, tanks, bins, silos, or other confined spaces as described in WAC 296-62-145.

(2) Work on hazardous slopes, or dismantling safety nets, working on poles or from boatswains chairs at elevations greater than 1.829 meters (6 feet), swinging scaffolds or other unguarded locations.

10. WORKING ON, OVER, OR ADJACENT TO WATER. Ref. WAC 296-155-235.

U.S. Coast Guard approved life saving devices must be worn unless it can be shown that conditions, such as shallow water, are such that flotation would not be achieved. At least one lifesaving skiff or boat shall be immediately available. Ring buoys with at least 27.432 meters (90 feet) of line shall also be provided for emergency rescue operations. Distance between ring buoys shall not exceed 60.96 meters (200 feet). Whenever boats

or skiffs cannot be used due to swift currents, life lines close to the water surface shall be provided and, whenever practical, a line stretched across the stream with tag lines.

All workers must be provided with U.S. Coast Guard approved buoyant life saving devices while transported in open boats or barges.

11. HAND TOOLS. Ref. WAC 296-155, Part G.

Electrically powered hand tools must be of the double insulated type or grounded. Power actuated tools must be operated by employees trained in the operation of the particular tool.

12. MACHINERY GUARDING. Ref. WAC 296-155-350 and 296-24-205.

a. When power operated tools are designed to accommodate guards, they shall be equipped with such guards when in use.

b. Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or moving parts of equipment shall be guarded, on all sides, if such parts are exposed to contact by employees or otherwise create a hazard.

13. LADDERS. Ref. WAC 296-155-480.

Portable ladders must be free of defects and adequately supported or anchored. The pitch of a ladder should be approximately 300 millimeters (1 foot) out at the base from the vertical plane for every 1.2 meters (4 feet) of length. Single cleat ladders must not be more than 9.144 meters (30 feet) in length and double cleat ladders no more than 7.315 meters (24 feet) in length. All ladders must have side rails which extend at least 914 millimeters (36 inches) above the landing. Cleats must be inset into the side rails 13 millimeters (½ inch) or filler blocks used on the rails between the cleats. Cleats must be uniformly spaced 305 millimeters (12 inches) top-to-top.

No work shall be performed on a ladder over 7.62 meters (25 feet) from the ground or floor that requires the use of both hands to perform the work, unless a safety belt is worn and the safety lanyard is secured to the ladder.

14. SCAFFOLDS. Ref. WAC 296-155-485.

Scaffolds more than 3.048 meters (10 feet) above the ground must have guardrails 914 to 1067 millimeters (36 to 42 inches) high plus a midrail and 102-millimeter (4-inch) toeboards. Where persons are required to work or pass under the scaffold a 13-millimeter (½-inch) wire mesh screen extending along the entire opening, must be installed between the toeboard and guardrail. Scaffolds 1.219 to 3.048 meters (4 to 10 feet) in height having a horizontal dimension of less than 635 millimeters (45 inches) in either direction shall have standard guardrails and toeboards installed on all open sides and ends of the platform.

15. CRANES, DERRICKS, ETC. Ref. WAC 296-155, Part L.

Rated load capacities must be posted on the equipment. Positive boom stops shall be provided and boom angle and load indicating devices shall be in good working order. There must be a minimum crew consisting of one person plus the operator during operations. No person is allowed to “ride the hook.” Work platforms suspended from cranes must be provided with standard railings and toeboards on all open sides.

The platform bridles must be attached by a safety strap above the ball or hook. Each worker on the platform must wear a safety belt with a lanyard tied off above the ball or hook. Electrical distribution lines near operating equipment should be de-energized and grounded or insulating barriers erected to prevent contact with the lines. Otherwise the operation must allow at least 3.048 meters (10 feet) clearance from live electrical power lines.

16. MOTOR VEHICLES. Ref. WAC 296-155-610.

a. Before leaving a motor vehicle unattended:

(1) The motor shall be stopped.

(2) The parking brake shall be engaged and wheels turned into the curb or berm when parked on an incline.

(3) When parking on an incline and there is no curb or berm, the wheels shall be chocked or otherwise secured.

b. All vehicles shall be equipped with an adequate audible warning device (horn) at the operator’s station and in operable condition.

c. No motor vehicle equipment having an obstructed view to the rear shall be allowed unless:

(1) Vehicles other than passenger cars and pickups shall have an automatic reverse signal alarm audible above the surrounding noise level no less than 4.572 meters (15 feet) from the rear of the vehicle, or:

(2) The vehicle is backed up only when an observer signals that it is safe to do so.

d. Vehicles used to transport employees shall have seat belts firmly secured and adequate for the number of employees to be carried.

17. EARTH MOVING EQUIPMENT. Ref. WAC 296-155-615.

Audible horns must be operated as necessary. Equipment with obstructed views to the rear must have a reverse signal alarm or an employee available to signal the driver in backing situations. Equipment must have brakes capable of stopping and holding the equipment fully loaded. Rubber tired vehicles must be equipped with fenders if speeds exceed 24 kph (15 mph) unless the employer gets a variance showing that uncovered wheels present no hazard to personnel from flying materials. All earth moving equipment must have approved Rollover Protective Structures (ROPS).

18. EXCAVATION, TRENCHING, AND SHORING. Ref. WAC 296-155, Part N.

Prior to opening an excavation or trench, efforts shall be made to determine whether underground installations of utilities will be encountered. If so, the appropriate utility company shall be notified and requested to identify the exact location of the underground installation.

a. Proper supports and precautions shall be provided for existing installations.

b. When electric lines are of the direct burial type, a qualified person shall make positive identification of the cable.

c. Mechanical excavation equipment shall maintain a 610-millimeter (2-foot) clearance from the direct burial cable.

No equipment, motor vehicle, tool, or individual shall operate within 3.048 meters (10 feet) of any power line or electrical distribution equipment except in conformity with the requirements of WAC 296-155-525(2)(e).

Trees, boulders, and other surface encumbrances located so as to create a hazard must be removed or made safe before excavation is begun.

Banks more than 1.22 meters (4 feet) high must be shored or sloped to the angle of repose. Sides of trenches in unstable or soft material 1.22 meters (4 feet) or more in depth must be shored, sheeted, braced, or sloped. When no shoring is used, the angle of repose must begin at the bottom of the trench. An adequate means of exit such as a ladder or steps shall be provided and located so as to require no more than 7.62 meters (25 feet) of lateral travel.

Portable trench boxes or sliding trench shields may be used for protection of personnel in lieu of a shoring system or sloping. Excavated or other material must be stored and retained 610 millimeters (2 feet) or more from the edge of the excavation.

Open top spaces more than 1.22 meters (4 feet) in depth, such as pits, tubes, vaults, vessels, and trenches shall be considered and treated as a confined space. See item 27 for confined space requirements.

No person shall be allowed to work in a trench over 1.22 meters (4 feet) in depth unless there is a top person in constant attendance. The top person shall be in addition to the equipment operator when the person in the trench is not in constant view of the equipment operator.

Air quality will be maintained within excavations and trenches to ensure the health and safety of workers.

a. In locations where an oxygen deficient atmosphere or gaseous conditions are possible, air in the excavation or trench shall be tested before entering.

b. Controls as set forth in WAC 296-155 Parts B and C shall be established to assure acceptable atmospheric conditions.

c. When flammable gases are present, adequate ventilation shall be provided and sources of ignition shall be eliminated.

d. Attended emergency rescue equipment, such as breathing apparatus, a safety harness with lifeline, basket stretcher, etc., shall be readily available where adverse atmospheric conditions may exist or develop in a excavation or trench.

(1) During such conditions, a competent top person shall be in constant attendance.

(2) The top person shall be thoroughly trained in emergency rescue procedures and shall maintain voice or visual contact with the persons in the excavation or trench at all times.

19. CONCRETE FORMS. Ref. WAC 296-155, Part 0.

Forms must be erected and braced so as to safely withstand all vertical and horizontal loads that may be imposed on them during concrete placement. Stripped forms must be removed and stockpiled promptly after stripping. Protruding nails, wire ties, etc., must be removed to eliminate hazard.

20. STEEL ERECTION. Ref. WAC 296-155, Part P.

Employees shall not be permitted to work above vertically protruding reinforcing steel unless it has been protected to eliminate the hazard of impalement.

Workers shall not ride on steel being hoisted, nor slide down ropes, columns, or ladders.

The use of safety harnesses, lanyards, and lifelines in steel erection shall be in accordance with WAC 296-155-225.

a. When connecting beams at the periphery of a building or structure where the fall distance is greater than 3.048 meters (10 feet), employees shall be tied off by approved safety harness and lifelines.

(1) To either peripheral columns;

(2) Pendant lines secured at the tops of peripheral columns;

(3) Catenary lines;

(4) Other secure anchorage points.

During the erection of structural steel members, the load must not be released from the hoisting line until the members are secured with at least two bolts drawn up wrench tight, or the equivalent at each connection.

21. COFFERDAMS. Ref. WAC 296-155-740.

If overtopping of the cofferdam is possible by high water, means must be provided for controlled flooding. Cofferdam walkways, bridges, or ramps with at least two means of rapid exit shall be provided with guardrails.

22. EXPLOSIVES. Ref. WAC 296-52.

The storing, transportation, and use of explosives must be in compliance with the Safety Standards for the Possession and Handling of Explosives, WAC 296-52. Every person in charge of the purchasing or using (blaster) must be licensed by the Department of Labor and Industries.

23. ELECTRICAL. Ref. WAC 296-155, Part I.

All electrical installations must conform to the Electrical Construction Code, WAC 296-44, and Safety Standards for Construction Work, WAC 296-155-425 through 296-155-455.

No person shall be permitted to work in close proximity to any part of an electric power circuit that they may contact in the course of their work unless the person is protected against electric shock by deenergizing the circuit and grounding it or by guarding it by effective insulation or other means.

Before work is begun, the Contractor shall ascertain by inquiry or direct observations or by instruments whether any part of an electrical power circuit, exposed or concealed, is so located that the performance of the work may cause contact.

All 120-volt, single-phase receptacle outlets on construction sites, which are not part of the permanent wiring of the building or structure and which are in use by employees, shall have approved ground-fault circuit interrupters for personnel protection.

Receptacles on a two-wire, single-phase portable or vehicle-mounted generator rated not more than 5 kw, where the circuit conductors of the generator are insulated from the generator frame and all other grounded surfaces, protection with a ground-fault circuit interrupter is not needed.

The Contractor shall establish and implement an assured equipment grounding conductor program on construction sites covering all cord sets, receptacles which are not part of the permanent wiring of the building or structure, and equipment connected by cord and plug which are available for use or used by employees.

24. HANDLING TRAFFIC THROUGH AND AROUND CONSTRUCTION.

Temporary roadways and detours must be properly maintained. Satisfactory traffic control measures (signs, barricades, and flaggers) must be used in accordance with the *Manual on Uniform Traffic Control Devices*.

25. ASBESTOS CONTROL. Ref. WAC 296-62-077.

It shall be determined whether asbestos, hazardous materials, hazardous chemicals, gases, explosives, flammable materials, or similarly dangerous substances are present at the work site. When the presence of any substance is apparent or suspected, testing and removal or purging shall be performed and the hazard eliminated before demolition is started.

Asbestos containing material (ACM) may be encountered during a construction project in the form of asbestos cement pipe, pipe insulation, or as insulation in a structure that is being demolished. It can be found in pipe for water and sewer mains, electrical conduits, drainage pipe, and vent pipes, etc. Normal breakage and crushing of the material can cause an asbestos fiber release which presents a serious respiratory hazard. It is imperative that asbestos fiber release be controlled. Citations, by regulatory agencies, for an asbestos fiber release carry substantial fines.

Only employees certified by the State of Washington as a Certified Asbestos Worker may work on ACM during construction, demolition, repair, maintenance, renovation, salvage, or disposal of ACM.

Projects which will involve a known asbestos hazard, will have strict contract specifications and controls outlined in the Contract Plans and Contract Provisions. On projects where no asbestos hazard is expected, but asbestos is encountered, the Project Engineer or key field inspectors will:

a. Stop all activities that may disturb the material.

b. Wet the exposed, damaged material to prevent further fiber release, if possible.

c. Keep all employees and the public away from the material.

d. Notify the Project Engineer of the situation. Further activity that will disturb the material will require special workers, equipment, and controls, and require a change order.

Detailed procedures for asbestos hazard control are found in WSDOT's *Asbestos Abatement Manual*, M 27-60.

26. EXPOSURE TO GASES, VAPORS, FUMES, DUSTS, AND MISTS. Ref. WAC 296-155-160.

Exposure of employees to inhalation, ingestion, skin absorption, or contact with any material or substance at a concentration above those specified in WAC 296-62 shall be avoided.

To achieve compliance, administrative or engineering controls must be implemented. If this is not feasible, protective equipment or other protective measures will be used to control the employee exposure. The use of respirators shall comply with WAC 296-62-071.

Concern for suspected exposures should be discussed with the Contractor. If the concentration of air contaminants is unknown, but they are of notable presence through smell or sight, an Industrial Hygiene Consultant may be requested from the Olympia Service Center Safety Office through the Project Engineer's Office.

27. CONFINED SPACES. Ref. WAC 296-26-145.

Any space having a limited means of escape which is subject to accumulations of toxic or flammable contaminants or an oxygen deficient atmosphere is considered a confined space. All work conducted in a confined space shall comply with the provisions of WAC 296-62-145.

Confined spaces include but are not limited to storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open top spaces more than 1.22 meters (4 feet) in depth, such as pits, tubes, vaults, and vessels.

Whenever internal combustion equipment exhausts in enclosed spaces, tests will be made and recorded to ensure that employees are not exposed to unsafe concentrations of toxic gases or oxygen deficient atmospheres.

Whenever concern exists for the quality of air in a confined space, testing of the atmosphere shall be arranged. Prior to entry, Vapor Freeing shall be conducted by use of ventilation. A minimum of five air changes is recommended where oxygen deficiency may exist and ten air changes is recommended where a toxic and/or flammable material is involved.

Ventilation shall be maintained at all times when employees are in a confined space except when the atmosphere has been purposely inerted to provide safe working conditions. All work will stop and the area shall be evacuated if ventilation fails.

After initial cleaning, vapor freeing, and evaluation of the atmosphere, the confined space may be entered to complete cleaning, repair, or other work.

a. Respiratory protective equipment shall be used when indicated.

b. An observer capable of maintaining communications at all times shall be located outside the confined space. The observer shall have respiratory protection available when indicated.

c. If a toxic or flammable atmosphere, or oxygen deficiency exists or can develop, workers shall wear a safety harness with lifeline attached and a means of rescue shall be provided.

d. Fire extinguishing equipment shall be immediately available when indicated.

e. All tools and equipment shall be available as required.

f. Emergency lighting shall be available as required.

g. The area shall be evacuated if any indication of ill effects, such as dizziness, irritation, or excessive odors, are noted.

Contractors shall develop, distribute, and enforce a written procedure which shall include planning, general precautions, procedures, evaluations of hazards, ventilation requirements, personal protection, isolation, and responsibilities for confined space work.

28. HAZARDOUS WASTE CONTROL. Ref. WAC 173-303.

Waste is a natural by-product of human activity. Although all waste is a nuisance to society, not all waste is necessarily hazardous. Hazardous waste may be defined as that which poses a threat to human health, the environment, and public property if handled or disposed of improperly. The hazard is created by virtue of the toxicity, flammability, explosibility, reactivity, radioactivity, corrosivity, or etiologic (disease-causing) potential of the waste.

The safe handling, collection, and disposal of hazardous waste can be accomplished only if the physical, chemical, and hazardous properties of its components are known. Quite often, the composition is not known because waste

is usually a mixture of many components with different properties.

The Project Engineer and key field inspectors must ensure that contractors comply with all State and Federal regulations and have proper waste handling, storage, and disposal procedures. Construction site procedures should include but are not limited to the following:

a. Collect liquid wastes in either 19-liter (5-gallon) cans or 208-liter (55-gallon) drums.

b. Collect solid waste in appropriate containers.

c. Segregate chemically incompatible wastes.

d. Dispose of hazardous waste promptly so that only small quantities are allowed to accumulate at any one time.

e. Locate combustible piles away from buildings, roadways, and ignition sources.

f. Maintain flammable and corrosive liquid wastes in approved metal containers.

g. Inspect hazardous waste containers continuously to ensure their integrity.

h. Identify the hazardous waste and hazard associated with each waste by properly marking the exterior of each container, storage tank, transport vehicle, or building.

In situations where containers of unidentified chemicals are encountered at the construction site, the Project Engineer or key field inspectors will:

a. Stop all activities that may disturb the material.

b. Keep employees and the public away from the material.

c. Notify as soon as possible:

(1) The Regional Operations/Construction Office.

(2) The Olympia Service Center Construction Office.

(3) FHWA (for Federal-Aid Projects).

(4) The appropriate Regional Office, Environmental Quality Section, State Department of Ecology.

In situations where a potentially hazardous substance is spilled or emitted by WSDOT or Contractor employees at a construction site, the Project Engineer or key field inspector will:

a. Stop all activities that may disturb the material.

b. Keep employees and the public away from the material.

c. Notify immediately:

Division of Emergency Management (DEM) at (800) 262-5990, 24 hours a day, for spills or discharges, regardless of quantity, such that the public health or the environment are threatened. (This will activate the local emergency plan.)

d. Also notify as soon as possible:

(1) The Regional Operations/Construction Office.

(2) The Olympia Service Center Construction Office.

(3) FHWA (for Federal-Aid Projects).

(4) The appropriate Regional Office, Environmental Quality Section, State Department of Ecology (for ground spills or spills into ground or surface water).

(5) For discharges that result in emissions into the air, also notify:

Western Washington — Local Air Pollution Control Authority or;

Eastern Washington — Regional Office of the Department of Ecology.

29. LEAD HEALTH PROTECTION PROGRAM. Ref. WAC 296-155 -176

The Contractor is required to develop, implement, and maintain a Lead Health Protection Program (LHPP) when work disturbs paint containing lead. The Special Provisions will identify when a LHPP is required.

The Contractor shall send a copy of the LHPP to the Project Engineer at least 30 days prior to the initiation of the work that disturbs the paint.

The Lead Health Protection Program should include:

1. General introduction.

2. Lead health and safety organization and responsibilities.

3. Exposure monitoring for lead and other known hazards.

4. Engineering and administrative controls.

5. Respiratory protection.

6. Protective work clothing and equipment.

7. Hygiene facilities and practices.

8. Houskeeping.

9. Medical surveillance program, including medical removal protections and appropriate worker notification procedures.

10. Decontamination procedures.

11. Employee information and training procedures.

12. Record keeping.

The Project Engineer does not approve the LHPP, but only verifies that a plan has been established. However, any deficiencies the Project Engineer notices in the plan should be brought to the Contractor's attention.

30. CORRECTIVE ACTION FOR APPARENT VIOLATIONS.

When an apparent violation is noted, it should immediately be brought to the attention of the Contractor's project supervisor. If correction is initiated, notation should be made in the project diary and no other action need be taken.

If the Contractor's project supervisor fails to take satisfactory corrective action, an entry should be made in the project diary and written notice of the apparent violation will be given to the Contractor by the Project Engineer requesting a prompt correction or explanation. The Contractor should be advised that lack of response within 2 days may result in our notifying the State Department of Labor and Industries, and, if necessary, the U.S. Department of Labor, of the apparent violation and requesting their review. NOTE: It is expected that, should the Contractor fail to respond to the written notice, the Project Engineer will advise the Regional Operations/Construction Engineer of the problem, and that office will make the decision to call in the outside agencies. The Olympia Service Center Construction Office and the Olympia Service Center Safety Office may be contacted for assistance in Washington Administrative Code interpretations and other information to aid in making this decision.

If the Regional Operations/Construction Engineer's Office determines that the Washington State Department of Labor and Industries, Industrial Safety and Health Division (State L&I), needs to be called upon, there are two options to pursue the problem. State L&I offers consultation service (advise is given) and enforcement (citations are issued). There are five regions statewide, and the same phone number is called for consultation and for issuing citations. When calling, indicate which service is desired. The phone numbers and counties served are:

a. **Region 1** — Everett (206) 356-2950 or SCAN 599-2950 — Island, San Juan, Skagit, Snohomish, and Whatcom.

b. **Region 2** — Seattle (206) 281-5470 or SCAN 388-1470 — King.

c. **Region 3** — Tacoma (206) 593-2866 or SCAN 462-2866 — Clallam, Jefferson, Kitsap, and Pierce.

d. **Region 4** — Olympia (360) 753-6501 or SCAN 234-6501 — Clark, Cowlitz, Grays Harbor, Klickitat, Lewis, Mason, Pacific, Skamania, Thurston, and Wahkiakum.

e. **Region 5** — Spokane (509) 456-2978 or SCAN 545-2978 — Adams, Asotin, Benton, Chelan, Columbia, Douglas, Ferry, Franklin, Garfield, Grant, Kittitas, Lincoln, Okanogan, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman, and Yakima.

When a serious violation is noted by any WSDOT employee which presents an immediate danger to the Contractor's workers, WSDOT personnel, or the public, that employee shall immediately advise the Project Engineer or the delegated representative of the Project Engineer, who will review the situation promptly and, if the danger does exist, order the affected work shut down and temporary safeguards installed or other necessary safety measures taken. The Regional Operations/Construction Office shall be advised of the action as soon as possible and that office will notify the Olympia Service Center Construction Office of the shutdown. The Project Engineer will advise the Contractor of the violation and action at the earliest possible time verbally, with follow-up in writing. Here again, prompt corrective action by the Contractor will negate further action but failure to make corrections may result in the Region notifying the controlling agencies. Work will not be allowed to proceed until correction of the violation is complete. It is suggested that the expertise of the Service Center or Regional Safety Officer be utilized to the fullest extent considered appropriate.

When investigations are conducted by the FHWA, the U.S. Department of Labor, or the State Department of Labor and Industries, project personnel will extend full cooperation. In the event violations are cited and these agencies request that sanctions available under the contract be applied (i.e., work shutdown, withholding of payments, etc.) The Olympia Service Center Construction Office should be contacted for guidance.

1-2.2I(5) Pedestrian Safety

When the work area encroaches upon a sidewalk, crosswalk, or other areas that are near an area utilized by pedestrians or bicyclists, special consideration shall be given to their accommodation and safety. Pedestrians are more susceptible to personal injury in working areas than are motorists. Visibility and recognition of hazards

is an important requirement for the safety of pedestrians and bicyclists.

Protective barricades, fencing, handrails, and bridges, together with warning and guidance devices, should be used so that passageways for pedestrians and bicycles, bridle paths, and other nonmotorists are safe and well defined.

Where walks are closed by construction or maintenance, an alternate walkway should be provided when feasible. Where it is necessary to divert pedestrians into the parking lane of a street, barricades and delineation should be provided to separate the pedestrian walkway from the adjacent traffic lane. Pedestrians should not be diverted into a portion of the street used by vehicular traffic. At locations where adjacent alternate walkways cannot be provided, appropriate signs should be posted at the limits of construction and in advance of the closure at the nearest crosswalk or intersection to divert pedestrians across the street.

When hazardous work conditions exist overhead, it may be necessary to install a fixed pedestrian walkway of the fence or canopy type to protect and control pedestrians. In such cases, wood and chain link fencing can be used with warning lights and illumination to warn and guide both pedestrians and motorists.

Fences around a construction area are often necessary and may be a requirement of the local jurisdiction building code. They are often constructed in conjunction with a special pedestrian walkway or when there are deep excavations or when pedestrian access to the job site is not desirable. Installation of such fencing must take into account relocation of existing control devices and facilities such as traffic signals, pedestrian signals, traffic signs, and parking meters. The use of chain link fencing which can be seen through may be needed at intersections to provide adequate sight distance.

Relocating a walkway, without unreasonable inconvenience to pedestrians, residents, or commercial interest, is the safest practice of all. It should be remembered, however, that pedestrians like to “see what’s going on.” Simply denying them access does not, of itself, ensure their nonencroachment on the worksite. Sometimes it is advisable to design and construct a pedestrian observation area for this purpose.

1-2.2J Responsibility for Environmental Considerations

During the precontract period, the Project Engineer should obtain copies of the final Environmental Impact Statement and any special environmental studies related to the project. The Regional Environmental Office should have this information. It is important that all key personnel become familiar with the environmental factors considered during the design process. The contract documents will include necessary provisions for protection of the environment, including requirements that the Contractor secure permits from and abide by regulations of appropriate Federal, State, and local agencies. Any changes in the contract work which may become necessary must be reviewed to ensure conformance with requirements and commitments established during the environmental reviews conducted during design.

1-2.2K Responsibility for Posting Required FHWA and State Labor and Industries Job Site Posters

A combination of State and Federal laws and regulations require that on all WSDOT administered contracts some or all of the posters listed below be posted at the place of employment where all employees have ready and free access to inspect their contents. The Project Engineer shall ensure the Contractor complies with these requirements.

1. FHWA 1495 and 1495A — Wage Rate Information.
2. FHWA 1022 — Fraud Notice Poster.
3. OFCCP-1420 — Equal Employment Opportunity is the Law.
4. WISHA P416-081-000 — Job Safety and Health Protection.
5. Industrial insurance poster — P242-191-000.
6. Your rights as a worker — F700-074-000.
7. Notice to Employees — EMS 9874.
8. Approved Statement of Intent to Pay Prevailing Wages.
9. Copy of wage rates from the contract provisions.

If Federal funds are involved, posters 1 through 9 must be posted. If only State funds are involved, posters 4 through 9 must be posted.

After contract execution and before work begins, the Contractor shall be given a package containing the appropriate required job site posters. This package shall be accompanied by either a written or verbal explanation of the contents and shall include notification that the Contractor, each subcontractor, and each lower tier subcontractor will have to post a State L&I approved copy of a Statement of Intent to Pay Prevailing Wages. This action shall be specifically noted in the minutes of the meeting to serve as a matter of record.

Posters 1 through 7 listed above should be obtained through your Regional Supply Office.

1-2.3 Construction Traffic Control

1-2.3A Public Convenience and Safety

Under the many special conditions encountered where traffic must be moved through or around construction operations, serious problems of traffic control can occur. Most conditions are usually temporary and are therefore dangerous and difficult to deal with because they are unexpected and not in accord with the normal pattern of highway traffic.

Section 1-07.23(1) of the *Standard Specifications* requires the Contractor to conduct all operations with the least possible obstruction and inconvenience to the public and to provide adequate safeguards, safety devices, protective equipment, and any other needed actions to protect the life, health, safety, and property of the public. The responsibility to comply with these requirements is the Contractor's. The expense to comply with these requirements is the Contractor's, except that which is furnished by WSDOT. It is the Project Engineer's responsibility to ensure that the Contractor complies.

1-2.3B Construction and Maintenance of Detours

Construction zone detours (Section 1-07.23(2) of the *Standard Specifications*) shall be designed for the speeds vehicles *will* travel, not the speeds one *hopes* they will travel. Many drivers will not slow down once they are accustomed to sustained higher speeds. Detours should be designed to the highest geometric standards relative to the existing roadway and physical limitations of the area. Transition lengths, curve radii, and superelevations should be consistent with the design standards required for the speed of traffic that will be entering the detour. This could require an additional stage in the construction; for example, the placing of asphalt concrete over portland cement concrete pavement to build up superelevation. When warranted, temporary concrete barriers are recommended. Proper end protection must be provided.

Any sudden major changes in either geometric standards or speed limits should be avoided, if possible. The element of surprise can be reduced by making gradual, step-down reductions. These reductions should be made in increments of not more than 17 kph (10 miles) per hour.

Old traffic stripes or arrows on asphalt pavement should never be merely blacked out with oil or paint. Rather, the striped and adjacent areas should be sandblasted in a pattern different from the original marking until the marking is no longer visible. This change in pattern minimizes the possibility that the original marking will still be visible to drivers, especially at night or in rainy weather when covered-over stripes have a tendency to shine in contrast to the pavement.

Barricades are inherently fixed object hazards. Therefore, they should not be used unless the construction hazard the motorist may encounter is greater than the hazard of striking the barricades. They should not be used as primary delineation to guide traffic.

Delineation devices must be maintained, and kept clean. When delineators become covered with grime or are damaged they become ineffective. The condition and positioning of these devices should be checked daily.

1-2.3C Temporary Traffic Control

1-2.3C(1) General

General (Section 1-10.1 of the *Standard Specifications*) provides that: (l) no work shall be done until all necessary signs and traffic control devices are in place; (2) if the Contractor does not provide necessary traffic control, WSDOT may do it and deduct the cost from the Contractor's payments; and (3) the Contractor is responsible regardless of whether or not WSDOT orders, furnishes, or pays for necessary traffic control.

This subsection also provides for setting up new items that could not be anticipated by a prudent contractor. An example of this is: the original contract contemplates (or is silent about) all work being done in daylight hours, and due to traffic congestion during daylight hours, the Engineer directs the Contractor to perform certain phases of the work between the hours of 9 p.m. to 5 a.m. when the traffic congestion is minimum; then, illumination (light plants) for the flaggers should be considered for a "new" item. The key would be if the Engineer changed the contract from what a prudent contractor could normally expect to do. If the Contractor would normally expect to do this phase of the work at night for some other reason, such as convenience to the Contractor, it is normally done that way, and/or the Engineer did not direct the Contractor to do it that way, then, a new item would not be appropriate. Take note of the other limiting factors in the *Standard Specifications* for establishing a "new" item as provided in this subsection. The *Standard Specifications* also provides for the Engineer to determine what is usually anticipated by a prudent contractor if a dispute occurs. The best guide for this determination is the normal and common industry practice. If the Contractor requests a "new" item to be established, and if there is a doubt about normal and common industry practice, the Project Engineer should consult with the Regional Operations/Construction

Engineer and, if necessary, with the Olympia Service Center Construction Office so that a uniform statewide interpretation is made for this issue.

It is important for the Project Engineer to ensure that all necessary signs and other traffic control devices are properly placed at all times so the traveling public is made aware of all deviations from the normal traffic conditions and is furnished adequate direction and guidance to permit safe travel through the construction area. At no cost to WSDOT, the Contractor shall provide all necessary signs, barrels, barricades, and other devices not furnished or paid for by WSDOT.

1-2.3C(2) Traffic Control Plans

Traffic Control Plans (Section 1-10.2(2) of the *Standard Specifications*) addresses the requirements of Traffic Control Plans (TCP). The Contractor must adopt by written response, the TCP appearing in the contract or any modified TCP to be used for the project. The Contractor must adopt or propose modifications to all TCP at least ten calendar days in advance of the time the signs and other traffic control devices will be required.

Minor modifications to the TCP may be made by the Traffic Control Supervisor to accommodate site conditions. Modifications or adjustments to the plan must maintain the original intent of the plan. When there is a change in the intent and substantial revisions are needed, a revised plan should be submitted for approval. The Regional Traffic Office should be consulted when this situation occurs.

If the Contractor's method of operation or the work area conditions require other than minor modification of the specific TCP appearing in the contract or any of the TCP previously designated and adopted by the Contractor, the Contractor shall submit, to the Project Engineer, proposed modification of the TCP for approval. If the Contractor's proposed modifications comply with the MUTCD requirements, the Project Engineer may approve these proposed modifications. If the Contractor's proposed modifications do not comply with the MUTCD requirements, the Project Engineer shall submit the proposed modifications to the Regional Traffic Engineer for approval.

If there is any doubt that the TCP will comply with the MUTCD or provide for the safe movement of traffic, the Project Engineer should consult with the Regional Traffic and Operations/Construction Engineers.

1-2.3C(3) Construction Signs

Construction Signs (Section 1-10.3(3) of the *Standard Specifications*) divides construction signs into two categories, Class A and Class B. The work required for the Contractor is the same for the Class A and B signs. A specific pay item is provided for the Class A signs. The only payment for Class B signs is the labor for daily set up and removal.

The Project Engineer shall arrange to furnish to the Contractor all necessary standard signs and shall see that they are erected and maintained in proper condition by the Contractor during the period of need. As soon as the need for any sign is ended, the Project Engineer shall require the Contractor to remove the sign and return it to WSDOT in good condition. All signs lost, damaged, or destroyed by the Contractor shall be replaced in kind or their value deducted from payments due or coming due the Contractor.

At no time should signs be left in traffic control position during periods when they are not necessary to traffic safety. Indiscriminate use of traffic control signs soon destroys public confidence and respect for the signs. Unnecessary traffic restriction and inconvenience causes a resentful attitude by the public, tends to reduce the effectiveness of all signing, and causes difficulty in enforcement by authorities. The Project Engineer should ensure that signs are removed or covered with metal or plywood during the hours they are not needed, particularly after working hours, on nonworking holidays, and especially on weekends.

Signs needed for control of traffic around a work unit moving progressively along the roadway should be relocated as the work unit moves so that the length of the restriction area is kept to the minimum required. A warning sign too far in advance of the work area has little value. It is also necessary to inform the motorists when they have left the restriction area so they may resume their driving speed. If the end of this restriction area is the end of the project, the END CONSTRUCTION sign should be sufficient. If the restriction ends within the project limit, a resume speed, speed limit, or end lane closure sign should be posted.

Signing for nighttime traffic is more difficult than that required for daylight hours. All signs that are to convey their messages during the hours of darkness shall be reflectorized or illuminated. A review of the project signing should be made and recorded during the hours of darkness to determine that it is adequate.

In setting up signs and other control devices, the assistance of the Regional Traffic Engineer should be sought and utilized. After the installation is complete and traffic is being accommodated, the signing should be checked and the reaction of traffic to the various devices observed to ensure that the desired driver response is achieved. Many adjustments may be necessary to create order out of chaos. The Project Engineer or a designee of the Project Engineer must assure themselves that the traffic is operating smoothly and the message(s) conveyed to the motorist are properly received.

One should be judicious in the type and amount of signing to be used in construction zones. The use of too many signs can be dangerous because they may distract the driver's attention away from the roadway for an excessive span of time, cause confusion, or cause drivers to ignore them. "Too many" signs might be described as that number which creates a cluttered impression. A judgment based on the speed of traffic, amount of driver distractions, number of driver decisions necessary, and the geometrics of the highway must be made to determine the proper number of signs. Should any employee observe "near accidents," immediate action must be taken to check for down, obscured, or improperly placed signs. The TCP shall be reevaluated if necessary.

1-2.3D Advisory Speed Sign

Within a construction area, there may be short sections of roadway, such as curves or rough roadway, which may not be safely negotiated at the established speed limit. For these areas, an Advisory Speed Sign shall be used in conjunction with proper warning signs. The speed shown on the sign is not intended as an enforceable limit but should show, in multiples of 8 kilometers (5 miles) per hour, a reasonable speed for normal conditions of weather and lighting. The proper advisory speed must be determined in accordance with good traffic engineering practice by the Regional Traffic Engineer.

1-2.3E Speed Limits and Road Closures

1-2.3E(1) Reduced Speed Limits

When speed restrictions are necessary, the Project Engineer shall submit a request to the Regional Traffic Engineer in advance of the need. Per RCW 47.48.010, the Regional Administrator may establish a reduced regulatory speed limit in accordance with the following:

1. A reduced regulatory speed limit shall be established only where changes to the roadway environment dictate an operating speed lower than the normally posted speed limit. If the reduced speed limit is effective only during the hours of work, the reduced speed limit signs are to be removed or covered when the reduced speed limit is not in effect.

2. A reduced regulatory speed limit shall not be used as a warning device as it has no warning connotation and does not advise motorists of hazards which may be encountered.

3. Notice of reduced speed limit shall be published in one issue of a newspaper in the area in which the speed reduction will take place. The speed limit shall not be reduced less than 3 days after publication and posting of the notice of speed reduction. If the speed limit reduction is postponed beyond the published dates, it will be necessary to repeat the process prior to reducing the speed limit. In cases of emergency or periods of 12 hours or less the speed limit may be reduced without prior notice to the public, but if possible, we should post a notice one working day in advance of the reduction. See RCW 47.48.020 (Appendix I) for complete legal responsibilities.

4. The appropriate Maintenance Superintendent shall be advised of the established reduced regulatory speed limit by memorandum with a copy of the applicable traffic engineering investigative report attached.

5. When the speed limit is lowered, the area of reduced speed shall be adequately signed. Variable message signs should be used to supplement the speed limit signing and should explain the reason for the reduction. Coordinate with the Washington State Patrol (WSP) for enforcement of the reduced speed. The applicable Regional Office of the WSP shall be advised of the established reduced regulatory speed limit by separate memorandum or a copy of the memorandum required in paragraph 4 above.

WSDOT has an agreement with the WSP for them to provide troopers and vehicles to help with traffic control on construction projects. This will include flagging, controlling pedestrians, controlling signalized intersections, controlling traffic during lane or ramp closures, and enforcement of speed reductions. The WSP should be used for traffic management rather than exclusively for enforcement, by using a combination of stationary and circulating patrols. WSP will be available on an on-call basis. At the request of the Contractor, WSDOT will request in writing the use of WSP. If time does not allow an advanced written request, WSDOT may verbally request the use of WSP, with a written request following within 72 hours. WSDOT will reimburse WSP by voucher.

6. Speed limit signs for reduced regulatory speed limits will be black letters on a white background. Signs for advisory speed reduction such as on chip seal projects will be black letters on an orange background.

1-2.3E(2) Road Closures

When it is necessary to close a road, street, or ramp, the Project Engineer shall submit a request to the Regional Traffic Engineer in advance of the need. Per RCW 47.48.010, the Regional Administrator may close a road, street, or ramp.

Notice of the closure shall be published in one issue of a newspaper in the area in which the closure is to take place. Signs indicating dates and times of the closure shall be placed at each end of the section to be closed on or before publishing the notice in the newspaper. Publishing the notice and placing of the signs shall be a minimum of three days in advance of the closure.

In cases of emergency, or closures of 12 hours or less, the road, street, or ramp may be closed without prior notice to the public. If possible, a notice should be posted one working day in advance of the closure.

1-2.3F Records of Construction Signing

Due to the increased damages being awarded by the courts for improper signing, it has become mandatory that detailed records of signing and delineation be continuously maintained on every project on sections of highway within the construction limits under traffic. The following are procedures to be followed and methods of recording the signing on the project:

1. Pictures.

2. The Contractor's signing must adhere to the TCP, and the records must confirm that the sign installation is checked against that plan. The Regional Traffic Engineer should only be involved in significant changes to TCPs and need not be involved in minor adjustments.

3. Documentation of the Contractor's activity for traffic control, including signing, is completed by the Contractor's Traffic Control Supervisor (TCS). In accordance with the *Standard Specifications*, the TCS must maintain a daily project traffic control diary. DOT Forms 421-040A, Contractor's Daily Report of Traffic Control — Summary, and 421-040B, Contractor's Daily Report of Traffic Control — Traffic Control Log, are provided to the Contractor and used for this purpose.

4. The Summary report will typically contain a brief description of the daily activities of the TCS with expanded details of any important happening such as accidents, meetings, decisions, or rapidly deteriorating conditions of traffic or weather. The Summary report is usually sufficient to verify the location and status of Class A signs once they are installed.

5. The Traffic Control Log report is used to specifically identify all details of each Class B work zone setup. This includes identification of specific signs used, exact location of the signs, exact location of flaggers, exact location of the work zone, the time it was set up, and the time it was removed. Additional information includes if cones were used, if traffic was piloted through the work zone, and if the setup was in accordance with an approved traffic control plan.

1-2.3G One-Way Piloted Traffic Control Through Construction Zones

The major points to note in Section 1-10.3(6) of the *Standard Specifications* are: (l) that one-way piloting is not limited to treated bases, surface treatments, and pavements, therefore, it can be used in other operations, such as grading, when appropriate; (2) the "pilot car control area" is any one area or section of the project controlled by pilot car operations. There can be more than one area or section and there can be more than one pilot car and driver in each area or section, however, each "pilot car control area" will be addressed separately and accumulatively for the total hourly payment on the contract; (3) when the contract does not stipulate a pilot car operation (i.e., bid proposal does not include such an item) a new item can be established by change order if the Engineer deems that method of traffic control to be most appropriate; and (4) regardless of any flagging or piloting services furnished by WSDOT, responsibility for protection of the work and traffic remains with the Contractor.

1-2.3H Measurement and Payment for Traffic Control

Traffic Control Labor

"Traffic Control Labor" will be by the hour for each hour a person is actually performing the work described in Section 1-10.3(1), Traffic Control Labor. In other words, we will pay for the hours the paddle is in the air for flaggers and the hours an individual is handling Class B Construction signs and other traffic control devices. Additional payment will not be made for a relief flagger during the time the regular flagger is on break. No adjustment in the hourly bid amount will be paid for overtime work.

Portions of an hour will be rounded up to a whole hour.

Construction Signs Class A

The item "Construction Signs Class A" includes No Passing Zone signs. Class A signs may be used in more than one location; however, a sign will be measured for each installation, at any one location, one time only. Class B signs will not be measured for payment.

1-2.3I Traffic Control Management

WSDOT will provide a **certified** Traffic Control Supervisor for every project in which the Contractor is required to provide one. It is intended to have qualified, trained representatives from both the Contractor and WSDOT work together to manage traffic control on the project. When reference is made to the "Traffic Control Supervisor" in this manual or the *Standard Specifications*, it shall mean the Contractor's Traffic Control Supervisor unless stated otherwise.

1-2.3I(1) Contractor's Traffic Control Supervisor

Duties of the Contractor's Traffic Control Supervisor are listed in detail in Section 1-10.2(1) of the *Standard Specifications*, and include maintaining a daily traffic

control diary. WSDOT provides the Contractor's Daily Report of Traffic Control (DOT Forms 421-040A and 421-040B) for this purpose.

The Contractor's TCS may not be required full time on the project, but, is required to perform all the duties specified in the specifications. When the Contractor is working multiple shifts, it may be necessary to have more than one person assigned during a 24-hour day.

The Contractor will be paid a full day for any day or part of a day that one or more of the Traffic Control Supervisors are required to work, including meetings. Partial days should not be used for payment.

1-2.3I(2) WSDOT's Traffic Control Supervisor

WSDOT's Traffic Control Supervisor is intended to be a specialist representing the Project Engineer in matters concerning traffic control on a project. This position will work closely with, and be the primary liaison for, the Contractor's Traffic Control Supervisor. This position will also review the Contractor's Daily Report of Traffic Control to ensure it contains all necessary and pertinent information.

1-2.3J Records of Accidents and Surveillance

The Regional Administrator shall be responsible for establishing a policy that will ensure all accidents, within each construction project limits during the life of the project, are reported and a copy of that report is placed in a separate project file and made a part of the final permanent records (Chapter 10 of this manual). It is suggested that local and state law enforcement cooperation be enlisted to accomplish this purpose. In addition, when night inspections for traffic safety or reviews by Regional Traffic personnel (at any time) are made, the documentation of these inspections or reviews shall be placed in that separate file. This can be accomplished by copies of the Inspector's Daily Report, copies of Diary entries, or by a memo to the file. In other words, all documentation, relative to accidents or safety and traffic surveillance, shall be placed in that separate file and that file shall be dedicated solely for that purpose.

1-2.4 Application of Contract Provisions, Plans, and Specifications

1-2.4A Construction Contracts Information System (CCIS)

The CCIS is a mainframe/microcomputer system designed to track all construction projects and generate reports. The initial setup of a contract will be extracted from CAPS. A majority of the data entry will be entered into the system at the Project Engineer level. All data is entered and stored on the mainframe. To generate reports, this data is downloaded to a SQL server which anyone can access.

CCIS generates the Weekly Statement of Working Days and Change Orders. The system creates the forms for these so a preprinted form is not needed.

Following is a list of data that shall be entered in CCIS during the life of a project:

Contract Information

Region Administering contract
Region the contract is located in
Regional Administrator
Operations Engineer
Project Engineer
Begin and End mile post
County
Prime Contractor's local address if applicable
Prime Contractor contract person
Prime Contractor D/M/WBE type if applicable
Prime Contractor ethnic code if applicable
Date of Statement of Intent to Pay Wages
Date of Contractor and Subcontractor/Agent Cert. for F.A. Projects
Date of Affidavit of Wages Paid
Date of Preconstruction Conference Minutes
Date time started
Date work started
Date Orig. Progress Schedule approved
Date of Substantial Completion
Date of Physical Completion
Final Estimate to Contractor
Date of Completion
Final Estimate to Olympia Service Center (filled in by Region office)
Indicate which items are speciality items
Contract time

Request to Sublet

Training Program

Apprentice/Trainee Approval Request

Change Orders

Verbal Approval
Date sent to Contractor
Date received from Contractor
Is there Surety consent
Date of Surety consent
Dates of approval and execution

Weekly Statement of Working Days

Refer to the *CCIS Manual* for details on using the system.

1-2.4B Order Lists

The Project Engineer shall give the Contractor a pipe list to order pipes when the location and lengths of the pipe have been determined, with copies to the Region Office. Also, items such as guard rail, for which the Contractor has to order materials, shall be ordered in writing by the Project Engineer. Minor changes in position and/or length of these items will not require a change order.

1-2.4C Changes in the Work

WSDOT reserves the right to make alterations in the plans or quantities as may be considered necessary, in accordance with Section 1-04.4 of the *Standard Specifications*. In addition to changes ordered by WSDOT, the Contractor may submit proposals for changing the plans, specifications, or other requirements of the contract. The Project Engineer is encouraged to view these proposals as constructive and valuable ideas brought forth by a full partner in the contract and treat them accordingly. Contractor-proposed changes will generally fall into one of two categories:

1. Changes in Materials, Work Method, or Work Sequence

This type of proposal might include material or product substitutions, work method changes, work sequencing changes, etc., that normally take place during the construction of a project. Some of these require change orders, some do not. Contractor proposals would not require change orders when: (1) the contract specifies a material/product or an approved equal and the Contractor's proposal is for the substitution of such an equal; or (2) the contract contemplates and allows work method changes, sequencing changes, etc. Any other Contractor proposal would require a change order.

If a proposed change in this category is acceptable to WSDOT, but is not equivalent or superior to the plan, then WSDOT must receive an appropriate credit as part of the change order. This credit would normally be 100 percent of the cost or time savings. An analysis shall be made to ensure that a reasonable credit is included. This credit may be in the form of a price adjustment or reduced contract time. If the evaluator should determine that contract time is not affected and that any cost differential is negligible, then a "no-cost" change order may be executed. A no-cost change is appropriate when the proposal is shown to be equal or superior to the plan. When preparing "no-cost" contractor-proposed change orders, the Project Engineer may consider taking a credit to cover processing costs of the change.

2. Cost Reduction Incentive Proposals

It is the policy of WSDOT to encourage our contractors to be innovative and to identify areas of the project where cost savings can be realized. When a contractor identifies such a savings and provides a significant portion of the efforts needed to develop the proposal, then WSDOT will share the resulting savings with the Contractor. This policy is carried out through change orders known as Cost Reduction Incentive Proposals (CRIPs).

CRIPs were originally perceived as redesigns prepared by the Contractor, to replace the contract work with a physical product that provided the same service, at a lower cost and with no increase in total life-cycle costs. Over time, it became apparent that many of the ideas from Category 1 (Materials Substitutions, Work Method Changes, Resequencing, etc.) would also result in significant savings and these types of changes were being presented as potential CRIPs.

A CRIP may exist if the change is the Contractor's idea, if, in effect, it offers the same end result, if savings will be achieved by its implementation, if one or more of the following features apply to the proposal, and if one or more of the following actions are taken by the Contractor:

Qualifying features of a proposal:

Saves money for the WSDOT.
Reduces time for completion.
Contractor accepts design risk of temporary features.
Contractor accepts risk of constructibility.

Qualifying actions by the Contractor:

Makes a significant effort to develop the proposal.
Employs an outside engineer to assist in development.
Prepares all documentation, presentations, and plans.
Invests an unusual amount of time.

Once a CRIP is identified and developed to the point of conceptual approval, it is treated in nearly the same manner as any other change order. There are some differences, such as the Contractor's responsibility for preparing the documents, and there is a special method of calculating the incentive payment amount. These are discussed in Section 1-2.4C(5) of this manual.

Whether a change proposal is initiated by WSDOT or the Contractor, the resulting change order shall be prepared as described in the following pages and, before the actual work is begun, the appropriate approvals shall be obtained. When it becomes apparent that design features are involved in a change that is being considered, the Project Engineer shall consult with the office responsible for the design and contract provisions of that portion. This action should be taken to determine the original intent, to identify any unknown factors, and to ensure that the change is considered in similar circumstances in future contracts. In addition, other offices that might be impacted by the change (Maintenance, Local Programs, Environmental, Right of Way, Traffic, Archeological, etc.) should be

consulted. Documentation of these discussions must accompany the change order when it is submitted for approval. It is important that change orders be used for actual changes to the contract work and not to account for normal overruns and underruns that may occur in accomplishing the work specified in the contract. Also, change orders are not required for internal requirements such as changes or additions of group numbers, this shall be accomplished by memorandum to the Olympia Service Center Accounting Office (see Chapter 1-3.1B of this manual).

1-2.4C(1) Items Deleted From the Project

As provided in Sections 1-04.4 and 1-08.10(2) of the *Standard Specifications*, WSDOT may cancel all or portions of the construction items on a contract. Any work which is sublet to minority or women owned firms as a condition of award cannot be substituted for or deleted without prior approval of the Olympia Service Center Construction Office.

When work is deleted from the project and the Contractor has already ordered acceptable materials for such work, Section 1-09.5 of the *Standard Specifications* provides that WSDOT will either purchase the materials at the Contractor's actual cost or reimburse the Contractor for the actual costs connected with returning the materials to the supplier. A determination must be made by the Region as to the method of handling the matter. The determination shall be made using the following options:

WSDOT can use the material: If maintenance has a foreseeable need for the materials, the costs should be charged to the Maintenance Inventory Account and the materials placed in inventory. If maintenance has an immediate use for the materials the costs should be charged directly to the maintenance work order. If the materials are to be used on future construction projects, a determination must be made as to whether to charge costs to the Maintenance Inventory Account or to the Construction-on-the-System Program. The Contractor's direct costs for purchase and shipping the materials shall be paid with no allowance for overhead and profit.

Payment is made by voucher and not as an item on the contract. A change order shall be prepared to document the deleted work and the Contractor's direct costs for purchase and shipping the materials. The documentation must also include data which verifies that the materials will be paid by voucher.

WSDOT cannot use the material: If WSDOT has no need for the materials, the Contractor may elect to retain them for other work. If the Contractor does not wish to retain them, the Contractor will be required to attempt to return the materials to the supplier at cost, or subject to a reasonable restocking charge. If the materials are returned to the supplier or retained by the Contractor, the Contractor's actual costs incurred in handling the materials shall be paid with no allowance for overhead and profit. Payment is made by change order and shall be paid by an added item charged to the proper group on the contract. The change order shall document the deleted work and the Contractor's actual costs for handling the materials.

The Contractor cannot use or return the material: If the Contractor does not retain the materials and they cannot be returned to the vendor at a reasonable cost to WSDOT, they shall be purchased from the Contractor and delivered to WSDOT. The Contractor's direct costs for purchase and shipping the materials shall be paid with no allowance for overhead and profit.

Payment is made by change order and shall be paid by an added item charged to the proper group on the contract. The change order shall document the deleted work and the Contractor's direct costs for purchase and shipping the materials. The documentation must also include data which verifies that the material has been, or will be, disposed of as described in the manual for *Disposal of Personal Property* (M 72-91).

1-2.4C(2) Increased or Decreased Quantities

Section 1-04.6 of the *Standard Specifications* describes the criteria for, and the limits for renegotiating prices for increases and decreases in quantities.

Either the Contractor or WSDOT may request that the price for any item that qualifies, be renegotiated. To qualify, an item must increase or decrease by more than 25 percent and result in a change of $10,000 or more as measured by the original bid quantities and unit prices for the item.

The negotiated price for increases will apply only to the portion of the actual quantity in excess of 125 percent. Quantities up to 125 percent will be considered an overrun of the item and should not be included in the change order. The negotiated price for decreases cannot exceed 75 percent of the amount originally bid for the item. The adjustment will only apply to the portion that is in excess of: (1) a $10,000 overrun or (2) the dollar value of 25 percent of the original bid quantity, whichever is greater.

An adjustment in contract time must be considered for qualifying increases and decreases in quantities.

The Project Engineer shall maintain an accurate method of determining quantities and payments as the work progresses so that increases and decreases in quantities, qualifying for a price negotiation, are apparent as they occur. Overruns need to be addressed as they occur. Underruns may be addressed after the item is complete. Overruns and underruns should not be held until the total project is complete.

As variations in quantities occur which are eligible for renegotiation, the Project Engineer should review the price to determine whether or not it should be renegotiated. If the price appears to be fair payment for the actual quantity performed, the Project Engineer should document the review in the file and note that renegotiation is not necessary. A change order is not necessary unless the price is to be renegotiated.

1-2.4C(3) Equitable Adjustment

Section 1-04.4 of the *Standard Specifications* specifies that an equitable adjustment (EA) in accordance with Section 1-09.4 will be made when changes cause an increase or decrease in the cost of performing work on the contract. Determining the EA is one of the most difficult and complex aspects of the contract changes process.

The basic theory of an EA is to leave the parties to the contract in the same position costwise and profitwise as they would have been without the change, preserving to each as nearly as possible the advantages and disadvantages of their bargain. Although the Contractor is entitled to profit on the changed work, the profit (or loss) on the unchanged work should remain unaffected by the EA.

Accordingly the Contractor will be compensated for added costs plus a reasonable markup for overhead and profit when a change in the work increases the Contractor's cost of performance. Likewise, WSDOT will receive full credit for decreased costs, overhead, and profit when a change decreases the Contractor's cost of performance.

The first and best option for an equitable adjustment is agreement between the Contractor and WSDOT as to the increased or decreased cost for the performance of the changed work. The Region and/or the Project Engineer shall expend every effort possible to obtain a satisfactory negotiated equitable adjustment prior to submitting the change order to the Contractor for endorsement.

However, if the parties are unable to agree, the specifications provide that WSDOT will unilaterally determine the equitable adjustment. This allows payment for changed work prior to agreement on the price.

The procedures are the same for substantiating agreements with the Contractor, or determining the equitable adjustment unilaterally.

When work is decreased or deleted, payment will only be for the costs actually incurred and no profit will be allowed for work that was not actually performed. (See Section 1-09.5 of the *Standard Specifications*.)

Consequential damages will not be allowed. Consequential damages are generally such things as damages for: loss of credit, loss of bonding capacity, loss of other jobs, loss of business reputation, legal costs of processing a claim, loss of job opportunities, and others.

If the work does not differ materially from the specified contract work and the cost of the work does not differ materially from the unit contract prices, the equitable adjustment should be at unit contract prices.

If the work does differ materially from the specified contract work or the cost of doing the work does differ materially from the unit contract prices, the equitable adjustment will be made by one of the following methods:

1. Negotiated price.
2. Price determined by the Engineer.

Substantiation for a negotiated price and/or the price determined by the Engineer may be by using average unit bid prices, or unit bid prices of contracts in the same area, or market value, or by estimating the cost to perform the work, or a combination of these methods. The appropriate method of price substantiation is dependent upon the circumstances involved.

When forward pricing an equitable adjustment, the price should be based on the best estimate of the cost to perform the work. When pricing after the work has been performed, actual costs should be used to the extent they are available. It is preferred to use the Contractor's actual equipment rates when they are available. However, Contractors are not always able or willing to provide their actual costs for equipment. If the cost of the change is large, an audit should be considered to determine the actual costs. However, actual costs for equipment cannot exceed the rates established by the AGC/WSDOT Equipment Rental Agreement for an equitable adjustment. If the cost of the change is small, the use of force account rates is acceptable without considering an audit.

Contractors are usually operating under an estimated home office overhead rate which is checked by an annual audit each year. A Contractor's home office overhead rate varies from year to year as their work load varies. It is acceptable to use the firms most recently available overhead rate.

Equitable adjustment by force account can be either the agreed method between the parties or a unilateral determination by the Engineer. Force account will generally be used only when the cost of the change is small and when

the extent of the work cannot be reasonably estimated. The last method to consider for an equitable adjustment is force account.

The equitable adjustment will also include any increases or decreases in contract time that are a result of the change. An equitable adjustment in time is appropriate if the change has an impact on the progress of critical work that affects the total project completion. The basic tool for making an evaluation is the Contractor's approved schedule.

1-2.4C(4) Change Order Preparation

The Project Engineer shall prepare the change order in CCIS ensuring that all appropriate fields are filled in. The change orders will be numbered in sequence automatically by CCIS. The Project Engineer shall include a detailed work description so that everyone involved will understand the need for the change. The reason for the change order must be entered in CCIS using one of the reasons listed in the system. Any increases or decreases in contract time associated with the change order shall be entered in the appropriate field in CCIS so that the Weekly Statement of Working Days will be automatically updated. For condition of award change orders, the appropriate fields must be filled in to generate the change order and to automatically update the condition of award items.

It is the Region's responsibility to obtain the required fund control clearance from the Olympia Service Center Program Management Office.

It is the Region's responsibility to determine federal-aid nonparticipation on all Project Engineer and Region executed change orders.

The memorandum transmitting the change order shall include an explanation in sufficient detail so that everyone involved will understand the need for the change. If the change involves a design feature or impacts another office, this explanation must document all discussions with the impacted offices as well as the required discussion with the office responsible for the original design and contract provisions. A detailed substantiation of any increase or decrease in cost or time associated with the change shall be included in the explanation. If the change includes an increase in contract time that affects the withholding of liquidated damages, the Region must advise the Olympia Service Center Construction Office (in the memorandum) of the amount of liquidated damages currently withheld and the amount to be released to the Contractor due to the time extension.

On projects requiring FHWA inspection, the Project Engineer should make the FHWA Area Engineer and the Construction Office Engineer aware of any proposed or likely change orders, during FHWA's or the Construction Office's inspection of the project.

The Contractor's signature on the change order is desirable but not mandatory (unilateral change order) under any one of the following conditions:

1. The Engineer determines the equitable adjustment by establishing the cost.

2. The work to be done is by force account.

3. The appropriate prior approvals are obtained from the Region and the Olympia Service Center in the event of a written protest by the Contractor of any terms or conditions of the change order (as provided in Section 1-04.5 of the *Standard Specifications*), or in the event the Contractor refuses to sign a change order when the Contractor's signature is required under the conditions listed below.

The Contractor's signature on the change order or a letter for attachment to the change order is required under any one of the following conditions:

1. The work to be done involves an agreed price.

2. The change is proposed by the Contractor.

3. The change increases or decreases the total cost of the work by more than 25 percent when calculated from the original bid quantities and unit prices. If the change exceeds 25 percent of the original total contract amount, consent of surety is required by Section 1-04.4 of the *Standard Specifications*. If the Contractor refuses to sign and a unilateral change order is issued, the Surety shall be notified by letter, with the change order attached.

4. The change increases or decreases the quantity of any contract item and an equitable adjustment is required because of the provisions in Increased or Decreased Quantities, Section 1-04.6 of the *Standard Specifications*.

5. The change increases or decreases the contract time.

If the Contractor does not agree with the terms or conditions of a change order (or any other order, direction, instruction, interpretation, or determination from the Engineer), the Contractor is required by Section 1-04.5 of the *Standard Specifications* to give the Project Engineer or the Project Engineer's field inspector an immediate signed written notice of protest before doing the work. If the Contractor is ordered to proceed in spite of this signed written notice of protest and the Contractor desires to continue to protest the order, the Contractor must supplement the written protest within 15 calendar days with a

written statement providing all the information required in Section 1-04.5 of the *Standard Specifications*.

The Project Engineer must coordinate with the Regional TransAid Engineer:

1. When work changes are anticipated that would alter the termini, character, scope, or estimated cost of the approved project, Assistant Secretary for TransAid approval is required before the work may start.

2. When an estimated cost is increased beyond that authorized in the City/County Agreement, Federal participation of this increase is subject to: (a) availability of Federal funds to be determined by the Assistant Secretary for TransAid, and (b) proper execution of a supplement to the City/County Agreement.

The Project Engineer must receive local agency concurrence of the change and funding before submitting any change order to WSDOT's Regional Operations/ Construction Engineer. The Project Engineer will prepare the change order in WSDOT's CCIS. The change order is sent to the local agency for their concurrence and signature and a copy is sent to the Regional TransAid Engineer.

The following statement shall be typed on the change order:

> If the amount authorized in the City/County Agreement is exceeded and federal funds are not available for this change, the local agency will assume the total cost of this change order.

If a change order or the accumulation of change orders will result in the final cost of the project exceeding the amount authorized in the City/County Agreement, the local agency must submit a supplement to the City/County Agreement in accordance with the *Local Agency Guidelines* Manual. The local agency should contact the Regional TransAid Engineer for assistance in preparing the supplement to the City/ County Agreement and to determine if federal funds are available for the overrun.

A copy of the executed change order will be sent by the Project Engineer to the local agency.

Change orders will be submitted for appropriate approval. It is imperative that appropriate approval be obtained before the changed work begins. The Change Order Checklist in Chapter 1-2.4C(6) of this manual is intended to aid the Project Engineer regarding the appropriate approval authority. When verbal approval is obtained, the person that provided the verbal approval shall be noted in the transmittal letter if the change order is prepared and submitted to the Olympia Service Center Construction Office for execution. The verbal approval shall be entered in CCIS. Documentation of prior approval before work begins must be submitted with the change order package for all levels of execution of the change order.

The Regional Operations/Construction Office shall ensure that a copy of every executed change order is routed through the Regional Project Development Office. End of project reports will no longer be made, therefore, this will provide an opportunity for the design people to become aware of designs that require change orders and to avoid repetitive design flaws.

1-2.4C(5) Development of CRIPs

In the interest of uniformity, the following guidelines are to be used for the evaluation of cost-reduction incentive proposals submitted by the Contractor:

General Requirements and Principles Applying to CRIPs

1. The proposed change must alter a contract requirement.

2. The proposed change must result in a product that meets the intent of the original design. Generally, the change must be equal or superior to the contracted work, but a proposal that satisfies the original purpose may be considered if, in the judgment of the evaluator: it still provides a high-quality end product, the savings are significant, the original design was truly excessive, or for other reasons the evaluator thinks the proposal has merit.

3. With the best information available at the present time, the judgment of the evaluator is that the ultimate life-cycle costs to WSDOT shall not be unduly increased.

4. The proposal does not reduce the overall amount of work obligated to DMWBE contractors in the original contract. It is acceptable to delete work assigned to DMWBE contractors as long as the change defines substitutions that equal the deletion.

Additional Requirements for Time-Reduction CRIPs

5. The time saving is a direct result of an actual change in the design or method of work. Simply adding more crews would not be a CRIP.

6. The original time for completion was realistic. An early finish of a job with an unnecessarily long time for completion would not be a CRIP.

7. The project does not already have an incentive/ disincentive clause. In that case, the cost of accelerating the completion is assumed to be included in the bid and a CRIP sharing of the cost would not be appropriate.

Step 1: Concept Approval

The first effort in development of a CRIP shall be to achieve concept approval. To this end, the Contractor shall submit a written proposal to the Engineer for consideration. The proposal shall contain the following information:

- An explanation outlining the purpose of the change(s).
- A narrative description of the proposed change(s). If applicable, the discussion shall include a demonstration of functional equivalency or a description of how the proposal meets the original intent of the design.
- A cost discussion estimating any net savings. Savings estimates will generally follow the outline below under "Calculating the Incentive Payment."
- A statement providing WSDOT with the right to use all or any part of the proposal on future projects without obligation or compensation.
- A statement acknowledging and agreeing that the Engineer's decision to accept or reject all or part of the proposal is final and not subject to arbitration under the arbitration clause or otherwise be subject to claims or disputes.
- A statement giving the dates the Engineer must make a decision to accept or reject the conceptual proposal, the date that approval to proceed must be received, and the date the work must begin in order to not delay the contract.
- The proposal shall be addressed to the Project Engineer. A copy shall be sent to the Construction Office to initiate tracking of the progress of the proposal.

After review of the proposal, the Engineer will respond in writing with acceptance or rejection of the concept. This acceptance shall not be construed as authority to proceed with any changed contract work. The Contractor is expected to continue to perform work in accordance with the original contract.

Depending on the nature of the proposal, the review could include region and service center designers and, possibly, outside consultants. The completeness and quality of the proposal will have an effect on the time needed for the review. WSDOT will make every effort to expedite the review, but the Contractors should not expect immediate approval.

Step 2: Formal Approval

Concept approval allows the Contractor to proceed with the work needed to develop the final plans and other information to support the ultimate preparation of a change order. To qualify for an incentive payment, the Contractor will normally take the lead in the development effort. The Project Engineer is encouraged to provide whatever assistance is needed. The development of a CRIP is an example of partnering at work in a contract.

The Contractor's submittal shall provide the Project Engineer with the following:

- Deleted Work — Calculated quantities of unit price work to be deleted. Proposed partial prices for portions of lump sum work to be deleted. Time and material estimates for deleted work in force account items. All price proposals and estimates to be fully documented.
- Added Work — Calculated quantities of unit price work to be added, either by original unit contract prices or by new, negotiated unit prices. Proposed prices for all new items to be negotiated. All proposals to be fully documented.
- Contractor's Engineering — Extraordinary costs of engineering to develop the proposal shall be submitted. Costs of employees utilized in contract operations on a regular basis will not be included. Full documentation of the submitted costs will be required.
- Schedule Analysis — If the CRIP is related to time savings, a partial progress schedule showing the changed work. A discussion comparison of this schedule with the approved progress schedule for the project.
- Plans and Working Drawings — All drawings and supporting calculations necessary to accomplish the work. The drawings shall be on sheets measuring 24 by 34 inches, 11 by 17 inches, or on sheets with dimensions in multiples of $8^1/_2$ by 11 inches. Those drawings which include engineering calculations and features shall be prepared by a Professional Engineer licensed in the State of Washington and shall bear the professional engineer's signature and seal.

Preparing and Approving the Change Order

The change order itself shall be prepared in the same manner as any other change order. Approval shall be by authority delegated in this section as with any other change order.

Calculating the Incentive Payment

In the interest of uniformity, all CRIP change orders shall include separate payment items as follows:

- Any deleted work, whether at contract prices or at agreed prices;
- Any added work, whether at contract prices or at agreed prices;
- The Contractor's engineering costs, reimbursed at 100 percent of the Contractor's cost*; and
- The incentive payment to the Contractor*.

  * Where added work exceeds deleted work, but time savings make a viable proposal, these two items would be replaced by:

  - WSDOT's share of added cost to achieve time savings and
  - The Contractor's share of savings from deleted work.

The final sum of these shall ordinarily be the savings to WSDOT of the change. However, in some cases, savings may be offset by any increased inspection and administration costs, intangible, such as user benefits, or indirect, such as overhead and engineering savings in time reductions, or theoretical, such as a CRIP that eliminates a large anticipated overrun in plan quantity. In these cases, the benefits would not be expressly reflected in the change document, but should be discussed in the justification letter.

The incentive payment shall be one-half of the net savings of the proposal calculated as follows:

Proposal Savings:

	Gross cost of Deleted Work	
minus	Gross cost of Added Work	
equals	Gross Savings	
minus	Contractor's Engineering Cost	
minus	WSDOT's Engineering Cost	
equals	Net Savings	<=== Divided by 2 equals the Incentive Pay

WSDOT's engineering cost shall be actual consultant costs billed to WSDOT and extraordinary in-house personnel labor costs. Project personnel assigned to the field office or who work on the project on a regular basis shall not be included. The amount charged for WSDOT personnel labor shall be an average, to be determined from time to time by the Chief Construction Engineer.

Cost to Achieve Time Savings:

	Cost of Added Work	
plus	Contractor's Engineering Cost	
equals	Net Cost to Achieve Time Savings	<=== Divided by 2 Equals WSDOT's Share of Added Cost

If the time-saving proposal also involves deleting some work and, as a result, creates a savings for WSDOT, then the Contractor would also receive one-half of the savings realized through the deletion.

Authority to Proceed Prior to Final Agreement

The need may arise to proceed with changed work before the final agreement is executed. WSDOT is willing to provide a preliminary approval, allowing the work to proceed, if the following criteria has been met:

- Concept approval has been granted;
- The necessary design reviews and approvals have been completed, including plans and specifications; and
- The Contractor has guaranteed, in writing, the minimum savings to WSDOT

Such advance approval, if given, shall be in writing and shall constitute commitment by WSDOT to ultimate formal approval of the proposal. Where appropriate, the advance approval may contain a narrative formula of the elements to be utilized in the final cost negotiations. When work has begun under such an approval, detailed records shall be kept of the labor, equipment, and materials utilized and, if ultimate approval is not gained soon enough to provide prompt payment for the work, then an interim change shall be executed to allow partial payments.

Problems Arising After the Agreement

The Contractor assumes the risk of constructibility. However, there will occasionally be problems that arise while the work of the CRIP is being performed. These will be evaluated on a case-by-case basis. The controlling philosophy will be that we entered the CRIP as a team with the Contractor and we will approach problems in a similar vein. If the problem is something that could not reasonably have been anticipated in the design work of the CRIP, then the risk shall be shared as will the cost of the problem.

If a Proposed CRIP is Not Accepted

If the evaluator decides to reject a CRIP proposal, the Contractor will be notified in writing with an explanation. Copies of this notice, with an attached analysis of evaluation costs, shall be provided to the Regional Operations/ Construction staff and the Olympia Service Center Construction Office.

CHANGE ORDER — CHECKLIST

	YES	NO	Date Const. Office Approval
I. Executed by the Olympia Service Center Construction Office			
1. A cost or credit exceeding $100,000 (sum of absolute values).	❑	❑	
2. A change in the contract documents beyond the scope, intent, or termini of the original contract.	❑	❑	
3. Contractor proposed revisions to condition of award requirements.	❑	❑	
II. Approved by the Olympia Service Center Construction Office Executed by the Region			
4. A structural change for structures.*	❑	❑	_____
5. An extension of time in excess of ten working days.	❑	❑	_____
6. A specification change.	❑	❑	_____
7. Material or product substitution, work method change.	❑	❑	_____
8. A structural design change in the roadway section.	❑	❑	_____
9. A determination of changed condition.	❑	❑	_____
10. Removal and/or disposal of hazardous waste.	❑	❑	_____
11. Settlement of a claim submitted under Section 1-09.11(2).	❑	❑	_____
12. Repair of damage qualifying under Section 1-07.13 of the *Standard Specifications* regarding "acts of God" or "acts of the public enemy or of government authorities."	❑	❑	_____
III. Executed by the Project Engineer if They do Not Have:			
13. Cost or credit exceeding $25,000 (sum of absolute values).	❑	❑	
14. Any new contract pay item exceeding a cost or credit of $10,000.	❑	❑	
15. Force Account exceeding $10,000.	❑	❑	
16. An extension of time exceeding five working days.	❑	❑	

Items 5 through 12 marked yes must have the Construction Office approval.

*Written approval of the Bridge Technical Advisor may be used in lieu of the Construction Office approval. The Project Engineer may execute a Bridge Technical Advisor approved change order if it meets the criteria of Section III.

Figure 1-5

1-2.4C(6) Change Orders Executed by Regions or Ferries

The Regional Administrator is authorized to make changes without prior approval from the Olympia Service Center Construction Office if the necessity for changes can be substantiated and if no is marked for items 1 through 12 on the change order check list (Figure 1-5). If no is also marked for items 13 through 16 the Project Engineer may execute the change order (see subdelegation below). If yes is marked for items 1 through 3, the change order will require execution by the Olympia Service Center Construction Office. If yes is marked for items 4 through 12, the change will require approval by the Olympia Service Center Construction Office, but the change order will be executed and processed at the Region level.

The Director of Washington State Ferries (WSF) is authorized to approve all changes for Terminal Construction Projects and may consult the Construction Office for advice. Copies of all change orders and supporting documentation will be distributed to the Construction Office for review to ensure standard practices are adhered to.

The authority for approval by the Director of WSF may:

1. Subdelegate to the Manager of Terminal Engineering subject to the following restrictions:

   a. Cost or credit does not exceed $200,000.

   b. Condition of award requirements are not changed.

2. Subdelegated to the Project Engineer subject to the following restriction:

   a. Cost of the change order does not exceed $25,000.

   b. New contract pay items do not exceed a cost or credit of $10,000.

   c. Force account does not exceed $10,000.

   d. The change order does not include a time extension exceeding 5 days.

In the absence of the Project Engineer, the approval authority may be subdelegated to the Assistant Project Engineer.

The authority for approval by the Regional Administrator may be delegated to the Regional Operations/Construction Engineer. The Regional Operations/Construction Engineer may:

1. Subdelegate the authority to the Assistant Operations/Construction Engineer.

2. Subdelegate the authority to the Project Engineer subject to the following further limitations:

   a. Cost of the change order does not exceed $25,000.

   b. New contract pay items do not exceed a cost or credit of $10,000.

   c. Force account that does not exceed $10,000.

   d. The change order does not include a time extension exceeding five days.

In the absence of the Project Engineer, the approval authority may be subdelegated to the Assistant Project Engineer.

The Regional Administrator must address in writing to the Construction Office the extent of delegation and/or subdelegation of authority for change order approval. This letter will be kept on file along with any subsequent change in the approval authority.

If a change order, or particular items of a change order, are federal-aid nonparticipating, a new group must be created for these items. On the items page of the change order indicate that a new group is needed for state funds only, and stamp or write in **red** ink (on all copies except the Contractor's) that the items are federal-aid nonparticipating.

If a change order has been processed in accounting and it is later determined that the change order, or particular items of the change order, are determined to be nonparticipating by FHWA, the Region will send a memorandum to the Olympia Service Center Accounting Office indicating which items were determined to be nonparticipating. The memorandum must contain the contract number, the change order number, and the item numbers. Accounting will switch the funding from federal-aid to state funds within the existing groups.

The Construction Office will review all Region and WSF executed change orders. The three areas the Construction Office will review are:

1. Eligibility for Federal-aid participation has been addressed by the Region,

2. Compliance with the Change Order Checklist, and

3. Existence of supporting documentation.

The Construction Office reviewers will initial the change order if the above is verified, however, if deficiencies are found, they will be documented by memorandum to the Regional Operations/Construction Engineer or Marine Manager of Terminal Engineering.

The Regional Operations/Construction Engineer will provide a similar review of all Project Engineer executed change orders.

On all change orders that require local agency approval a copy of the change order must be sent to the Regional TransAid Engineer.

When a Bridge Technical Advisor (BTA) has been assigned to the project, the Region may execute a structural design change order, provided the BTA's stamp and signature are on sheet one of the change order, or on a drawing that shows the change, or there is other written approval by the BTA. The Project Engineer may execute a structural design change order if it has approval of the BTA and items 13 through 16 of the checklist have been met.

The BTA shall be guided by the following:

The Region and the Construction Office have agreed to refer on-site technical questions to the BTA assigned on a limited time, as needed basis, by the Bridge and Structures Engineer. Those technical questions which can be resolved on-site will be handled directly by the BTA. This will include documentation in support of the decisions as required by the Project Engineer. Technical questions which require support analysis exceeding field capabilities will be referred to the Olympia Service Center Bridge and Structures Office.

The BTAs also take on the responsibility of the first line of communication as a representative of the Bridge and Structures Engineer in addition to being a technical resource to the Project Engineer.

While of the role is technical in nature, the BTA must always be aware that the technical recommendations that are made must be made within the constraints of the contract; that is, the written agreement between WSDOT and the Contractor.

Specific guides for the BTA's role on-site are as follows:

1. Be alert to the need for technical advice to the Project Engineer and, of course, responsive to the Project Engineer's specific requests.

2. The BTA's thought process should develop along technical lines as to what is in the best technical interest of the project.

3. Recommendations are to be made generally in writing to the Project Engineer. The recommendations will include an assessment of (1) the approximate cost of a change order and (2) whether the technical recommendation is a mandatory or desirable change. A mandatory change is one which, if not made, will have a detrimental effect on the final structure. Desirable changes are all other changes. Change orders to effect desirable changes should be minimized. Such change orders shall be effected only if they are in WSDOT's economic best interest. The BTA should refrain from ever proposing such changes whenever they reflect strictly a matter of opinion.

4. Provide technical documentation to support the recommendations for mandatory changes to the Project Engineer who will then prepare the directive documentation to the Contractor in accordance with normal procedures. The BTA has the authority to approve and endorse the structural changes on behalf of the Bridge and Structures Engineer.

5. Do not make any direct contacts with the Contractor or subcontractors without the Project Engineer's knowledge and approval.

6. Act only as an advisor to the Project Engineer and, as such, shall have no authority, responsibility, or duty whatsoever to make decisions for the Contractor with regard to the Contractor's plans, drawings, specifications, methods, or work. Nonetheless, the BTA must recognize the documents in preparation of the BTA's documentation.

7. Keep a written factual record of activities and recommendations pertaining to the assigned project.

8. Conform to the field safety requirements of the Region and the Contractor.

9. Give the construction project top priority, but shall be prudent in the use of time and expenses charged to the project.

The above guides are not meant to be all inclusive, but are generally representative of the scope of services to be provided by the BTA.

The BTA's immediate administrative support on site will be provided by the Project Engineer. The BTA's technical responsibility will be to the BTA's regular supervisor in Olympia. Overall determination and monitoring of the assignments will be made by the Bridge and Structures Engineer.

1-2.4C(7) Distribution of Region or Ferries Executed Change Orders

Region will submit:

One copy to the Olympia Service Center Accounting Office

One copy to the Contractor

Original and one copy to the Olympia Service Center Construction Office (include one copy of transmittal Memorandum and supporting documentation with the original)

One copy to the Bridge and Structures Office when bridge is involved (including one copy of the transmittal memorandum)

One copy to the Olympia Service Center Materials Laboratory

1-2.4C(8) Change Orders Executed by the Olympia Service Center Construction Office

Change orders that do not qualify for Region execution must be executed by the Olympia Service Center Construction Office.

On all projects requiring FHWA inspection, FHWA approval will be required prior to beginning work, on all change orders that will increase the cost of the project by a minimum of $200,000 or alter the termini, character, or scope of work except for changes in accordance with Section 1-04.6. The Construction Office will submit the change order to FHWA for approval.

For change order approvals, the general areas of responsibility for the Construction Office Engineers are as follows:

Construction Engineer, Administration — General Contract Administration; Contract Payments and Withholding of Payments; Contractor Assignment of Payments; Contractor Default; Time Extensions; Assessment of Liquidated Damages; Contract D/M/WBE, EEO, and Training Programs; i.e., Division 1 of the *Standard Specifications*.

Construction Engineer, Roadway — Grading; Paving; Culverts and Drainage; Concrete Slope Protection; Bridge Approach Slabs; Lighting; Signing; Traffic Signals; Fencing; Rest Areas; Walls (1) Gravity: Masonry, Gabion, Rock, and etc., (2) Proprietary: Structural Earth and Geotextile, and (3) Soil Nail; i.e., Divisions 2, 3, 4, 5, 7, and 8 of the *Standard Specifications*.

Construction Engineer, Bridges — Bridges; Bridge Deck Overlays; Walls: Standard and Nonstandard Reinforced Concrete, Soldier Pile, Tieback, Slurry, and Cylindrical Pile; i.e., Division 6 of the *Standard Specifications*.

The Construction Office executed change orders must be approved verbally or in writing prior to the Contractor proceeding with the work. In an emergency the Regional Operations/Construction Engineer may authorize work to begin on any change order when the Regional Operations/Construction Engineer is unable to contact the Construction Office Engineer within a reasonable amount of time, provided:

1. A delay in starting the work would jeopardize life, property, or result in environmental damage;

2. A delay in starting the work would result in delay damage to the Contractor or WSDOT; and

3. The Construction Office is contacted as soon as practical.

If the Olympia Service Center Construction Office disagrees with the Regional Operations/Construction Engineer's decision and directs work to stop, all work performed under the Region's emergency authority will be paid for under the terms of Section 1-04.4 of the *Standard Specifications*. The project records of the Contractor's time, labor, materials, and equipment to perform the work must be kept in sufficient detail to allow accurate payment.

On all change orders that require Local Agency approval, a copy of the change order must be sent to the Regional TransAid Engineer.

When the change order requires Construction Office execution, the Region shall attach any further substantiation and explanation deemed necessary. The appropriate copies shall be forwarded to the Construction Office as noted under Distribution of Construction Office Executed Change Orders in Chapter 1-2.4C(9) of this manual. It will also be necessary to secure the approval of the Regional Operations/Maintenance Engineer on projects involving Maintenance funds (M Program seals, overlays, and bridge painting) before transmitting change orders to the Construction Office. If advance verbal approval has been given the Region by the Construction Office, this information should be so noted in the transmittal letter, giving the person's name. When the change order is executed, the Construction Office will make distribution.

1-2.4C(9) Distribution of the Olympia Service Center Construction Office Executed Change Orders

Region will submit:

Original and five copies of the change order (including one copy of the transmittal memorandum and supporting documentation)	To the Construction Office

The Construction Office will distribute executed change orders to the Region and the Contractor. Any change order not executed by the Construction Office will be returned to the Region.

1-2.4D Force Account

A. General:

When it is difficult to provide adequate measurement or to estimate the cost of certain items of work, force account may be used to pay the Contractor for performing the work. Some contract items are set up to be paid by force account. Some change orders may require payment by force account. However, force account should be the last choice when setting up items for payment on the original contract or when determining an equitable adjustment for a change (see Chapter 1-2.4C(3) of this manual). Section 1-09.6 of the *Standard Specifications* describes the allowable payment for force account work.

When added work is to be paid by force account, a change order shall be prepared detailing the added work to be performed and the estimated cost. Included in the description of work should be a short title of the work, such as "Removal of Slide — FA," "Construct Special Drainage — FA," etc., which can be used for the name of the pay item. Standard Item Number 7715 is to be used for all force account items that do not have an assigned Standard Item Number.

Force account payment is not authorized for superintendents or other employees engaged in general supervisory work. Allowance for their pay is included in the Contractor's percentage for overhead and profit. A foreman devoting full time to the force account work is eligible for payment on the force account.

On projects that require the Contractor to employ trainees in a training program, the trainees may be used on the force account work.

Force account work normally will not be performed on overtime unless overtime work is being performed for most of the work on the project. Overtime should be authorized only in emergencies for added work performed by force account.

The Project Engineer has the authority to direct every aspect of force account work. The specifications provide options for the prices to be paid on force account. Therefore, **before any work is performed** on a force account basis by the Contractor, the Project Engineer shall review and agree upon:

1. **Labor** — the classification and approximate number of workers to be used, the wage rate to be paid those workers, whether or not travel allowance and subsistence is applicable to those workers, and what foreman, if any, will be paid for by force account.

2. **Equipment** — the equipment to be used including the size, rating, capacity, or any other information to indicate the equipment is proper for the work to be performed. Whether the equipment to be used is owned by the Contractor or is to be rented. The cost per hour for the equipment to be used.

3. **Materials** — the material to be used including the cost and any freight charges. Whether the material is purchased specifically for the project or comes from the Contractor's own supply.

The procedure for record keeping and payment of the force account work on change orders shall be the same as for contract items to be paid by force account. Separate records are to be kept for each force account whether it is an item in the original contract or established as a result of a change order.

The Project Engineer shall prepare lists of the equipment and labor classifications actually used and the rates for each after the work has started. These lists will be filed and become a part of the source documents for the force account item. The lists shall include the following information:

1. Equipment List

The equipment list must include the complete nomenclature of the equipment, to establish the proper rental rate. Equipment rates that are included in the Rental Rate Blue Book in accordance with the AGC/WSDOT Equipment Rental Agreement, need not be submitted to the Olympia Service Center Construction Office for approval. Special equipment rates which are not set forth in the Rental Rate Blue Book must be approved by the Construction Office before they are used. The request must include equipment type, manufacturer, year manufactured, model or capacity, year purchased and purchase price, horsepower, and fuel type.

2. Labor List

The list for labor shall include the labor classification and the composite hourly rate. The composite hourly rate is the current basic wage the Contractor is obligated to pay for each classification and all added costs for labor listed in (a), (b), and (c) under Labor in Section 1-09.6 of the *Standard Specifications*.

B. Payment Procedures for Force Account Work:

1. Labor

The Contractor is obligated to pay at least the minimum rate as specified in Section 1-07.9 of the *Standard Specifications*. The composite hourly rate shall not exceed the rate the Contractor is obligated to pay. The specification says the rate shall reflect the Contractor's actual cost, but not exceed what is normally paid to comparable labor. Comparable labor is labor performing similar work on the contract for items of work being paid by a unit bid price. If appropriate, comparable labor could be determined from other or previous contracts in the area performing similar work, or even the customary rate paid to labor performing exactly the same type of work, if it exceeds the minimum required by Section 1-07.9. The object is for WSDOT not to pay an unreasonable rate just because it is force account.

Calculating labor rates for force account and monitoring minimum prevailing wages are two separate but related issues. The starting point for calculating labor rates for force account work should be the minimum prevailing wages in the contract special provisions because the Contractor is required to pay at least those rates. If the Contractor is paying more than the minimum prevailing rate, it is the Contractors responsibility to prove the increased payment is not an arbitrary decision unique to force account work. Proof may include union agreements or payrolls that show the higher rates are being paid for the same classification of labor on work that is not being paid by force account. Occasionally a subcontractor will only be performing force account work on a contract. A certified letter from the subcontractor attesting to the fact that a higher wage rate is and has been normal pay for their workers is usually acceptable proof. Another alternative would be copies of canceled checks showing prior commitment to a higher wage rate.

If the project has Federal-aid funds, then certified payrolls are required by minimum prevailing wage regulations and are conveniently available to use for checking labor rates used in force account work. If the project is funded with state funds only, then certified payrolls are not required unless specifically requested by the Project Engineer. If there are no problems in the minimum prevailing wage area, it may not be reasonable to request certified payrolls for the sole purpose of checking labor rates for force account work. This is a discretionary item for the Project Engineer to decide on a case by case basis.

When a force account requires work to be done by a firm that provides technical/professional services (for instance air monitoring and testing laboratories), we can pay for the work based on an invoice. The markups of 20 percent for labor and 15 percent for equipment do not apply since it is assumed that these costs are already included in the invoice cost. All other markups would apply. If the firm has any employee working on the project whose working classification is covered by prevailing wage laws, then a statement of Intent to Pay Prevailing Wages and an Affidavit of Wages Paid will be required.

If the force account work is added by change order, the language to pay for the technical/professional services firm by invoice, should be included in the change order.

When a force account requires the Contractor to pay for permits or fees (hazardous waste dumping, etc.) that would fall outside the scope of overhead, we will reimburse them for these costs. A markup of 15 percent plus the markups in Section 1-09.6 items 5, 6, and 7 of the *Standard Specifications* will apply.

Payment for force account work should be paid on the same timely basis as any other item of work. When money is being withheld from a progress estimate, the criteria for withholding should apply equally to all items of work, not just to force account work because of its method of payment.

Industrial insurance, medical aid, and supplemental pension rates must be obtained from the Contractor. The Washington State Department of Labor and Industries (L&I) furnishes these rates to the Contractor only when the rates are changed. The Contractor must furnish current rates and any updated rates to the Project Engineer. The Contractor is reimbursed the full premium for industrial insurance because the Contractor is required to pay that premium to L&I and cannot deduct any part from the employee's salary. The Contractor will be reimbursed for the amount of the medical aid and supplemental pension the Contractor pays. The portion the Contractor deducts from the employee's salary will not be reimbursed.

To become self-insured, contractors are required to be certified by L&I. The Contractor must furnish evidence to the Project Engineer that he/she is certified. Self-insured contractors are not required to pay industrial insurance and medical aid to L&I. They are required to pay the rate for supplemental pension to L&I. Self-insured contractors must furnish, to the Project Engineer, the rates for the cost representing industrial insurance and medical aid. They must also furnish, to the Project Engineer, the current rate and any updated rate for supplemental pension. Self-insured contractors are reimbursed the full amount of the cost representing industrial insurance and medical aid not to exceed the current basic rate published by L&I in the *Washington Workers Compensation Insurance Manual*. The rate established for this purpose shall reflect a subtraction for any deduction made to the employee's salary if the employee shares in these costs. If there is any doubt that a contractor is self-insured, the Region should seek confirmation from L&I's self-insurance office at (360) 956-6867 or SCAN 269-6867.

Early in the project, before any force account work is done, the Project Engineer should advise the Contractor about the required documentation. The Contractor should also be advised that payments may not be

made or may be delayed for labor until the documentation is received. The information furnished by the Contractor and any other substantiation shall be filed and become a part of the source documents for the force account item. The letter (regarding Industrial Insurance, etc.), certified payrolls, and other substantiation shall be sufficient documentation of the rates and Construction Office approval will not be required.

WSDOT will pay the Contractor 20 percent of the sum of the costs listed in (a), (b), and (c) under Labor in Section 1-09.6 of the *Standard Specifications* to cover project overhead, general company overhead, profit, and any other costs incurred.

2. Materials

Paragraph 2 of Section 1-09.6 of the *Standard Specifications* is further clarified to include payment for those materials or supplies which are totally consumed in the work. Such material may include sandpaper, form lumber (if consumed only for a single contract), brooms, sacks, paint brushes, sand for sandblasting, plastic sheeting, or other material which was purchased or furnished by the Contractor for the force account item and has no significant value or use after the life of the contract. Items which are not eligible for payment are such items as personal clothing, office supplies, hand tools, or other items which have a significant value or use after the life of the contract.

WSDOT will add 15 percent of the eligible and verified Contractor-supplied material costs to the Contractor's payment to cover project overhead, general company overhead, profit, and any other cost of supplying materials.

3. Equipment

The Project Engineer shall review and comply with the rules governing payment for equipment as outlined in the AGC/WSDOT Equipment Rental Agreement.

Force account work should be planned to avoid the need for standby time whenever practicable. When standby time is required, the conditions must be fully documented. When Contractor or subcontractor owned equipment is ordered by the Project Engineer to be held at standby, any combination of standby time and actual operating hours shall not exceed 8 hours (10 hours if the Contractor or subcontractor is working 10-hour shifts four days a week) during a 24-hour period, nor more than 40 hours a week. When equipment rented by the Contractor or subcontractor from outside sources is ordered by the Project Engineer to be held at standby, payment will be computed on the basis of actual invoice cost.

If the Contractor or subcontractor claims their equipment is "not available" and in the opinion of the Project Engineer the Contractor or subcontractor does have equipment available, the Project Engineer shall notify the Contractor, in writing, that WSDOT will limit invoice payment to comparable (Blue Book) rental rates for available equipment unless they can show why their equipment is not available.

WSDOT will add 15 percent to equipment costs to cover project overhead, general company overhead, and profit.

4. Mobilization

Force account mobilization is defined in Section 1-09.6 of the *Standard Specifications* as off-site preparatory work, transportation of tools and equipment, and personal travel time.

Force account mobilization is not allowed for most of the force account items included in the original contract bid proposal. The primary reason for this is that contractors can identify these costs during the preparation of bids and include these identifiable costs in the mobilization item for the total contract.

If the force account work is added work and not included in the original contract bid proposal, the work may be eligible for force account mobilization. At times, the special provisions specify that some force account items included in the original contract bid proposal will be eligible for force account mobilization. Eligible force account mobilization will be paid to the Contractor if the following conditions are met:

a. The Contractor specifically requests reimbursement in writing, in advance, for any off-site preparatory mobilization work. The written request shall include an estimate of costs and the basis for reimbursement.

The Engineer approves, in writing, the Contractor's request prior to the commencement of any off-site mobilization work. In emergencies, this request and approval does not need to be in writing provided that the written request and written approval is supplied as soon as practical.

b. The equipment is not or will not be used for other work on the project.

c. The Contractor is paying personal travel time because it is included in a bargaining agreement.

To the agreed final amount of mobilization for force account shall be added 15 percent of that

sum for all other cost, including project overhead, general company overhead, and profit.

5. Sales Tax

The following guidelines pertain to retail sales tax on force account work.

a. STATE-OWNED LANDS — If the work is on state-owned land, Section 1-07.2(2) of the *Standard Specifications* and State Department of Revenue (DOR) Rule 170 applies. The Contractor pays retail sales tax based on the full contract price. The CAPS system automatically adds retail sales tax to an estimate. WSDOT reimburses the Contractor for the retail sales tax on the full contract price and for other retail sales tax as follows:

(1) When material is incorporated into the final work the Contractor is not required to pay retail sales tax at the time of purchase. Therefore, any retail sales tax included on invoices for such materials that are incorporated into the final work shall be deducted before entry into the ledger for payment.

(2) Rental equipment and consumable materials/supplies not incorporated into the final work are for the Contractor's use and, therefore, subject to retail sales tax at the time of purchase. Therefore, any retail sales tax included on invoices for rental equipment and consumable materials/supplies that are not incorporated into the final work shall remain on the invoice for entry into the ledger for payment.

WSDOT is not double taxed on items incorporated into the final work, but is double taxed on all other retail sales tax the Contractor is required to pay.

b. LANDS NOT OWNED BY THE STATE — If the work is on nonstate-owned land, Section 1-7.2(1) of the *Standard Specifications* and DOR Rule 171 applies except as addressed below. The Contractor does not pay retail sales tax on the full contract price, therefore, WSDOT does not reimburse the Contractor retail sales tax on the full contract price. However, the Contractor is required to pay retail sales tax to suppliers of rental equipment and suppliers of any materials/supplies whether or not the materials/supplies are consumed or incorporated into the final work. Therefore, any retail sales tax included on invoices for rental equipment and any materials/supplies shall remain on the invoice for entry into the ledger for payment.

Construction of the following facilities has been specifically excepted from DOR Rule 171. They fall under DOR Rule 170 even if they are on nonstate-owned land:

- Water mains;
- Sanitary sewers, if they are not a part of the road drainage system;
- Telephone and telegraph lines;
- Electrical power, if such power does not become a part of a street or road lighting system; or
- Other conduits or lines.

Before any consideration is given to paying the Contractor for retail sales tax on force account, the materials or supplies must be eligible for payment as described above in this Chapter 1-2.4D, subsection B, paragraph 2 Materials.

WSDOT employees are not expected to add retail sales tax to invoices when it is missing. Retail sales tax added to invoices by the Contractor, rather than a supplier or a material man, should not be paid.

If the Contractor draws materials or supplies from materials or supplies previously purchased in bulk, the retail sales tax may be paid from Contractor prepared invoices provided that: (a) the Contractor produces written evidence (invoice for the bulk purchase) from a bonafide supplier or materialman indicating the original purchase price and the actual retail sales tax paid, and (b) the retail sales tax will not be paid in the manner described above in subsection a, (1), i.e.; materials incorporated into the final work on state-owned lands. Such retail sales tax shall be a prorated portion of the bulk retail sales tax to reflect the amount that represents only the materials and supplies used for the force account under consideration.

For additional clarification, the finance officer in the Olympia Service Center Accounting Office may be contacted at SCAN 705-7561 or (360) 705-7561 to determine appropriate application of retail sales tax.

6. Records and Source Documents

Daily time records shall be kept on Form 422-008, Daily Report of Force Account Worked. This shall be signed by the Inspector and the Contractor's representative verifying the hours worked. A copy of the report shall be given to the Contractor. When the work is performed by a subcontractor, a copy shall also be furnished the subcontractor.

The cost of the force account work should be computed and entered in the CAPS System. This computation may be made on the daily report form or on a separate sheet summarizing several days' or weeks' work. For labor, the composite hourly rate shall be entered in the rate column. Separate lines should be used for regular time and overtime rates. Fringe benefits, which are part of the composite hourly rate, must be deducted before computing overtime rates. When the report is prepared, two or three lines should be skipped between the listing of the labor and the listing of the equipment used during the day. Also, two or three lines should be skipped between the listing of the equipment and the listing

of materials used. These spaces provide room for listing the subtotal of costs for labor, equipment, and materials. Next, the markup should be computed for project overhead, general company overhead, and profit and listed on the report. If the work is done by an approved subcontractor, this markup shall be computed and added to the report. Finally, the other markups as provided in Section 1-09.6 of the *Standard Specifications* shall be added to the report. All computations shall be checked, initialed, and dated. After the cost of the work has been computed in the office, a copy of completed Form 422-008 shall be furnished the Contractor.

A sample of the Daily Report of Force Account Worked form is included in Chapter 10.

1-2.4E Differing Site Conditions (Changed Conditions)

If a Contractor indicates to the Project Engineer that differing site conditions (changed conditions) have been encountered as described in Section 1-04.7 of the *Standard Specifications*, the Project Engineer shall advise the Contractor that written notice must be served and that the condition must not be disturbed until WSDOT has investigated the site. The Regional Operations/Construction Engineer shall be notified immediately of the condition so that arrangements can be made with the Olympia Service Center Construction Office for prompt investigation and decision as to the validity of the contention of differing site conditions (changed condition). The Project Engineer shall keep complete records of all matters relating to the condition to assist in the investigation and for use in considering any dispute that may arise, and shall advise the Contractor to do the same.

Section 1-04.7 of the *Standard Specifications* also provides for a decrease in the costs or time to perform the work because of differing site conditions (changed conditions). The Project Engineer should be alert to such circumstances and follow the same basic procedures as outlined herein.

The following guidelines are to be used in addressing alleged differing site conditions:

- The Contractor must serve written notice.
- The Project Engineer shall acknowledge the notice by return letter to the Contractor and advise that: the alleged condition is being investigated, the site must not be disturbed until the investigation is completed, and full and complete records of cost and time must be kept.
- The Project Engineer shall inspect and document the physical evidence and immediately notify the Regional Operations/Construction Engineer.
- The Region may deny differing site conditions if their investigation concludes a differing site condition does not exist. This denial shall be in writing. If this denial is not accepted and is protested by the Contractor, or if the Region's investigation is inconclusive, the Region shall notify the Construction Office immediately.
- The Construction Office will contact the Olympia Service Center Materials Laboratory for technical advice. The Materials Laboratory will notify the Construction Office whenever they are called out by the Region for advice on a differing site condition.
- The Construction Office will make a determination that there is or is not a differing site condition based on the physical evidence.
- The Region will notify the Contractor in writing of the determination. If the determination is positive, the Contractor is advised that the work is to proceed in such a manner to minimize the time and cost.
- The Project Engineer must keep accurate equipment, labor, and time records whether or not the determination was negative or positive.
- It is preferable to resolve time and cost during construction rather than waiting until the completion of the total project.

1-2.4F Termination of Contract

Section 1-08.10 of the *Standard Specifications* discusses in detail the important information concerning termination of a contract. Contract termination is divided into two major categories, termination for default and termination for public convenience. Regulations covering termination of Federal-aid contracts are found in 23 CFR 635, Subpart A.

Section 1-08.10(1) of the *Standard Specifications* defines the situations when a contract may be terminated for default. When a Federal-aid contract is terminated for default, there is a specific regulated limit to the amount of federal participation for any work necessary to complete the work of the original contract. FHWA should be informed prior to actual termination for default.

Section 1-08.10(2) of the *Standard Specifications* defines the situations when a contract may be terminated for public convenience. Prior to terminating a Federal-aid contract for public convenience it is vitally important that notification and discussion take place between WSDOT and FHWA. There is no specific regulated limit to the amount of federal

participation in this type of termination. However, FHWA is required by regulation to review the circumstances of the case, determine the amount of federal participation, and give prior concurrence in the termination.

In both categories initial discussions should be made by the Project Engineer with the FHWA Area Engineer. Formal notification and discussion will use normal channels through the Region to the Olympia Service Center Construction Office. Authority to terminate a contract rests with the same position having authority to execute a contract.

1-2.4G Subletting Portions of the Contract

Requests by the Contractor for subletting are submitted on Form 421-012 (Request to Sublet) and shall be approved by the Regional Operations/Construction Engineer, or approval may be subdelegated down to the Project Engineer. Form 421-012 (Request to Sublet) must be formally processed and approved prior to the performance of any work on the project by the subcontractor or lower tier subcontractor. A copy of the subcontractor's or lower tier subcontractor's Statement of Intent to Pay Prevailing Wages, approved by State L&I on State L&I's form must be provided to the Project Engineer by the Contractor prior to payment for any work performed by a subcontractor or lower tier subcontactor. In addition, for Federal-aid projects, Form 420-004 (Contractor and Subcontractor or lower tier subcontactor Certification for Federal-aid Projects), must be submitted with the Request to Sublet.

If subcontractors want lower tier subcontactors to perform part of their work, the Contractor shall submit a request to sublet for approval of the lower tier subcontactor along with the request to sublet the work. If more than one subcontractor on a project wants to utilize the same firm as a lower tier subcontactor, separate requests for approval shall be required. Section 1-08.1 of the *Standard Specifications* provides the limitations on the amount of work a lower tier subcontactor may perform for each subcontractor.

Section 1-08.1 of the *Standard Specifications* sets forth the procedure for subletting portions of the project, and the percentage of the contract which may be sublet. The amount of the contract to be used for determining the percentage that is sublet, is the total original contract costs less the amount of specialty items which are sublet.

The Region is responsible to verify adequacy and accuracy of the completed form prior to approval. The Request to Sublet shall be processed as follows:

1. The Contractor fills out the Request to Sublet form with the amounts the Contractor is actually paying the subcontractor.

2. The Project Office will enter the request to sublet data in CCIS.

   a. Ensure that the dates of the State L&I approved Statement of Intent, Contractor and Subcontractor or Lower Tier Subcontactor Certification for Federal-aid Projects, and the State L&I approved Affidavit of Prevailing Wages Paid are entered when they are received.

   b. For subcontractors or lower tier subcontactors that are not a Condition of Award, enter the minority information when known.

   c. When Condition of Award items are sublet, ensure that the total amount is equal to or greater than the amount in the Condition of Award and the condition of award items are sublet to the proper Condition of Award subcontractor.

   If a bid item shown on the Condition of Award letter is not sublet to the proper D/M/WBE, then a change order is required.

3. If a previous Request to Sublet is revised, CCIS will recalculate the percentages of all the subsequent sublet requests.

4. When added work is subcontracted, the percentage shall be reflected as a zero entry. A Request to Sublet will not be required for added work if performed by a previously approved subcontractor.

1-2.4H D/M/WBE Construction Contracts

The Chief Construction Engineer and the Director of the Office of Equal Opportunity are responsible for administering the external Disadvantage/Minority/Women's Business Enterprise (D/M/WBE) and combined Business Enterprise (CBE) contractual obligations during the life of the contract. The Regions are subdelegated this responsibility subject to the following:

1. Subcontractor approval will be by the Regional Operations/Construction Engineer, the Assistants of the Regional Operations/Construction Engineer, or the Project Engineer.

2. The Condition of Award (COA) letter provides that D/M/WBE firms will perform specific item(s) of work for specific dollar amounts. The letter also identifies whether a firm will perform as a "subcontractor," "manufacturer," or "regular dealer." Any indication that a COA subcontractor, manufacturer, or regular dealer will not perform the items of work specified, or be used as specified, shall be discussed with the Olympia Service Center Construction Office immediately.

3. All changes to the COA must be approved by the Construction Office.

4. Deletion or substitution of any COA contract work with D/M/WBE involvement will require the Construction Office approval.

5. Compliance issues should be brought to the attention of the Office of Equal Opportunity.

6. Imposition of sanctions for violations of the D/M/WBE provisions shall be jointly by the Office of Equal Opportunity and the Construction Office.

The Project Engineer and the Project Engineer's staff have the most positive and potentially effective role in the success of this program. There is no "cookbook" answer on how to plan this role. Rather, this role includes the application of understanding, fairness, flexibility, and toughness in the optimum proportions for each individual case as it occurs. The following guidelines are designed to anticipate and avoid problems rather than provide specific solutions:

1. Read the D/M/WBE specifications carefully in the contract. They are as important as any other contract requirements.

2. Read the COA letter which details the Contractor's obligation. This letter carries the same contractual obligation as the contract specifications. This letters is part of the contract provisions when the contract has D/M/WBE goals. The specific items of work to be performed by COA firms will be provided by the Contractor prior to execution of the Contract.

3. Discuss the D/M/WBE obligation in detail at the beginning stages of the project. Answer questions and follow up promptly with answers to any questions you could not answer during the discussion. Encourage sharing of knowledge by the Contractor with the D/M/WBE on routine WSDOT contractual matters, especially if the D/M/WBE has not previously done business with WSDOT. Emphasize the Contractor's responsibility to convey important Federal and State requirements which apply to subcontractors (e.g., minimum wage requirements, flagger card requirements, etc.). Encourage the Contractor to invite designated D/M/WBEs to all meetings that affect their participation in the contract. If the Contractor doesn't follow up on important items, take the extra effort yourself to show the new subcontractor the ropes. D/M/WBE firms which are COA subcontractors, must perform a commercially useful function during the execution of their work. Execution of work contains three elements: performance, management, and supervision. This would be discussed with the COA D/M/WBE firms and it should be pointed out to them that they will be reviewed on the job site to confirm compliance with this requirement.

4. When the D/M/WBE arrives on the job, seek out the key personnel and offer to answer any questions about the work or other routine WSDOT matters which the firm may not be aware of.

5. Treat the COA D/M/WBE personnel in a courteous, businesslike manner. It is essential that communications remain positive and conducive to problem solving in the event a problem should occur.

6. Review any special provisions which pertain to the COA D/M/WBE's work, and explain any different or unusual requirements which may be unique to the contract.

The Project Engineer (or designee) will conduct an on-site review for each COA subcontractor. On-site reviews should be conducted when the COA D/M/WBE starts work, during the peak period of the COA D/M/WBE's work, and whenever there is a change in the execution of the work. The on-site review is a "snapshot in time" and should record personal observation(s), documentation reviews, and personnel interviews. Each review question (as contained on Form 272-051) should be thoroughly answered using additional sheets when necessary.

On-site reviews shall also be conducted when there is a substitution or change to the COA D/M/WBE or when a recognized D/M/WBE is employed on the project but is not listed on the COA.

The appropriate copy of the completed form (272-051) should be forwarded to the Office of Equal Opportunity immediately after the review.

8. Explain WSDOT's chain of command in the event problems occur which cannot be resolved at the field level. The COA D/M/WBE and other subcontractors pursue resolutions in the following order:

a. The Contractor,

b. Project Engineer,

c. Regional Operations/Construction Engineer,

d. Office of Equal Opportunity, and

e. The Construction Office.

9. Quality control remains an essential priority on all items of work on the project. Inspect all work in the early stages so that corrections can be made, if necessary, before serious and costly remedial action is needed. If you are not sure of a specific remedy, ask the Chief Inspector or Project Engineer to assist you. Do not direct the work of the COA D/M/WBE but offer suggestions when asked.

1-2.4H(1) Substitution/Deletion of COA D/M/WBE Work

The Contractor is required to utilize the COA D/M/WBE subcontractors, manufacturers, etc., to perform the work

for which they are listed in the COA letter, except for the following conditions:

1. The COA D/M/WBE firm becomes decertified;

2. The COA D/M/WBE firm is unable or unwilling to perform the work; or

3. WSDOT deletes the COA D/M/WBE's intended work.

Under condition (l) above, the Contractor will be required to substitute another D/M/WBE unless one of the following situations has occurred:

a. The Contractor can show substantial financial loss,

b. The work has progressed to the point where no other work remains to be subcontracted, or

c. The subcontractor has taken the positive step of graduating from the D/M/WBE program.

Under condition (2) above, the Contractor must submit documentation substantiating the firm's unwillingness or inability to perform the work and the Contractor's own effort to obtain performance. Normally, this will include a signed statement from the COA D/M/WBE firm. If the COA D/M/WBE firm has defaulted and the Contractor can provide documentation of efforts made to contact the firm, the requirement for a signed statement may be waived. The Contractor is required to substitute another D/M/WBE firm for an equal dollar value of work or to provide documentation of good faith efforts to do so. If the Contractor furnishes WSDOT evidence of a substantial financial loss to be incurred due to high quotes from other D/M/WBEs, the Contractor may be released from the COA.

Substitutions must meet the following requirements:

1. On federally funded projects, disadvantaged firms must be substituted for disadvantaged firms, and on projects funded with only State funds, women-owned firms must be substituted for women-owned firms and minority-owned firms for minority-owned firms.

2. The elimination of work from a COA D/M/WBE firm must be acknowledged by the D/M/WBE firm originally proposed to do the work, either by letter or by signature on the change order.

3. The new firm must do the same work or an equal dollar value of other work on the contract. The dollar value of the substituted work assigned to the new firm should not exceed the dollar value of the items assigned the original D/M/WBE firm. The substituted D/M/WBE firm may be sublet additional work, but the change order should not increase the dollar amount of the original goals.

Where the Contractor proposes a change to the contract resulting in the deletion of D/M/WBE work, the Contractor will be required to substitute an equal dollar value of work to the same or a different D/M/WBE firm.

If the deletion of COA D/M/WBE work is initiated by WSDOT, then WSDOT will relieve the Contractor from attaining that portion of the goal.

If the deletion is initiated by the COA D/M/WBE and the Contractor has exceeded the original goals established, and the deletion of the COA D/M/WBE work does not jeopardize attainment of the original goals, we may accept the Contractor's proposal without requesting substitution of another D/M/WBE.

4. Any changes to the COA letter must be made by preparing a no-cost change order complete with:

a. An explanation of why the change is necessary.

b. Identification of deleted work and added work.

c. Revised subtotals for each affected D/M/WBE firm.

d. Revised total attainment for DBE, MBE, and/or WBE participation.

e. Documentation of efforts to obtain another D/M/WBE, including copies of quotes from other D/M/WBE firms, telephone logs, etc., if a substitution is not proposed.

The Project Engineer/Region may execute change orders deleting COA work where WSDOT has initiated the change. All Contractor proposed revisions to the COA must be executed by the Olympia Service Center Construction Office.

When preparing the change order in CCIS Pending COs, use menu option 3, Condition of Award Items, to include (b), (c), and (d) above in the change order.

1-2.4H(2) Disputes

In the event disputes arise, the suggested procedures are:

Disputes Between COA D/M/WBE and the Contractor:

1. Document the facts as accurately as possible.

2. Enlist the services of the State's D/M/WBE Supportive Services Contractor. Their telephone number can be obtained from the Office of Equal Opportunity.

3. Get involved as an intermediary only if you can help to promote essential communication between the COA D/M/WBE and the Contractor so that they may solve their own problems.

4. If the dispute involves money and the COA D/M/WBE feels correct payment has not been received for work performed, explain the procedures for filing a lien against the Contractor's retainage. See Chapter 1-3.3C of this manual for guidance.

Disputes Between COA D/M/WBE and WSDOT:

1. Document the facts as accurately as possible. Allegations should be noted as such.

2. Most of the disputes can be resolved at the field level and you are encouraged to do so. Exceptions may be some extensions of time and any liquidated damages which must be resolved at the Construction Office.

3. Settlement of claims are encouraged at the Region level with coordination from the Construction Office.

4. Written charges of discrimination should be forwarded to the Office of Equal Opportunity.

5. Verbal charges of discrimination should be recorded in your diary and the Project Engineer so informed.

1-2.4H(3) Affidavit of Amounts Paid DBE/MBE/ WBE Participants

An Affidavit of Amounts Paid DBE/MBE/WBE Participants (Form 421-023) will be required from the Contractor on all projects annually (fiscal year July 1 through June 30) by the 20th of July and upon final completion of the project.

The affidavit shall include all DBE/MBE/WBE subcontractors and lower tier subcontractors working on the project whether they were a condition of award or not. They shall be listed on the form even if they did not work during that reporting period. The dollar amounts shown shall be only the amounts paid to the DBE/MBE/WBE during the reporting period. If no work was performed, show zero dollars. The final affidavit shall show only the dollar amounts paid from July 1 through the completion date.

When completed, the form shall be submitted to the Olympia Service Center Office of Equal Opportunity for entry into CCIS.

1-2.4I Contractors' Shop Plans and Working Drawings

In general, all shop drawings and supplemental details submitted by the Contractor should be checked in detail for conformance to all contract requirements before forwarding for approval. A Change Order is required for any deviation from the contract plans.

Any plan errors detected or revisions desired by the Project Engineer should be noted in *green pencil* on one copy of the drawings being forwarded to the Olympia Service Center (or Terminal Engineering, for Washington State Ferries projects) for approval. If Change Orders to cover any deviations from the contract plans have been issued, or are being processed, those changes should also be noted in *green*.

The following is a list of the most common shop plans and drawings required with a reference to the chapter of this manual that covers the procedures for processing them:

See Chapter 6-1.5 for:
- Bridge Demolition Plans
- Falsework Plans
- Form Plans
- Cofferdams and Cribs
- Post-Tension Details

See Chapter 6-2.6D for:
- Welding Reinforcing Steel

See Chapter 6-2.7A for:
- Shop Detail Plans of Prestressed Concrete Girders and Piling
- Shop Detail Plans of Precast Concrete Piles

See Chapter 6-3.1 for:
- Shop Plans for Structural Steel for Bridges

See Chapter 6-3.6C for:
- Welding Structural Steel

See Chapter 6-4.1 for:
- Prefabrication Plan of Treated Timbers

See Chapter 6-5.4 for:
- Welding Cast-In-Place Steel Shells

See Chapter 6-5.6 for:
- Welding Steel Piling

See Chapter 7-2 for:
- Plans for Hydraulic Items

See Chapter 8-20.2B for:
- Shop Plans for Luminaire and Traffic Signal Poles

See Chapter 8-21.3 for:
- Shop Plans for Sign Structures

Use Form 410-025 to transmit all falsework, form, and shop plans to the Bridge and Structures Engineer (or Terminal Engineering, for Washington State Ferries projects).

Shop plans for all hydraulic items which do not have a standard plan should be submitted in accordance with the procedures outlined for falsework plans.

Control of Shop Plans

The Project Engineer should maintain a log of all shop plans or other drawings received for each contract. The log should include the dates received, sent, approved, etc. as they are essential for later analysis of extensions of time if required.

Shop Plans for Standard Plan Items

In general, shop plans for items which have a standard plan, except those listed above, should be checked and approved by the Project Engineer. One copy of the approved shop plans must be furnished to the person who will be inspecting the fabrication of the material.

Shop Plans for Building Projects

Shop plans as required by the special provisions should be submitted by the Contractor to the Project Engineer. Quantities of these plans are stipulated in the documents. The Project Engineer should retain one set and forward the balance to the Construction Office for review and approval. The Construction Office will retain one set and return the remainder to the Project Engineer who should retain one copy for the office files and mark up the original copy for the use of the Inspector. The balance of the returned copies shall be forwarded to the Contractor.

1-2.4J Relief of Third Party Damages

Section 1-07.13(2) of the *Standard Specifications* holds the Contractor responsible for all work and materials under the contract until the project is completed. This Section further provides relief to the Contractor from maintaining and protecting specific portions of the contract as they are completed. Upon receipt of a written request from the Contractor for this relief, an analysis shall be made to ensure the requirements of Section 1-07.13(2) of the *Standard Specifications* are met. The Regional Operations/ Construction Engineer or Assistant Regional Operations/ Construction Engineer may approve these requests. This approval may be further subdelegated to the Project Engineers.

Relief may be granted for several specific items, for example, “Item 17, Beam Guardrail, Type l; Item 18, Beam Guardrail Anchor Type l; etc.” Relief may also be granted for all work except certain items, for example, “All work except Item 38, Electrical.” A copy of the approval letter shall be sent to the Construction Office and Finance and Budget Management Division/Claims Administration. The following is the body of a suggested format of the approval letter:

> Your letter dated _____ to _____, Project Engineer, requested relief from responsibility for damages to permanently completed work for this contract described more specifically as: (list the specific items for which relief is requested) *or* (all work) *or* (all work except for Item ___, _____).
>
> Effective _____, you are granted relief from the duty of maintaining and protecting the completed permanent work (described above) *or* (except for that item described above) in accordance with Section 1-07.13(2) of the *Standard Specifications*.
>
> This relief is granted for damages from any cause except that which may result from your operations, or your failure to exercise sound engineering and construction practices in the conduct of your work. This relief, shall in no way be construed to be final acceptance of work or materials, or to modify responsibility for workmanship and materials as assigned under the contract.

Section 1-07.13(3) of the *Standard Specifications* provides relief of responsibility for damage by **public traffic** when it is necessary for public traffic to utilize a highway facility during construction. When all three conditions specified in this section are met, the Contractor is automatically relieved of responsibility for damage caused by public traffic alone. This relief does not extend to damage by vandalism or other cause. Since the Contractor resumes responsibility if traffic is relocated to another section of roadway, it is best that this relief not be granted in writing.

1-2.5 Contract Time

1-2.5A General

The length of time allotted to the Contractor for completing the work on the contract is stated in the contract provisions. The time is usually allotted in terms of working days. Therefore, the instructions in this chapter pertain to contracts in which time is allotted on a working day basis.

Immediately upon award of the contract, the Project Engineer shall notify and remind the Contractor of the progress schedule requirements of the contract. The standard requirements are contained in Section 1-08.3 of the *Standard Specifications*. The contract provisions may have requirements that add to, or overrule, all or part of Section 1-08.3.

Section 1-08.3 requires, in part, that:

1. No later than five calendar days after execution of the contract, the Contractor shall submit a preliminary progress schedule that shows the work to be performed in the first 30 working days.

2. No later than 30 calendar days after execution of the contract, the Contractor shall submit five copies of a progress schedule that shows, among other things, the total working days to physically complete the contract.

3. The progress schedule must be developed by a critical path method except where a simple bar graph prepared on Form 421-506 is allowed by the contract provisions.

4. The Contractor shall provide supplemental progress schedules within ten calendar days of receiving written notice of the request.

5. Progress payments may be withheld for failure of the Contractor to meet progress schedule requirements.

Progress schedules shall outline in graphic form the operations and relationships in order of performance, with sufficient detail that progress of the work can be evaluated accurately at any time during the performance of the contract. Instructions for preparing a critical path schedule can be found in Section 10.300 of the *Washington Computer Manual*.

After review and approval of the progress schedule by the Project Engineer, a copy will be furnished to the Region Office, the Olympia Service Center Construction Office, and the Contractor. The date the progress schedule is approved shall be entered in CCIS.

At least each month the Project Engineer shall monitor the approved progress schedule. When the Project Engineer determines the original or any supplemental progress schedule does not provide the information needed, a supplemental schedule shall be requested from the Contractor. The contract provisions may also require supplemental periodical progress schedules from the Contractor. The date a supplemental progress schedule is approved shall also be entered in CCIS.

The Contractor may begin work as soon as the contract is executed and shall prosecute the work continuously to physical completion, except during periods when it is impossible to do so because of inclement weather or other events that may cause a suspension of work.

The Region is notified by telephone on the day the contract is executed by WSDOT, and this information shall be passed on to the Project Engineer. Since it normally takes several days for the executed contract to reach the Contractor, the Project Engineer shall immediately give verbal notification of the date of execution so the Contractor may order materials and make preparation to move on the project to begin work.

The Project Engineer shall notify FHWA (on Federal-aid projects) of the date when work is started on the project. The start work date shall be entered in CCIS.

There are four milestones when the project is completed or nearing completion. Figure 1-6 shows these milestones which will be addressed later in this chapter.

1-2.5B Working Day Charges

When the contract time is expressed in working days, the first working day shall be established in accordance with Section 1-08.5 of the *Standard Specifications* or such other date prescribed by the contract provisions.

In order to effectively track time on a contract, phases (interim completion dates) have been established in CCIS. The main contract is always 00. Any interim completion dates will be phase 01, 02, etc. Time associated with each phase will be shown on the Weekly Statement of Working Days.

The Project Engineer shall furnish a weekly statement advising the Contractor of the current status of time charges against the contract. This statement will be issued on the Weekly Statement of Working Days form generated from CCIS and shall be filled out in accordance with Section 1-08.5 of the *Standard Specifications*. The purpose of this statement is primarily informational as to the time remaining in which to physically complete the contract. It is also helpful in evaluating requests for extensions of time. It is not intended as a substitute for the work suspension orders discussed in Chapter 1-2.5B of this manual, and its use for this purpose should be confined in most cases to single days or very short periods of shutdown due to inclement weather.

The Project Engineer shall take into consideration the following conditions when preparing the weekly statement of working days:

1. The effect of inclement weather on critical activities.

2. The effect of conditions caused by inclement weather on critical activities.

3. Traffic restrictions imposed by the contract or the Project Engineer that affect a critical activity, except where the contract specifically prevents the allowance of unworkable days for traffic reasons.

If any of the above conditions prevent work or reduce the Contractor's efficiency on critical activities on the project, workable day charges must be adjusted accordingly. If no work can be performed on critical activities, an unworkable day shall be granted. If the Contractor is able to continue work on critical activities but the efficiency is significantly reduced, a partial day may be charged. Partial days shall be charged to the nearest one-half day.

If a Contractor elects to work 10 hours a day and 4 days a week (4-10s), Section 1-08.5 of the *Standard Specifications* is specific in the description of what constitutes a

Contract Completion Milestones

Substantial Completion	*Physical Completion*	*Completion*	*Acceptance*
Starts the time when any liquidated damages caused by overruns of contract time are limited to direct engineering.	Establishes the date liquidated damages will no longer be charged to the contract.	Starts the 60-day time period for release of retainage.	Start of 180-day period for contractor to bring legal action against WSDOT.

Substantial Completion	When the contract work is completed to the extent that WSDOT has full and unrestricted use and benefit of the facilities, and only minor incidental work remains to physically complete the total contract.
Physical Completion	When all of the work is physically completed on the project. All the documentation, required by the contract and required by law, does not necessarily need to be furnished by the Contractor by this date.
Completion	When all work specified in the contract is completed and all the obligations of the Contractor under the contract are fulfilled. All documentation has been submitted by the Contractor.
Final Acceptance	When the Chief Construction Engineer accepts the contract by signature on the Final Contract Voucher Certification.

Figure 1-6

chargeable working day. Therefore, if a Contractor elects to work Monday through Thursday 4-10 hour shifts, and Friday is a day that would ordinarily be charged as a working day under the provisions of Section 1-08.5, then that Friday shall be charged as a working day whether or not the Contractor works on that day.

In the event the Contractor protests, in writing, the Project Engineer's determination of a workable day, the Project Engineer will analyze any discrepancy and immediately respond to the Contractor by either denying the protest or transmitting a revised Weekly Statement of Working Days.

If the number of working days provided in the contract are used before completion of the work, the Weekly Statement of Working Days shall continue to be made out weekly to show which days are workable and which days are unworkable due to weather conditions. The Project Engineer shall refer to Chapter 1-2.5G of this manual regarding assessment of liquidated damages on progress estimates.

When the contract time is expressed in calendar days, refer to the contract provisions regarding the charging of contract time.

1-2.5C Suspension of Work and Notice of Delay

When, in the judgment of the Project Engineer, inclement weather, or conditions caused by inclement weather, make it impracticable to achieve satisfactory results, an order shall be issued to suspend work wholly or on any part of the contract. Subject to the approval of the Regional Operations/Construction Engineer, delays caused by other conditions beyond the control of the Contractor may warrant such an order to suspend work, i.e., delays caused by WSDOT or delays caused by third parties.

When conditions cause a shutdown of work for short periods of time, oral authorization to suspend work may be granted. All or part of any working day (time increments not less than one-half day) during which work is suspended shall be declared unworkable and not charged against contract time on the Weekly Statement of Working Days. Such authorizations are discussed in Chapter 1-2.5C of this manual. These shutdowns of work for short periods of time need no further written documentation other than the Weekly Statement of Working Days.

When seasonal weather conditions cause work on the project to be partially or wholly suspended for an extended time, a written Order to Suspend Work (Form 421-006) shall be issued. If some items of work on the project can be continued unaffected by the weather conditions, those items of work should be excepted from the Order to Suspend Work. The Project Engineer must review the Contractor's approved progress schedule in determining if the items of work being performed are advancing the physical completion of the project and whether or not the Weekly Statement of Working Days should continue to be issued. If work is suspended on the items of work critical to physical completion of the project, the Order to Suspend Work should include a statement that working days will not be charged and the Weekly Statement of Working Days will cease during the suspension period. If work is suspended only on noncritical items, the Order to Suspend should include a statement that working days will continue during the suspension period. When working day charges are continued during a partial suspension of work, it is important that the Contractor's approved progress schedule be monitored in relation to the time charges. It is possible for work that originally was not critical to become critical if all the float time is used up. The following is an example of how this can occur:

> The Contractor's progress schedule shows 50 working days to build bridge approaches and 150 working days to build a structure. Twenty working days into the project the grading work is shut down due to winter weather, but work continues on the structure. Since the structure work is critical, the Project Engineer continues charging time. Six months later the structure is complete, with a total of 140 working days charged and only 10 working days available to complete the project; however, 30 days work remains on the grading portion of the project. In this case the Project Engineer should have suspended working day charges when there were 30 working days remaining on the project, because at that point the grading portion of the project had become critical.

A written Order to Resume Work (Form 421-007) must be issued when work is resumed from a suspension or partial suspension. Form 421-007 will reflect, or be altered to reflect, the total authorized suspensions and unworkable days to the date of the Order to Resume Work. When work is resumed, the first Weekly Statement of Working Days shall include this total. Time increments of less than one-half day shall not be used.

In the event that a suspension of work is necessary for an extended period and the requirements of Section 1-08.7 of the *Standard Specifications* have been complied with in all respects, the Project Engineer may recommend to the Regional Operations/Construction Engineer that the Contractor should be relieved of the routine maintenance during the period of suspension. The Project Engineer, as early as possible, shall make an estimate of, and arrangements for, the construction funds that will be required for the interim routine maintenance of the roadway by WSDOT. The Contractor shall take all action necessary to control erosion, pollution, and runoff prior to, and during, the shutdown period before WSDOT will assume

responsibility for maintenance. Any areas which are not open to traffic shall be maintained and safeguarded by the Contractor at no cost to WSDOT.

Section 1-08.6 of the *Standard Specifications* provides that the Contractor may be entitled to compensation and/or time extensions if a delay is caused by WSDOT. If a delay is caused by anything other than WSDOT (such as other state agencies, other governmental agencies, or other outside forces), an extension of time may be granted under the criteria of Section 1-08.8 of the *Standard Specifications*; however, compensation will not be allowed. The compensation allowed by Section 1-08.6 recognizes only WSDOT caused suspensions, delays, or interruptions. If the Contractor believes WSDOT is causing a delay and WSDOT has not acknowledged to the Contractor responsibility for compensation and/or a time extension, the Contractor must serve written notice to WSDOT in order to retain the right for consideration of an equitable adjustment.

The General Special Provision (GSP) for Suspension of Work which is included in all Federal-aid projects for the Interstate System, Forest Highway projects, and Public Lands projects has a distinct difference from Section 1-08.6 of the *Standard Specifications* that is worth noting. The GSP provides that the Contractor may be entitled to compensation and/or a time extension if a delay is caused by anything, as long as the delay was caused by conditions beyond the control and not the fault of the Contractor, its suppliers, or subcontractors at any tier and not caused by weather.

In all cases, the Contractor must have suffered, as a result of the delay, increased cost in the performance of the contract to receive compensation and increased time for the performance of the contract to receive an extension of time.

When WSDOT is responsible for delaying a project and as a result may be liable for any increased costs the contractor incurs as a result of the delay, the Project Engineer should consider ordering the Contractor to recover the schedule by accelerating the work. First, an event or an accumulation of events must be identified which are the responsibility of WSDOT and have delayed the Contractor. Second, a time impact analysis of the Contractor's schedule must be performed to determine the impact of the delay on the schedule. Third, a cost analysis should be made to compare the estimating costs associated with the delay to the estimated costs of recovering the schedule. Acceleration of the contract by working longer hours, using increased resources, or resequencing the work should be considered when estimating the cost of delay mitigation. All change orders to pay the Contractor for schedule recovery must be approved by the Olympia Service Center Construction Office before ordering the Contractor to proceed.

The weather and all suspension and resumption of work orders and the reasons therefor shall be recorded in the project records.

1-2.5D Extension of Time

Whenever it is apparent that the number of working days provided for in the contract will be used prior to physically completing the main contract or a phase of the contract, the Project Engineer shall ensure that proper notice is provided to the Contractor of the process for requesting an extension of time. No time extension should be granted without a request in writing from the Contractor unless the time extension is related to added work and included in the same change order.

The Contractor should be encouraged to submit time extension requests as delays occur. The Contractor may request an extension of time at any time during the life of the contract, or after the contract time has overrun. The request shall be processed promptly.

The Contractor's letter requesting an extension of time must bear consent of surety when the accumulated requests are for 20 percent or more of the original contact time. If the Contractor's request is for 10 working days or less and the analysis made by the Region justifies the time extension, the Region may execute a change order granting the time extension. All extensions of time granted by the Region must be by change order. The Project Engineer may approve up to 5 working days on a change order if the extension of time is related to changes implemented in that same change order. Refer to Section 1-2.4C of this manual. If the Contractor's request is not approved, the Contractor shall be notified in writing.

When the Contractor's request is for more than 10 working days, the time extension shall be forwarded to the Olympia Service Center Construction Office for approval.

The analysis and documentation shall be the same for either Region approved or the Construction Office approved extensions of time. The project diaries should have a full and complete record of weather and other conditions that might affect the progress of the work. The analysis should refer to the CPM (or critical items on the approved progress schedule).

If the Region executes a change order for an extension of time that would result in the release of previously withheld liquidated damages, the Region shall write a memorandum to the Olympia Service Center Accounting Office advising them to release the appropriate amount of liquidated

Example

DATE:

FROM: District Operations Engineer

SUBJECT: Contract No. SR
Contract Name
FA No. or State

TO: Chief Construction Engineer

Attached is a copy of the Contractor's letter dated _____ complete with Consent of Surety requesting a 30-day extension of time. The status of the contract time is as follows:

	Date	**Working Day Charges**
Award	June 1, 1987	—
Execution	June 12, 1987	—
Substantial Completion	Feb. 14, 1988	140
Physical Completion	March 1, 1988	150
Working Days Charged to Date (use when there is no physical completion date)	March 1, 1988	150
Original Allotted Time	—	110
Total of Authorized Extensions	—	10
Total Allotted Time	—	120
Net Overruns to Substantial Completion	—	20
Net Overruns to Physical Completion	—	30

Note: Include phase 1 & 2 data if contract specifies dual physical completion times.

We have reviewed the Contractor's request and offer the following analysis and recommendations:

1. (Analysis) — Recommend 11 days.

2. (Analysis) — Recommend 0 days.

In summary, we recommend that the Contractor be granted an 11-day extension of time. This extension of time, if granted, will result in a net overrun to substantial completion of 9 days at $750 per day, which will necessitate assessment of liquidated damages in the amount of $6,750. There were $242.45 direct engineering costs charged between the date of substantial completion and the date of physical completion.

Liquidated damages in the amount of $15,000, and direct engineering costs in the amount of $242.45 have previously been withheld from monthly progress estimates. Therefore, $8,250 should be released to the Contractor.

Figure 1-7

damages that have previously been withheld. The memorandum shall refer to the specific change order that granted the extension.

When the Contractor submits a letter requesting an extension of time that requires the Construction Office approval, the Contractor's letter will be forwarded with the transmittal memorandum from the Region (or with a thru memorandum from the Project Engineer). The Region's memorandum shall be submitted in a format similar to Figure 1-7 and provide an analysis and recommendation regarding the Contractor's request and a complete explanation of the reasons for the recommendations.

The Construction Office will review the Contractor's request and the Region's recommendation and notify the Contractor in writing whether or not an extension of time will be granted. Where the time extension results in the relief of liquidated damages which were previously withheld, Accounting will be directed to release the withheld liquidated damages to the Contractor.

After the date of physical completion, the Region shall ensure that all issues of time are resolved immediately to avoid delays in processing the final estimate.

1-2.5E Substantial Completion

Substantial completion can be granted when only minor items remain to physically complete the project. Liquidated damages for overruns of time after substantial completion are reduced to direct engineering costs. The following criteria may be used to determine substantial completion of a project:

1. The public has full and unrestricted use and benefit of the facility.

2. Major safety features are installed and functional, including guardrail, striping, and delineation.

3. Illumination, if required, is installed or a temporary system with equal functional capabilities is operating.

4. Signals, if required, are installed or a temporary system with equal functional capabilities is operating.

5. The need for temporary traffic control on a regular basis has ceased. There will be no need for lane closures during the hours of darkness nor for more than 8 hours at any one time during daylight hours.

6. The traffic is operating in its permanent configuration.

7. Only plant establishment is remaining to physically complete the project.

The Project Engineer is responsible for determining the substantial completion date. When the Project Engineer determines that WSDOT has full and unrestricted use and benefit of the facilities under the above conditions, the Contractor shall be notified by letter of the substantial completion date with a copy sent to the Olympia Service Center Materials Engineer. The letter shall also state that THIS DOES NOT CONSTITUTE PHYSICAL COMPLETION, COMPLETION, OR ACCEPTANCE OF THE CONTRACT but establishes that the amount of liquidated damages (if the total contract time is overrun) will be reduced to direct engineering and other related charges to the project. Direct engineering costs do not apply when substantial completion is granted for the plant establishment period.

The Project Engineer shall continue to submit the Weekly Statement of Working Days showing the workable and unworkable days as they occur until the project is physically completed. If the only items of work remaining after substantial completion are 2nd- and 3rd-year plant establishment, Weekly Statements of Working Days will no longer need to be prepared. The substantial completion date shall be entered in CCIS and noted on the Weekly Statement of Working Days when that date has been established.

1-2.5F Date of Physical Completion

Before the Contractor's forces and equipment are removed from the project, it is recommended that the Project Engineer review the work to ensure that all work required by the contract has been completed.

When the Project Engineer is satisfied that all physical work is completed, the date of physical completion will be established and entered in CCIS. The physical completion letter from the Project Engineer to the Contractor shall be sent immediately after the date of physical completion is established. A sample letter is shown in Figure 1-8. If there was an overrun in time, the letter shall contain an indication of the number of days the project overran and the probable liquidated damages and/or direct engineering and related costs to be assessed the Contractor if there is no extension of time granted. The letter should designate a reasonable time (allow approximately 20 calendar days) to respond if the Contractor feels there are reasons for WSDOT to grant an extension of time. The Contractor should also be advised in the letter that if no response is received in the designated time, it will be assumed an extension will not be pursued. Copies of the letter will be sent to:

1. The Olympia Service Center Program Management Office on Federal-aid projects.

2. The Railroad companies if applicable. Refer to Section 1-4.2B of this manual.

Sample Physical Completion Letter

Date

Contractor Name
Address

Contract SR
Contract Title
FA No. or State Project

Ladies and Gentlemen:

In accordance with Section 1-08.5 of the *Standard Specifications*, this project is considered physically complete as of _____.

The contract required the work to be physically completed within _____ working days. There were _____ working days used to physically complete the project. (Address overruns of time.)

This notification does not constitute completion, or acceptance by the Secretary of Transportation.

Also, attached is a Contractor's Construction Process Evaluation form. Please complete the form in accordance with the instructions on the reverse side.

Sincerely,

Project Engineer

cc: Olympia Service Center Construction Office
Regional Operations/Construction Office
Olympia Service Center Program Mgmt. on FA projects
RR Companies if applicable
Olympia Service Center Accounting Office
FHWA on all FA projects
Olympia Service Center Materials Laboratory
Regional/TransAid Engineer
Planning and Programming Service Center Transportation Data Office

Figure 1-8

3. The Olympia Service Center Accounting Office on all projects.

4. FHWA on all Federal-aid projects.

5. The Olympia Service Center Materials Laboratory on all projects.

6. The Regional TransAid Engineer on all city and county projects.

7. The Planning and Programming Service Center Roadway Data Office, MS 47380.

Promptly upon receiving any request from the Contractor for an extension of time, the Project Engineer shall pursue the procedures outlined in Section 1-2.5D of this manual so that the issue of time and any appropriate liquidated damages may be resolved without any delay in the processing of the final estimate. If no request for an extension of time is received within a reasonable time, the Project Engineer shall prepare a memorandum similar to the one shown in Figure 1-7 explaining the status of contract time on the project and recommend the assessment of liquidated damages and/or direct engineering costs. A copy of the direct engineering cost work sheets shall be submitted with the recommendation.

1-2.5G Liquidated Damages

Contract time and any appropriate liquidated damages must be resolved before the final estimate can be completely processed. Liquidated damages of any form (from the formula calculations in Section 1-08.9 of the *Standard Specifications* and/or direct engineering costs) are to be assessed only for that period of time after contract time has expired to the date of actual physical completion.

Any withholding or assessment made against the Contractor or the Contractor's payments shall be preceded by written notification to the contractor. For those issues that may require action by the Contractor, the notification shall be far enough in advance for such action to be taken by the Contractor to mitigate or completely avoid any withholding or assessment.

The term "withhold" refers to a temporary deduction shown on a progress estimate. The term "assess" refers to a permanent deduction that could be shown on a progress estimate, but will be shown on the final estimate.

Liquidated damages fall into two categories — one deals with contract time and the other deals with miscellaneous things such as ramp or lane closures. These two categories are described below:

1-2.5G(1) Contract Time Liquidated Damages

Section 1-08.9 of the *Standard Specifications* (and at times the contract provisions) establishes the amount of liquidated damages to assess the Contractor for overruns in contract time. These assessments are: (1) either the formula calculated liquidated damages, or the liquidated damages prescribed by the contract provisions; and (2) the direct engineering and related costs. Any temporary withholding or the final assessment of these liquidated damages shall be shown as a below the line "liquidated damages" deduction on progress estimates and the final estimate.

The Chief Construction Engineer has not subdelegated to the Region the authority to assess below the line "liquidated damages" on progress estimates or the final estimate. However, the authority to withhold below the line "liquidated damages" on progress estimates has been subdelegated to the Region, and may be further subdelegated to the Project Engineer. See Section 1-3.B(5) of this manual.

Liquidated damages should be addressed whenever it is apparent that the number of working days provided in the contract will be used before physical completion of the work. The sample letter illustrated below shall, in all cases, be sent by the Project Engineer to the Contractor when is obvious that the work on the main contract or a phase of the contract will not be physically completed within the prescribed time. The letter may be altered for phases or when substantial completion has been previously established for the contract.

Sample Letter

> The specifications for this contract require the work to be physically completed in its entirety within ___ working days. The progress of work is such that WSDOT may be obligated to deduct liquidated damages from monies due your firm under the terms of Section 1-08.9 of the *Standard Specifications*.
>
> Please be advised that Section 1-08.8 of the *Standard Specifications* explains the conditions under which WSDOT may grant an extension of time. If WSDOT does not receive a written request for an extension of time from your firm fully explaining the reasons for delay of this project by (date, allow approximately 20 calendar days), WSDOT will commence deduction of liquidated damages from the monthly progress payments due your firm. Liquidated damages for this project will be $___ per working day of contract time overrun (the Project Engineer shall calculate the amount using the formula given in Section 1-08.9 of the *Standard Specifications*, rounding to the nearest dollar). Liquidated damages for an overrun in contract time after substantial completion has been granted

will be based upon direct engineering and related costs as provided in Section 1-08.9 of the *Standard Specifications*.

In some cases, there are legitimate reasons for time extensions which would preclude withholding of liquidated damages on progress estimates. An example of these "legitimate reasons" would be when there is no doubt that WSDOT in some way caused a delay during the progress of the work as described in Section 1-08.8 subparagraph (2) of the *Standard Specifications*. However, if the Project Engineer has any doubts regarding a possible time extension that would preclude withholding of liquidated damages on progress estimates, the Region and/or the Construction Office should be consulted for guidance. If the Project Engineer determined that withholding of liquidated damages on progress estimates would not be appropriate, the reasons for not withholding shall be documented by a memorandum to the files.

If the Contractor has responded to the above sample letter within the prescribed time and it is still determined that withholding of liquidated damages on progress estimates is appropriate, a follow-up letter should be sent to the Contractor advising that the issue is being evaluated and that liquidated damages will be withheld until the question is resolved.

If the Contractor responds by requesting a time extension, the Region will submit the Contractor's request, together with the Region's recommendations (Figure 1-7) in accordance with Chapter 1-2.5D of this manual, to the Olympia Service Center Construction Office.

If the Contractor does not respond within the designated time, the Region will submit a statement to that effect, together with its recommendation (per Figure 1-7), to the Construction Office. The Construction Office will review the Region's recommendations to determine if liquidated damages will be assessed.

The Construction Office will notify the Contractor in accordance with Chapter 1-2.5D.

The following describes the procedures for addressing contract time related liquidated damages in the various stages or phases of the project:

1. Phases (Interim Physical Completion Dates)

Liquidated damages for phases will be shown in the special provisions.

When the contract includes additional phases, and the time for physical completion of a phase has overrun, the overrun should be resolved as it occurs. This involves the Contractor either being granted an extension of time or being assessed liquidated damages by the Construction Office.

2. After Substantial Completion Date of the Contract

If substantial completion is granted after the expiration of contract time the formula liquidated damages in Section 1-08.9 of the *Standard Specifications* will be assessed for that period of time between the expiration of contract time and the substantial completion date.

Liquidated damages assessed after the date of substantial completion will be only the direct engineering and related costs incurred. The direct engineering and related costs will be the field engineering and inspection time charges plus any vehicle, travel pay, or per diem charges connected with the delayed contract physical completion. Engineering costs such as computing grades, quantities, etc. which would have accrued to WSDOT under normal conditions should not be included in the direct engineering and related costs.

If substantial completion is granted on or prior to the expiration of contract time, direct engineering costs will only be assessed for that period of time between the date contract time expired and the physical completion date.

Direct engineering and related costs should not be assessed when the total amount is less than $300.

3. Before Physical Completion

If substantial completion has not been established, the formula liquidated damages in accordance with Section 1-08.9 of the *Standard Specifications*, will be assessed for that period of time between the expiration of contract time and the physical completion date.

1-2.5G(2) Miscellaneous Liquidated Damages

The contract provisions may provide for assessment of other liquidated damages, such as failure to open traffic lanes within the prescribed time and failure to open ramps within the prescribed time. Any temporary withholding or final assessment of these liquidated damages shall be shown as a below the line "miscellaneous" deduction on progress estimates and the final estimates. The Construction Office has subdelegated the authority to the Regions to withhold and assess these types of liquidated damages on progress estimates and the final estimate. The Project Engineer shall notify the Contractor in writing when these type liquidated damages are to be assessed. See Section 1-3. lB(6) of this manual.

Miscellaneous liquidated damages should not be assessed when the total amount is less than $100.

1-2.5H Completion Date

Immediately after the physical completion date has been established, the Project Office shall notify the Contractor of all the outstanding documents required to establish a

completion date. Once all the obligations of the contract have been performed by the Contractor, the Project Engineer shall give the Contractor written notice of completion of the contract. (A sample letter is shown in Figure 1-9.) In order for the completion date to be established, all the physical work on the project must be complete, and the Contractor must furnish all documentation required by the contract and required by law. In other words, the Project Engineer has all the documents necessary to process the final estimate. This includes all Affidavits of Wages Paid, Material Certifications, and the Contractor signed Final Contract Voucher Certification. (Note: Establish the completion date as soon as the last item of paper work is received. The final estimate does not have to be processed in order to establish the completion date.) The completion date shall be the same date as the date of the written notice to the Contractor. A COPY OF THE COMPLETION LETTER SHALL BE FAXED TO THE CONTRACT PAYMENTS SECTION OF THE OLYMPIA SERVICE CENTER ACCOUNTING OFFICE, (FAX NUMBER SCAN 705-6804) ON THE DAY THE LETTER IS WRITTEN.

If the Contractor refuses, or is unable to return, a signed FCVC or any of the necessary documents to process the final estimate, WSDOT can establish a completion date and accept the contract. See Chapter 1-3.1D for unilateral acceptance procedures.

1-2.6 Enforcement of Wage Rate Requirements

1-2.6A General Instructions

Section 1-07.9 of the *Standard Specifications* provides the wage requirements for the Contractor, any subcontractor, lower tier subcontractor, or other person doing any work under the contract. Additionally, contracts financed in whole or in part with Federal funds will have the Required Contract Provisions Federal-aid Construction Contracts (FHWA-1273) included in the contract provisions to provide the Federal wage requirements.

For projects involving both Federal funds and State funds, the Hourly Minimum Wage Rate and Fringe Benefit schedule specified in the contract will include both the prevailing wage rate and fringe benefits determined by the Washington State Department of Labor and Industries (State L&I) and by the U.S. Department of Labor (USDOL). When there is a difference between these two determinations, the Contractor, subcontractors, and lower tier subcontractors must pay a wage not less than the higher of the two. The comparison between State and Federal wage rates must include the addition of the appropriate fringe benefits as found at the beginning of each major skill classification listed in the contract provisions. The comparison between State and Federal wage rates must also include any notes as found at the end of each major classification.

It is the responsibility of WSDOT to establish monitoring procedures which will ensure that the Prevailing Wage Rate provisions, both State and Federal, are properly enforced.

The Project Engineer must be familiar with these requirements and must not assume that compliance with one constitutes compliance with both.

1-2.6B Enforcement of State Requirements

The prevailing wage requirements are set forth in the *Standard Specifications*, Section 1-07.9, and the Wage Rate Provisions of the specific contract. Certified payrolls are not routinely required on projects with only State funds involved. However, they may be requested if noncompliance with any State requirement is questioned.

1. Before WSDOT allows any payment, the Contractor must submit a State L&I approved Statement of Intent to Pay Prevailing Wages on State L&I's form number F700-029-000 to the Project Engineer. State L&I approves this statement which certifies that the document meets the requirements of RCW 39.12.040 and the date of this approval is to be entered in CCIS by the Project Office.

2. All subcontractors and agents of lower tier subcontractors must submit a State L&I approved Statement of Intent to Pay Prevailing Wages on State L&I's form number F700-029-000 to the Project Engineer. No payment will be made for any subcontracted work unless a State L&I approved Statement of Intent to Pay Prevailing Wages has been received. State L&I approves this statement which certifies that the document meets the requirements of RCW 39.12.040, and the date of this approval date is entered in CCIS by the Project Office.

3. The Contractor, all subcontractors, and lower tier subcontractors must submit a State L&I approved Affidavit of Prevailing Wages Paid (AWP) on State L&I's form number F700-007-000 to the Project Engineer after the project is completed. The approval date of each State L&I approved AWP will be entered in CCIS by the Project Office. The State L&I approved AWP is incorporated in Final Record Book No. 1. It is the Contractor's responsibil-

ity to obtain these AWPs. In the event a subcontractor or lower tier subcontractor cannot or will not provide a completed AWP form, the Contractor must seek guidance from State L&I.

4. RCW 49.28 permits some contractors to work their employees 4 days with 10-hour shifts without being required to pay overtime (4-10s).

WAC 296-127-022 provides that "It is prohibited to work more than 10 hours in any calendar day on a public works project except in cases of extraordinary emergency, such as danger to life or property." RCW 49.28 has always had this provision (except it referred to 8-hour days) and State L&I has, and still does, deem the work and workers on our highway project to be a "danger to life or property," therefore, this provision has been waived for WSDOT's construction activities.

State L&I and WSDOT have agreed to the following:

a. RCW 49.28 applies to all contracts.

b. If requested by the Contractor, WSDOT will provide a copy of WAC 296-127-022 immediately after execution of the contract. The Contractor will be instructed to provide copies to any subcontractor or lower tier subcontractor that is, or is planning on, working 4-10s.

When the WAC rule is provided to the Contractor, the Project Engineer will advise the Contractor to become familiar with, and abide by, all State and Federal laws, rules, and regulations pertaining to overtime, and in particular this WAC rule if they plan to work 4-10s. The Contractor shall be advised that WSDOT will hold them responsible for ensuring that all subcontractors or lower tier subcontractors abide by these laws, rules, and regulations.

c. In conjunction with WSDOT's normal compliance review of certified payrolls, WSDOT will confront the Contractor or the lower tier subcontractors (through the Contractor) with noncompliance for overtime requirements only when:

(1) Over 10 hours are worked in any one day by their employees without the benefit of being paid overtime pay. (This is a State requirement.)

(2) Over 40 hours are worked in any week by their employees without the benefit of being paid overtime pay. (This is both a State and a Federal requirement.)

d. In the event WSDOT gets any complaints from employees of any contractor regarding improper, or nonpayment of, overtime pay, WSDOT (through the Olympia Service Center Construction Office) will seek assistance from State L&I for a determination.

5. WAC 296-127 defines "Contractor" to include: (1) any fabricator or manufacturer that produces nonstandard items specifically for a public works project, and (2) employers that contract with contractors or subcontractors for the purpose of the production and/or delivery of gravel, concrete, asphalt, or similar materials. This causes some employees of firms that do this work to be covered by the State prevailing wage law, RCW 39.12. State L&I provides WSDOT with prevailing wage rates for those workers. Therefore, WSDOT will include these rates in all contracts that **may** have this type work.

The Statement of Intent to Pay Prevailing Wages (SI) and the Affidavit of Wages Paid (AWP) for those firms must be submitted on State L&I's forms. WSDOT can not make progress payments to the Contractor for the work or materials involved in producing these products (and for the delivery of gravel, concrete, asphalt, or similar materials) to be incorporated into the contract until an approved SI is provided to WSDOT, nor can WSDOT release any of the retained percentage until an approved AWP is provided to WSDOT after that work is completed. We will hold the Contractor responsible for compliance with the requirements.

It is strongly recommended that this issue be discussed as part of the required preconstruction meetings and discussions. It might also be wise to supply the Contractor with a copy of these WAC rules. The Contractor should be advised that we are obligated to monitor enforcement of these requirements to protect the interest of WSDOT and to ensure that WSDOT is not liable to the Contractor's employees for wages due as provided in RCW 39.12.042.

It must be remembered that these WAC rules are a State requirement and not a Federal requirement. Accordingly: (1) WSDOT will not request certified payrolls from these firms (Suppliers, Manufacturers, and Fabricators), even on Federal-aid projects, unless we are compelled to do so by State L&I (The Olympia Service Center Construction Office should be contacted if State L&I or anyone else demands WSDOT to get certified payroll for these firms.); (2) WSDOT will not conduct wage rate interviews with employees of these firms; and (3) State L&I's enforcement authority is limited to within State's boundaries, therefore, firms performing this work outside the State are not covered by these requirements.

1-2.6C Compliance With Federal Contract Provisions

All contracts financed with Federal-aid funds contain in the contract provisions the "Required Contract Provisions Federal-aid Construction Contracts" (FHWA-1273). It

Sample Completion Letter

Date

Contractor Name
Address

Contract SR
Contract Title
FA No. or State Project

Ladies and Gentlemen:

All your obligations under the above-referenced project have been met in accordance with Section 1-08.5 of the *Standard Specifications*. As of the date of this letter, this contract shall be considered complete.

Your retainage will be released 60 days after this date, provided all releases have been received and there are no outstanding claims against the retainage.

This notification does not constitute acceptance by the Secretary of Transportation.

The contract final amount as shown on the Final Contract Voucher Certification is $_____.

Sincerely,

Project Engineer

cc: Olympia Service Center Accounting Office (Faxed)
Olympia Service Center Construction Office
Regional Operations/Construction Office

Figure 1-9

is the responsibility of the Project Engineer to enforce these provisions to the degree necessary to ensure full compliance.

The Contractor, each subcontractor, and each lower tier subcontractor must submit weekly certified copies of payrolls and statement of compliance to the Project Engineer, must post the wage rate poster (FHWA 1495 and FHWA 1495A when appropriate) and the Wage Determination decision of the Secretary of Labor (Federal wage listing in the contract provisions), and allow interviews of employees during working hours by authorized representatives of WSDOT, the Federal Highway Administration, and the U.S. Department of Labor. The Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor. Upon completion of the contract, the record of materials, supplies, and labor must be submitted by the Contractor on Form FHWA-47 (see Chapter 1-2.8F of this manual). *Rigid compliance with the federal regulations and contract provisions must be ensured by thorough on-the-job inspection procedures and routine checking procedures at the Regional Office level.*

PAYROLL INSPECTION

The Project Engineer is responsible for checking the Contractor's payrolls to see that the required information is complete and the payrolls are correct. A thorough check shall be made of the first payrolls submitted on the project by the Contractor, each subcontractor, and each lower tier subcontractor. If the first payroll is correctly prepared, subsequent payrolls for that project may be accepted on the basis of spot checking approximately 10 percent of each of the payrolls as they are submitted. If errors are found during the spot checking, more thorough checking shall be made of the payrolls.

The payroll inspection by the Project Engineer shall include the following item:

1. The contract number and contract name must be noted on the payroll form, together with the payroll number and payroll period. The name of the employer showing whether Contractor, subcontractor, or lower tier subcontractor must be shown.

2. It is necessary to be able to identify a specific minimum wage rate for each worker. Word descriptions for labor classifications included in the Wage Rate Contract Provisions shall be used on payrolls.

Section 1-07.9 of the *Standard Specifications* permits the Contractor to use an alternate method to identify the labor description used by them to compare with the contract provisions. The object is for the Project Engineer to be able to easily determine that the proper wages are being paid.

3. The minimum State wage requirements are listed under State Rate and the minimum Federal wage requirements are listed under Federal Rate of the Hourly Minimum Wage Rate Schedule as shown in the contract provisions. On Federal-aid projects, to meet both the State and Federal minimum wage requirements, the wage paid each employee must at least equal the higher of the two minimum wages (including fringe benefits) listed for the appropriate classification. The appropriate fringe benefits must be added to the amounts in each column if the Contractor does not have an approved bona fide fringe benefits program (see #12 of this subsection). Only actual hours worked should be shown. Overtime must be stated separately and must be shown as such and not converted to equivalent straight time. Travel pay must be shown separately.

4. Payroll deductions must conform with the "Anti-Kickback" Act. If payroll deductions are questionable, contact the Olympia Service Center Construction Office for assistance.

5. Every laborer or mechanic working on the contract must be classified for the proper minimum prevailing wage in accordance with the designated wage determination. If a classification of worker is used that does not appear in the contract special provisions, Section 1-07.9 of the *Standard Specifications* makes it the Contractor's responsibility to contact the U.S. Department of Labor for a determination of the proper wage rate. The FHWA 1273, Required Contract Provisions Federal-Aid Construction Contracts, also provides a method for handling this situation. It is prudent to contact the Construction Office whenever this occurs. In many cases, the Construction Office can determine what the proper wage should be in a much faster response time than any of the other alternatives.

6. Foremen who perform actual work during 20 percent or more of their time exclusive of time spent in supervisory work are subject to the Davis-Bacon and Related Acts (DBRA) and must be classified in the appropriate journeyman classification and must be paid wages at least equal to the journeyman rate as stated in the wage schedule in the contract provisions.

7. Before using apprentices on the job the Contractor shall present to WSDOT written evidence of registration of such employees in a program approved by the Washington State Apprenticeship and Training Council. If written evidence of registration is not provided, the full journeyman rate must be paid (RCW 39.12.021).

The Contractor, subcontractor, or lower tier subcontractor shall submit to WSDOT written evidence of the progression schedule for each apprentice and the established apprentice-journeyman ratios and wage rates in the project

locality upon which will be the basis for establishing such ratios and rates under the contract.

When an apprentice is shown on the payroll, the apprenticeship registration number must be shown, and the period of apprenticeship must be included with the classification.

8. Bona fide owner-operators of trucks and similar construction hauling equipment who are independent contractors are not considered "employees and/or laborers and mechanics" under the terms of the Davis-Bacon and Related Acts. Certified payrolls should include the names of such bona fide owner-operators but need not show hours worked or wages paid. The identifying notation "owner-operator" is needed. This instruction does not preclude the Contractor from including any other information on the payroll which may be desired for their own use. The purpose for identifying the individual owner-operator by name on the payroll is to ensure that such owner-operators are recognized as independent contractors not subject to wage regulations and are distinguished from equipment operators who are employed on an hourly basis and are protected by wage rate laws and regulations.

Drivers or operators of fleet-owned equipment or other fully operated equipment, regardless of any contractual or rental arrangements between the employee and the Contractor must be carried on the Contractor's, subcontractor's, or lower tier subcontractor's payroll in complete form. In those cases where the employees are actually furnished and paid by a fleet-owner or rental company the Contractor, subcontractor, or lower tier subcontractor in lieu of carrying these employees on their own payrolls, may furnish copies of the fleet-owner's or rental company's payroll for the periods the employees worked on the subject project. If this is done, the payroll should be footnoted to indicate the hours the employees worked on the subject project; and wages paid, deductions, etc., must comply with current regulations. Certifications of these payrolls must be made by the Contractor, subcontractor, or lower tier subcontractor in the same manner as required for their own payrolls.

9. Employees of material suppliers involved only with delivery of supplies or materials to the job site are not subject to the Davis-Bacon and Related Acts (DBRA) minimum wage rates. However, if these employees do any actual work at the job site in incorporating the materials into the work, they become subject to the DBRA and must be carried on the Contractor's, subcontractor's, or lower tier subcontractor's payrolls. Should a material supplier set up a production plant at or near the job site for the sole purpose of supplying material to the project, the plant employees become subject to the DBRA and must be carried on the Contractor's, subcontractor's, or lower tier subcontractor's payrolls.

10. Each employee's Social Security number and permanent address must appear on the first payroll on which their name appears, or on a separate list attached to the payroll. Changes in address must be reported.

11. All payrolls must have a statement of compliance signed and in the form prescribed by Section V of the Required Contract Provisions Federal-aid Construction Contracts (FHWA-1273).

12. All payrolls must be certified by the Contractor, subcontractor, or lower tier subcontractor in accordance with the DBRA. This certification contains four elements: (l) that the payroll copy furnished is a true copy, (2) that the payroll is correct and complete, (3) that the wage rates contained therein are not less than those determined by the Secretary of Labor and that the classification set forth for each laborer or mechanic conforms with the work being performed, and (4) that the appropriate fringe benefits due each employee have been paid in full.

13. Subcontractors and lower tier subcontractors shall be required to submit payrolls to the Project Engineer either direct or through the Contractor, preferably through the Contractor.

Any payrolls which do not comply fully with the requirements outlined above must be corrected by a supplemental payroll. The payrolls and supplemental payrolls shall be filed in the project records for the three-year period from the date FHWA accepts the final payment voucher.

1-2.6C(1) Employee Interviews

The Project Engineer (or designee) shall conduct employee interviews periodically. The purpose of these spot interviews is to establish with reasonable certainty that the minimum wage rate provisions are being complied with and there is no misclassification of workers or disproportionate employment of laborers, helpers, or apprentices. The occupation description is included in the wage listing in the contract provisions. The occupation description shall be shown on the form for the employee interviewed under current duties. Some employees may refuse to reveal their rate of pay, which is acceptable and should be noted in the remarks column. Many employees do not know or may guess at the rate. If possible, a determination of the accuracy of the stated rate should be made, and any uncertainty noted in the remarks column to reduce the need for follow-up interviews. If either the stated rate (from the employee) or the record rate (from the certified payroll) is below the minimum rate (from the contract wage listing), an investigation shall be conducted. The investigation may be as simple as a follow-up interview with the employee if the stated rate is less but the record rate is equal or greater than the minimum. The investigation may result in a request for a supplemental payroll if the stated rate is equal to or

greater than the minimum but the record rate is less than the minimum. In any event, the matter must be resolved so that the employee interview report describes what corrective action was taken to ensure that the employee has been paid the minimum prevailing wage rate. This corrective action shall be reported under remarks on the form or by attached memo if more space is needed. All discrepancies found must be resolved.

The frequency and extent of these interviews should be sufficient to ensure a representative coverage of all classes of workers employed on the contract. A minimum sampling should include employees of the Contractor and all major subcontractors. A major subcontractor is one that has a significant portion (30 percent or more) of the contract dollars. The interviews should be made with such frequency as may be necessary to ensure compliance.

Employee Interview Report, Form 424-003, shall be used to record and report interviews.

1-2.6C(2) Wage Rates

The Wage Determination decision (wage listing in the contract provisions) for each project must be posted by the Contractor in the manner prescribed by the Federal Highway Administration in a prominent place where it can be seen easily by the workers. Standard posters (forms FHWA 1495 and FHWA 149SA) are to be posted and are available to the Region from the Support Services Supervisor, FHWA, Olympia, Washington. Form FHWA 1495A is the Spanish version which must be posted when the project is in an area where there is a possibility that workers could be of Spanish or Mexican origin.

1-2.6C(3) Complaints

Any complaints of violations of minimum wage rate regulations referred to the Project Engineer by employees of the Contractor, subcontractor, or lower tier subcontractor shall be treated as confidential and shall be investigated promptly by the Project Engineer.

1-2.6C(4) Liquidated Damages for Wage Violations

It is anticipated that the majority of the violations found will be nonwillful in nature and that an amicable settlement and/or restitution of wage shortages to each affected employee can be accomplished without difficulty. However, in addition to unpaid wages for work in excess of 40 hours per work week, the Contractor, subcontractor, or lower tier subcontractor shall be liable to the United States for liquidated damages in the amount of $10 per person per calendar day for each violation whether willful or not. Recommendations for assessment of liquidated damages shall be forwarded to the Chief Construction Engineer for final determination. Liquidated damages can only be forgiven upon appeal within 60 days to the U.S. Secretary of Labor which shall be transmitted through the Olympia Service Center Construction Office to the FHWA.

1-2.6C(5) Department of Labor Investigation

The U.S. Department of Labor will include investigation of compliance with the DDBRA and the Contract Work Hours and Safety Standard Act (CWHSSA) when conducting investigations relative to compliance with the Fair Labor Standards Act and other Acts under its enforcement authority, even though DBRA and CWHSSA do not fall under their direct responsibility for administration and enforcement.

Investigative action taken by the U.S. Department of Labor with respect to DBRA and CWHSSA does not in any way change the degree of authority and responsibility of WSDOT for enforcement of these Acts. Actions by the U.S. Department of Labor as indicated herein should be considered as services we may use to assist us in our enforcement activities but should not be considered to relieve us of our basic responsibility to investigate fully all potential violations and to apply such sanctions as are deemed applicable under our enforcement authority.

1-2.6C(6) Fraud Notice Poster

Fraud Notice, FHWA 1022, Title 18 USC 1020, must be displayed on all Federal-aid projects during the course of the work. It points out the consequences of impropriety on the part of any contractor or WSDOT employee working on the project.

1-2.7 Equal Employment Opportunity and Training

1-2.7A Equal Employment Opportunity — General

It is the policy of WSDOT to provide equal employment opportunity (EEO), prohibit discrimination in employment because of race, creed, color, sex, national origin, age, or disability, and promote the full realization of equal opportunity through the dissemination of WSDOT's policy, recruitment efforts, personnel actions, training, and promotions.

Discrimination in all phases of employment is prohibited by Title VII of the Civil Rights Act of 1964, Presidential Executive Order 11246, as amended by Executive Order 11375, the Washington State Law Against Discrimination, and Chapter 49.60 RCW.

WSDOT is responsible for ensuring adherence by the Contractor and any subcontractors with the EEO and On-the-Job Training (OJT) requirements specified in the contract provisions: *Requirement For Affirmative Action*

to Ensure Equal Employment Opportunity (Federal-funded projects); and *Special Requirements For Affirmative Action* (State-funded projects).

1-2.7A(1) Olympia Service Center EEO/OJT Contract Compliance Responsibilities

The Office of Equal Opportunity is responsible for the overall WSDOT EEO/OJT contract compliance program. Its responsibilities include the following:

1. Conduct all comprehensive contract compliance reviews;

2. Establish OJT Contract Goals;

3. Provide direction and technical assistance relating to EEO and On-the-Job Training (OJT);

4. Coordinate the monitoring and enforcement of the EEO/OJT program effort;

5. In coordination with the Regional EEO Officers, ensure the preparation and submittal of required EEO/OJT reports; and

6. In coordination with the Regional EEO Officer, investigate/resolve discrimination and harassment complaints.

1-2.7A(2) Region Responsibilities

The Regions have the responsibility to:

1. Review with the Contractor their EEO requirements, and if applicable, OJT requirements during preconstruction meetings and discussions.

2. Ensure that the Contractor post and maintain notices and posters setting forth the Firm's EEO policy. A supply of Department of Labor, Office of Contract Compliance Posters (OFCCP), Equal Employment Opportunity is the Law, shall be made available to the Contractor. This poster is available through the Regional Supply Office.

3. Monitor on-site compliance of the EEO and OJT requirements.

4. Ensure the Contractor's compliance with the nonsegregated facilities requirements and that the working environment is free of discrimination and harassment.

5. Prepare the required EEO and OJT reports.

6. Provide assistance to WSDOT's OJT Supportive Service Consultant. The Consultant must be notified of meetings and discussions with the Contractor that involve contract-assigned training goals and be given an opportunity to participate. The Consultant may also be utilized to assist Contractors and/or their employees in resolving OJT problems.

1-2.7A(3) EEO/OJT Required Reports

Failure of a contractor and/or subcontractor to provide required EEO/OJT reports in a timely manner may result in a finding of noncompliance. Withholding of progress payments, upon proper warning, may be invoked to ensure Contractor compliance with the reporting requirement.

Report forms can be obtained through the Region's normal form ordering procedures.

Title and Description
EEO Reports:

Form PR-1391 Contractor's Annual EEO Report

The Contractor's Annual EEO report is to be completed by the Contractor and each subcontractor and signed by a responsible official of the company. The report is to be submitted by August 25 to the Project Engineer's office and to the Region's EEO Officer by September 17. The report should reflect the Contractor's total employment on all Federal-aid highway projects in the State as of July 31. The figures to be reported should represent the project workforce for all or any part of the last payroll period proceeding the end of July.

Form PR-1392 Summary of Employment Data

The Summary of Employment Data Report is prepared from Form PR-1391 by each Region for all its Federally assisted, including Local Programs, projects. *The completed report, including all Form PR-1391's, is due at the Olympia Service Center by September 24.*

Form CC 257 Monthly Utilization Report

This report includes the total work hours for each employee classification in each trade in the covered area for the monthly reporting period. Instructions for completing CC-257 can be found on the back of the form. This report is to be submitted by the Contractor and each subcontractor with one copy retained by the Region. The Contractor should send a copy directly to the OFCCP regional office at: U.S. Department of Labor - OFCCP, 1111 Third Avenue, Suite 745, Seattle, Washington 98101-3212. The report is due on the 5th of each month.

The Region may utilize the "Monthly Employment Utilization Report Worksheet" (DOT Form 272-054) to monitor a Contractor's on-going compliance.

OJT Reports:

Form DOT 272-060 Federal-aid Highway Construction Annual Training Report

This report is to be completed annually by the Project Engineer or a designee summarizing the training accom-

plished by the individual trainees during the reporting period beginning June 1 of the previous year and ending May 31 of the current year. A computer generated report providing the same information requested may be submitted in lieu of this report. Due at the Regional EEO Office by June 10.

Form DOT 272-061 Federal-aid Highway Cumulative Training Report

This report is to be completed annually by the Regional EEO Officer summarizing the data found on DOT Form 272-060. A computer generated report providing the same information as requested may be submitted in lieu of this report. Due at the Olympia Service Center by June 20.

Form DOT 272-049 Training Program

A training program is to be completed by the Contractor and/or subcontractors if they are assigned training. The report must be submitted to the Engineer not later than the cutoff date for the first estimate. The Project Engineer may approve SATC approved apprenticeships programs if all other training program requirements are met. *On interstate contracts only, FHWA concurrence is required for all programs proposing to utilize apprentice/trainees not approved by either the Bureau of Apprenticeship Training (BAT) or the State Apprentice Training Committee (SATC) approved apprentices/trainees.* Final approval of an individual trainee cannot be authorized until a Training Program is filed with the Region.

Form 272-050 Apprentice/Trainee Approval Request

This form is to be submitted by the Contractors and/or subcontractors for each trainee intended to be trained on the project. The Contractor is required to review and submit this form for approval of each subcontractor's trainees.

1-2.7B On-the-Job Training Special Provisions — General

In accordance with Section 1-07.11(7) of the *Standard Specifications*, selected Federal-aid construction contracts are assigned the bid item training. The trainee/hour goals are established based on considerations such as type, duration, location, and size of contract. Each Contractor is expected to comply with both the set number of trainees and hourly goals assigned. Beneficial training must be provided.

1-2.7B(1) Affirmative Action — Training

This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not. However, the training and upgrading of minorities and women toward journey level status is a primary objective of this training provision. Accordingly, the Contractor shall make every effort to enroll minority and women trainees to the extent that such persons are available within a reasonable area of recruitment.

1-2.7B(2) Administration

The Contractor shall prepare and submit a completed Training Program (DOT Form 272-049) to the Engineer for approval *no later than processing of the first Progress payment* and whenever changes occur. If the Contractor fails to furnish a training program or does not cooperate in furnishing necessary documentation in a timely manner, the Region may withhold monthly progress payments as an inducement to provide the information. The Contractor must be warned in advance that such action will be taken. Monthly progress payments shall not be withheld without prior approval of the Olympia Service Center Construction Office.

The Training Program shall contain the trade or trades proposed to accomplish the training item in the contract, the number of trainees and hours assigned to the trade and the *estimated beginning work date* for the trainee. The Training Program will be discussed with the Contractor as to the scheduled arrival of assigned trainees at the construction site, the phase of construction the trainee will work, the craft, and the approximate number of hours of training which will be provided.

One copy of the approved Training Program must be submitted to the Olympia Service Center Office of Equal Opportunity immediately after approval.

Following approval of the Training Program, the Engineer shall make arrangements to have the Contractor's construction superintendent/foreman notify the Engineer when a trainee is employed on the project. The Contractor must provide the following information on Apprentice/Trainee Approval Request (DOT Form 272-050): name of trainee, social security number, ethnic background, classification to be trained, and previous training received. Spot checks must be made in the field to ensure that the trainees are working and receiving proper training consistent with their approved programs. Reimbursement can be denied for training not consistent with the approved program.

If the approved Training Program involves the upgrading of a trainee, regular checks should be made in the field to ensure that the training being received is actually at the higher skill level.

1-2.7B(3) Training Program Approval

DOT Form 272-049, Training Program, must be completed and submitted by the Contractor and/or any subcontractor assigned training under the contract provision. It shall

be the Contractor's responsibility to ensure that their subcontractor's Training Program is accurate and consistent with the program approval criteria. The Contractor shall retain full responsibility for compliance with the OJT contract provisions and training goal assignments.

Training approval can be given by the Project Engineer, or a designee, if the program complies with the following criteria:

1. Total program hours equal the contract quantity for the training item. (The Contractor's and subcontractor's Training Programs *must be approved as a total package*.)

2. The number of trainees intended for use must equal or exceed the number in the contract provisions.

3. The apprenticeship/trainee program is BAT/SATC approved (refer to the Olympia Service Center).

4. The maximum initial assignment for any one trainee is 1,000 hours.

5. The training assignment is not less than 20 hours.

6. The maximum assignment of traffic control tasks does not exceed 200 hours for any one individual. (Note: Trainees that have previously received 200 hours of traffic control training on other WSDOT projects shall not be approved for additional traffic control training.)

7. The training hours assigned must enhance the trainee(s) progression toward journey level status.

8. The training hours allowed must provide continuity.

9. The training hours must be meaningful and beneficial to the apprentice/trainee.

10. In addition to the above criteria, Contractors who are not affiliated with a program recognized by BAT/SATC can be approved provided that persons being trained are paid not less than the minimum wage rate prescribed for a journey worker of that craft and, that they provide, per Section II, DOT Form 272-049, a detailed breakdown of the hours assigned to the various skills of the trade. The Contractor must provide the following standards:

a. **Minimum Qualifications** — The Contractor shall establish minimum qualifications for persons entering the training program. (No employee shall be employed as a trainee in any classification in which that employee has successfully completed a training course leading to journey level status or in which the employee has been employed as a journeyman. Mid and upper level management training positions such as foremen and superintendents shall not be approved.)

b. **Work Skills** — An outline of the work processes in which the trainee will receive supervised work experience and training on-the-job and the allocation of the approximate time to be spent in each major process shall be set forth in these standards.

c. **Terms of Training** — The term of training shall be stated in hours. Non BAT/SATC Training Programs shall not exceed 1,000 hours for any one individual.

d. **Program Monitoring** — The method for recording and reporting the training completed shall be clearly stated.

e. **Ratio of Trainees** — A numeric ratio of trainees to journeymen shall be established. It shall be consistent with proper supervision, training, safety, and continuity of employment. The ratio language shall be specific and clear as to application in terms of job site and workforce during normal operations (considered to fall between 1:10 and 1:4).

11. On *Interstate contracts only*, FHWA concurrence is required for final approval of programs proposed per Item 10 above.

1-2.7B(4) Trainee Approval

DOT Form 272-050, Apprentice/Trainee Approval Request, must be submitted and completed prior to apprentice/trainee approval. The following criteria must be met prior to approval of a trainee:

1. Training hours for any one individual does not exceed 1,000 hours or is not less than 20 hours. (Request for additional training hours for a particular trainee can be approved on a case-by-case basis, but only if training is provided pursuant to a BAT/SATC program.)

Those trainees not participating in a BAT/SATC program will be limited to a l,000-hour total for all projects, regardless of craft designation for which training is claimed. It is important that all previous training accomplished be indicated so as to properly monitor the trainee's progression.

2. Traffic control tasks are allowed at a maximum of 200 hours for any one individual. If a proposed trainee has previously received 200 hours of traffic control training on any one or more contracts, the trainee shall not be eligible for additional traffic control training under the OJT program.

3. Trainees shall be paid in accordance with the provisions of RCW 39.12.021, which reads as follows:

Apprentice workmen employed upon public works projects for whom an apprenticeship agreement has been registered and approved with the State Apprenticeship Council pursuant to Chapter 49.04 RCW, must be paid at least the

prevailing hourly rate for an apprentice of that trade. Any workmen for whom an apprenticeship agreement has not been registered and approved by the State Apprenticeship Council shall be considered to be a fully qualified journeyman, and, therefore, shall be paid at the prevailing hourly rate for journeymen.

4. Good faith effort documentation is required for all nonminority males proposed for training, unless:

a. The apprentice/trainee was significantly employed (200 hours or more) and approved as an apprentice/trainee for the same Contractor during the preceding construction season and is among those initially recalled for work soon after the start of the current construction season; or

b. The Contractor proposing to utilize the nonminority male trainee is otherwise in compliance with the contracts EEO and OJT requirements and further provides satisfactory documentation as to the efforts taken to fill the specific training position with either minorities or females; or

c. If not otherwise in compliance, the Contractor furnishes evidence of systematic and direct recruitment efforts in regard to the position in question and in promoting the enrollment and employment of minorities and females in the craft which the proposed trainee is to be trained.

As a minimum, a Contractor who is not otherwise in compliance can substantiate their systematic and direct recruitment efforts by providing documentation as to the following:

- Written notification to minority and female recruitment sources and community organizations of available employment opportunities with the Contractor and/or enrollment opportunities with its unions;
- Records documenting the Contractor's efforts, and the outcome of those efforts, to employ minority and female applicants and/or refer them to unions;
- Records reflecting the Contractor's efforts/participation in developing minority and female on-the-job training opportunities, including upgrading programs and apprenticeship;
- Written notices to unions and training programs disseminating the Contractor's EEO policy and requesting their cooperation in achieving EEO and OJT obligations.

Note: Systematic and direct recruitment efforts must be through public and private sources likely to yield minority and female applicants. Such documentation must be submitted in a timely manner. Contractor compliance with this section shall be made on a case-by-case basis.

5. Under no circumstances will hours be allowed beyond the trainee achieving journey level status.

1-2.7B(5) Trainee Reimbursement

At estimate time, the Contractor shall submit a certified invoice requesting payment for training that provides the following information for each trainee employed during the period: (l) the related weekly payroll number; (2) name of trainee; (3) total hours trained under the program; (4) previously paid hours under the contract; (5) hours due for current estimate; and, (6) dollar amount due for current updated estimate. When a BAT/SATC apprentice/trainee is first enrolled, a copy of the apprentice/trainee's certificate showing apprenticeship/training registration must accompany the Trainee Approval Request.

Retroactive payment shall be allowed provided: the Training Program is approved; the apprentice/trainee is otherwise approvable; and that the Contractor verbally or in writing in a timely manner notified the Engineer of the apprentice/trainee's commencement of work.

Overrun hours must not exceed 25 percent of the contract quantity or 500 hours, whichever is least. Increases are allowable and will be approved on a case by case basis by change order. Overruns will not be permitted when the bid price is excessive or beneficial training is not provided.

The Contractor's certified invoice requesting payment for training shall be kept with the project records and shall become part of the temporary final records to be retained in the Region three years after completion and acceptance of the project. An entry shall be made in the project ledger for this item with a reference to serve as documentation and summary for this pay item. It shall be the Project Engineer's responsibility to see that the project ledger indicates reference to the location of the source documents for this item so whenever an audit is made, the proper file may be readily located.

1-2.8 Control of Work

1-2.8A Authority of the Project Engineer

The Project Engineer is given considerable authority to enforce the provisions of the contract under Section 1-05.1 of the *Standard Specifications*. This authority is tempered by WSDOT's policies and delegation of authority from the Engineer to the Project Engineer. Accordingly, considerable care and good judgment shall be exercised by the Project Engineer to avoid exceeding that authority so delegated and to avoid decisions and actions contrary to WSDOT policy. In case of doubt as to the limits of

authority, the Project Engineer should consult the Regional Operations/Construction Engineer.

In some cases, the courts have held that where the Project Engineer has exceeded the authority provided in the plans and specifications or the authority delegated by the Engineer, the actions of the Project Engineer are binding upon WSDOT. It is important, therefore, that the Project Engineer shall make no instructions, verbally or by written memoranda, that will be outside the scope of the plans, specifications, contract provisions, or the authority delegated by the Engineer.

In the course of the Project, minor or isolated items of work may be identified, for which the Project Engineer may choose to modify the normal inspection or testing procedures in the interest of economy and efficiency. In such actions, the Project Engineer is acting under the professional responsibility inherent in all action as a representative of the Department and a Licensed Professional Engineer. Full accountability of such incidents is expected and the recommended scope of such actions should fall within limits of individual items not in excess of $500 and accumulated actions under a single bid item not to exceed $5,000.

The nature of the work should be that considered noncritical, such as nonreinforced concrete incidental fabricated items outside the vertical limits of the roadway. Acceptance should involve dimensional conformance to the plans and visual determination that the materials are suitable. In such action, the Project Engineer should be guided by the principle of achieving the intent of the contract, attaining reasonable expectations of service life proportional to cost, and protection of public safety. Actions taken in accepting such materials should be identified in the Project Records with acknowledgment by the signature of the Project Engineer and identified as materials deficiencies in the Project Engineer's preparation of the Certification of Materials under Chapter 9-1.5 of this manual. (Such deficiencies exist not due to lack of conformance of materials to the specifications, but in lack of conformance to the sampling and testing requirements.)

1-2.8B Contractor's Equipment, Personnel, and Operations

The Contractor is required to furnish adequate equipment for the purpose used and it must be maintained in good workable condition. Prior to starting work, the Project Engineer shall ensure by inspection that the Contractor's plant, equipment, and tools comply with specifications. The Contractor should not be allowed to start work unless so equipped.

Whenever the specifications state specific requirements for equipment, such as mass of rollers or vibrating frequency of vibrators, the Inspector should verify that the equipment meets the specification requirements and document this in the Inspectors Daily Report. The Contractor is required to furnish on request any manuals, data, or checking tools necessary to check their equipment.

Automatically controlled equipment which may be specified is intended for one or more of the following purposes:

1. Provide uniformity of construction.

2. Reduce the amount of construction surveying and staking.

3. Minimize the inspection required to monitor quality or quantity of materials.

4. Reduce the extent and cost of subsequent operations.

5. Minimize variations in alignment, grade, and cross-section, thereby reducing inspection and checking for conformance to specified tolerances and eliminating or reducing requirements for corrective action.

It is most important that the operation of automatically controlled equipment be checked carefully and that the Contractor be advised immediately whenever the equipment is not performing properly. Equipment which is not capable of consistent operation within the specified tolerances should be rejected.

It is essential that the Contractor's supervisory personnel be competent, experienced, and able to properly execute the work at hand in order that the specifications and plans will be strictly adhered to. When the Contractor's supervisory personnel are not fully competent, the Project Engineer shall immediately notify the Regional Operations/Construction Engineer of the facts in the matter.

It is expected that, consistent with WSDOT's policies and delegated authority, the Project Engineer will assist the Contractor in every way possible in accomplishing the work under the contract. *However, the Project Engineer must not undertake to direct the method or manner of performing the work*. Should the Contractor select a method of operation that results in substandard quality of work, nonspecification results, a rate of progress insufficient to meet the contract schedule, or that otherwise violates the contract specifications or provisions, the Contractor should be ordered to discontinue that method and to make changes to comply with contract requirements. Where cooperation cannot be achieved, the Project Engineer shall notify the Regional Operations/Construction Engineer and a report should be submitted to the Chief Construction Engineer. The Engineer shall decide any and

all questions which may arise as to methods of construction, quality or acceptability of materials furnished or work performed, the rate of progress of the work, and all questions as to the acceptable fulfillment and performance of the contract on the part of the Contractor.

1-2.8C Defective or Unauthorized Materials or Work

Final acceptance of all work is the function of the Secretary of Transportation; however, the Secretary relies on the actions and opinions of authorized representatives in determining acceptability. It is expected that the Regional Operations/Construction Engineer and the Project Engineer will ensure that sufficient inspection is conducted to determine that the work will comply with contract requirements. When inspections or tests are performed that indicate substandard work or materials, immediate notification shall be given to the Contractor, and unsatisfactory work or material will be rejected. When a borderline situation exists which establishes a question as to materials acceptability, the Contractor shall be notified that the materials may be rejected after more thorough testing. Inspection and testing by WSDOT personnel during work progress is not an absolute guarantee to the Contractor that the work is acceptable. The quality of the final completed work will determine acceptability.

1-2.8C(1) Defective Materials

The intent of any construction contact is that the project is constructed of the specified materials and that they are installed according to the plans and specifications. The Project Engineer can reject materials not conforming to the requirements of the specifications. The rejected materials, whether in place or not, shall be immediately removed from the site of the work unless the following guidelines for acceptance of nonspecification materials are followed:

Material Not In Place

1. Nonconforming aggregate materials that are within defined tolerance limits can be accepted in accordance with Chapter 9-5.6 of this manual. Failure to comply with these requirements may result in assessment of a price adjustment.

2. There may be situations where WSDOT can obtain significant benefit from the use of nonconforming materials. This requires prior concurrence of the Chief Construction Engineer and modification of the project specifications. The modification of the contract shall be accomplished by change order and shall include documentation supporting WSDOT’s advantage in making the change and a justification of the adjusted price. When addressed in this manner, prior to use, the price adjustment shall be a matter of negotiation, taking into consideration the benefits to both WSDOT and the Contractor.

Except for 1 and 2 above, materials that are known in advance as failing to comply with the Specifications shall not be incorporated in the work.

Material In Place

1. Price adjustments have been developed and are referenced in the contract for certain materials whose properties cannot be determined until they are in place. Items this policy applies to include: concrete compressive strength, consistency, and air contents; Portland cement concrete pavement thickness; and asphalt concrete asphalt content, gradation, density, and pavement smoothness.

2. Materials incorporated into the work which are subsequently found to be in nonconformance with the specifications and for which price adjustments are not included in the contract shall be reviewed as to their acceptability. The determination of acceptability shall be made only when the Project Engineer feels that there is possible service obtainable from the material in question. The Project Engineer may direct that the material be removed and replaced. For determination of possible reduced service and a consequent credit to be assessed by change order, a joint determination shall be made between the Project Engineer and the Regional Operations/ Construction, for review and concurrence by the Chief Construction Engineer and the Materials Engineer. Following such determination, discussions shall be initiated with the Contractor, and a final change order, approved by the Chief Construction Engineer, shall be required to accept the nonspecification material.

To determine the possible utilization of in-place nonspecification material, the Project Engineer shall assemble a package that includes the test reports for the material involved, the quantity involved, the location on the project where the material was placed, and Inspector's Daily Reports or other documentation of the inspector's actions and responses from the Contractor. The Project Engineer should also provide any additional observations as to the performance of the material and any initial recommendation as to the disposition thereof. The submission of and adjustment of service life reflected in contract payments, shall not apply to those materials for which the Project Engineer has determined as noncritical items and instituted modified acceptance procedures.

The Regional Operations/Construction Engineer shall review the submittal from the Project Engineer and provide any additional information or recommendations and forward to the respective section (Roadway or Bridges) in the Construction Office.

The Construction Office shall review the submittal from the Region. If a corrective action to a similar situation has been previously agreed upon, the Construction Office will provide the recommended correction to the Region for preparation of a credit change order and will forward a copy of the recommendation to the Materials Engineer. If it is a new issue, the submittal from the Region will be forwarded to the Materials Engineer for assessment and determination of a recommended correction.

The Materials Engineer shall review the information and recommend a corrective action, including application of price reduction calculations, to the Chief Construction Engineer for final review and concurrence. The Chief Construction Engineer will then forward to the Region for processing a credit change order.

When it is determined that the specification violation will not compromise the performance of the material, the violation will be considered a technical infraction of the specifications and a price adjustment, generally a minimum of 15 percent of the cost of the material involved, shall be made by change order. When it is determined that the performance of the material is affected by nonconformance with the specification, the probable reduction in service level or service life shall be assessed. Based on this assessment, a price adjustment varying from a small percentage (usually 15 percent) of the material cost up to the total unit contract price of the item involved will be imposed. When a serious specification violation leads to the determination that complete removal and replacement of the nonspecification material is warranted, it shall be done at no cost to WSDOT.

Acceptance of nonspecification material will require approval of the Chief Construction Engineer prior to discussing with the Contractor. A change order approved by the Construction Office is required any time nonspecification material is accepted.

1-2.8C(2) Defective or Unauthorized Work

Work performed contrary to, or regardless of, the instructions of the Project Engineer; work done without lines, grades, and slope stakes being given; work done beyond the line, slope stakes, and grades shown on the plans or as given by the Project Engineer; or any deviation made from the plans and specifications without written authority will be considered unauthorized and at the expense of the Contractor and will not be measured and paid for by WSDOT. All unauthorized work may be ordered removed. See Section 1-05.7 of the *Standard Specifications*.

If the Contractor fails or refuses to carry out the orders of the Engineer or to perform work in accordance with the contract requirements the Project Engineer shall immediately notify the Regional Operations/Construction Engineer of the facts in the matter.

1-2.8C(3) Material Acceptance by Manufacturer's Certification

Section 1-06.3 of the *Standard Specifications* describes the procedures for acceptance of materials based upon the Manufacturer's Certificate of Compliance. Division 9 of the *Standard Specifications* describes those materials that may be accepted on the basis of certifications.

It is desirable for the certification to be furnished prior to use of the material. However, in some cases, the Contractor may request, in writing, authority from the Project Engineer to install the material prior to submitting the required certification. The Project Engineer's approval shall be conditioned upon withholding payment for the items of work until an acceptable Manufacturer's Certificate of Compliance is received. Examples of materials that *shall not* be approved for installation prior to the Contractor's submittal of an acceptable certification are rebar, bridge drains, i.e., materials that are encased in concrete. The Project Engineer's approval or denial shall be in writing to the Contractor, stating the circumstances that determined the decision.

At the conclusion of the contract, some items may be lacking Acceptance certification. These items shall be addressed as to their acceptability prior to payment of the Final Estimate and subsequent Materials Certification of the contract. The review of these items shall include:

a. Comparison with the suitability of other shipments to the project or other current projects.

b. Sampling and testing of the items involved or residual material from the particular lot or shipment. If found acceptable, sampling and testing costs shall be deducted from the contract payment.

c. Independent inspection on site of the completed installation.

The analysis and processing of the results of this procedure shall be made in accordance with the provisions of Chapter 1-2.8C(I), Material In Place.

1-2.8D Contractor Submittals

In order to avoid delays in processing the final estimate, the Project Office shall endeavor throughout the project to request from the Contractor, as they come due, such things as materials certifications, certified payrolls, Affidavits of Prevailing Wages Paid from subcontractors as they

complete their work, extension of time requests, or any other thing or document that might delay processing the final estimate.

1-2.8E Statement of Materials and Labor, Form FHWA-47

This report shall be prepared in accordance with the requirements and instructions contained on the form and in the "Required Contract Provisions Federal-aid Construction Contracts" on Federally financed projects over $1,000,000 in contract cost. Secondary (S, BRS, TQS, SG, ES, ESG, RSG, OS, SOS, SOSG, RRO, RRP, LSF, LSZ or RS) projects are excluded.

When this report is a requirement of the contract, the Project Engineer will obtain it from the Contractor, complete Section A, and submit it directly to the Olympia FHWA office.

It is mandatory that the materials be reported in the units shown, i.e., tonnes, meters, etc. Materials not listed on the report form need not be reported.

In the event that the monetary total of labor plus the material and supplies exceeds the amount of the final estimate, the transmittal letter must state that this fact has been verified by the Contractor, and is not the result of errors in calculation.

1-2.8F Contractor's Performance Reports

The procedures for completing and submitting the Prime Contractor Performance Report, Form 421-010, are described in WAC 468-16-150 and WAC 468-16-160 and the *Prime Contractors Performance Report Manual*, M 41-40.

At the preconstruction meeting and discussions, the Contractor shall designate, in writing, the individual who will be representing the Contractor in meetings with the Regional Operations/Construction Engineer regarding interim and final Contractor performance reports.

Should the Contractor's performance on a current contract become typically below standard, the Project Engineer shall immediately notify the Regional Operations/Construction Engineer of the facts of the matter. The Regional Operations/Construction Engineer shall consult directly with the Chief Construction Engineer for guidance.

When completing Section III of the form, the rater will use the following statements when evaluating the Contractor's performance with regards to each numbered rating element:

Administration/Management/Supervision

1. Supervision and Decision Making — The ability of supervisors to make maximum utilization of personnel, equipment, and materials. The ability to make effective decisions for the execution of the project and exercise effective coordination between the various working elements on the project. Providing sufficient on-site supervisory presence. The Contractor's effectiveness in reducing project costs.

2. Coordination and Communication With Subcontractors and Suppliers — The Contractor's ability to properly schedule the delivery of supplies and coordinate the various activities and those of the subcontractors and suppliers to produce the smooth flow of work and the elimination of delay in completing the contract. The ability of the Prime Contractor to minimize conflict between working elements of the project is also considered.

3. Submission of Documents and Reports — The Contractor's prompt and accurate submission of change orders, certified payrolls, wage affidavits, final project documents, and other requested paperwork.

4. Adequacy and Timeliness of Progress Schedule — The suitability of progress schedule submitted by the Contractor at the beginning and throughout the duration of the project and the suitability of any needed supplemental progress schedules during the performance of the work. The timeliness in which these schedules were submitted.

5. Public Safety and Traffic Control — Adequacy of the Contractor's traffic control plan and adherence to the plan. Attention should be given to the manner of performance of traffic control personnel. The utilization and placement of personnel, equipment, and devices to enhance public safety is considered.

6. Compliance With Laws, Ordinances, and Regulations — Under this element, a rating is given to reflect the Contractor's adherence to laws, ordinances, regulations, rules, and any court orders affecting the project. Among applicable examples, but not limited thereto, are load limits, road weight restrictions, covered truck bed requirements, environmental regulations, and prevailing wage rules.

7. Maintenance of Employee Safety Standards — Compliance with the Occupational Safety and Health Act and the Washington Safety and Health Act must be considered in this rating area. Additionally, the safety enhancement activities of the Contractor should also be reflected upon under this element. The personal attention given by supervisory personnel to safety should be rated.

8. Coordination and Cooperation With Department Personnel on Project Matters — This element relates to the

manner in which the Contractor reacts to comments, suggestions, and instructions; particularly those relating to the Contractor's furthering timely completion and enhancing the quality of the project. Also, consider the Contractor's coordinating effort for the smooth flow of activities and information between WSDOT and the Contractor.

9. Compliance With EEO, Affirmative Action Requirements, and MBE/DBE/WBE Requirements — Rate the complete and timely manner in which the Contractor complied with the laws, rules and regulation (State and/or Federal), and the contract requirements for EEO, Affirmative Action, and MBE/DBE/WBE.

10. Public Relations With the General Public, Other Agencies, and Adjacent Contractors — Rate the Contractor's actions which promoted smooth working relationship with adjacent contractors, goodwill with public and private agencies, and the general public, by providing efficient services, adherence to rules, and courteous interactions.

Quality of Work

1. Adherence to Plans and Specifications — Rate the degree to which the Contractor complied with the plans and specifications throughout the life of the project.

2. Standards of Workmanship — Rate the impact made by supervisory personnel on the quality of the project by their instructions and standards set by management. The quality of work exhibited by workers is also considered.

3. Completion of Final (punch-list) Work — Rate the Contractor's diligence and promptness in completing the cleanup and other work after major phases of the project have been completed.

Progress of the Work

1. Completion of Project Within Allotted Time — The Contractor's effort to complete the project as scheduled, considering authorized time extensions and stop work orders. Any special effort or lack thereof in the Contractor's making up lost time.

2. Scheduling and Execution of Schedule — The manner in which the Contractor scheduled the work and how effectively the Contractor has adhered to the schedule throughout the life of the project.

3. Delivery of Materials and Supplies — The timely delivery of materials and supplies and coordination of equipment needed for their installation and utilization to preclude delay in project progress.

4. Operation and Use of Equipment — The use of the proper equipment for the assigned task, e.g., the proper haul equipment for the size of project and haul distance. Consider safe operation and potential or actual damage to the project by the manner of the operation.

5. Use of Personnel — The use of the proper personnel to accomplish the required task, e.g., personnel with requisite skills and in sufficient numbers to preclude delays in project completion.

Equipment

1. Condition — The state of, and suitability of, the equipment to efficiently perform the work required by the contract. Consider whether the equipment has appropriate attachments.

2. Maintenance — The Contractor's maintenance efforts. Evaluate the degree to which the equipment had breakdowns while in operation on the project. Evaluate the detrimental effects of inadequate maintenance on the finished product, e.g., oil leaks on ACP, etc.

1-3 Estimates and Records

1-3.1 Estimates

1-3.1A General

Payment for work performed by the Contractor and for materials on hand shall be made in accordance with Section 1-09 of the *Standard Specifications*. To facilitate payments to the Contractor and ensure proper documentation, WSDOT utilizes an automated computer system to record project progress in terms of bid item quantity accomplishment and to actually pay the Contractor for work performed or materials on hand. The latest version of the Contract Administration and Payment System (CAPS), installed in 1987, completes an electronic tie between each project office data terminal and the mainframe computer. This provides high visibility to a large volume of corporate data and allows for the following procedures:

1. Contract Initiation — An Olympia Service Center action whereby new contracts are created and stored in a computer file. The information consists of the names of the Contractor and the Project Engineer, project descriptive data, accounting identifier numbers, preliminary estimate, proposal date, bid opening date, award date, execution date, accounting groups and distributions, and an electronic ledger.

2. Project Ledger — An updating process by the Project Office which keeps track of work performed on the contract as it happens.

3. Estimate Payments — A Project Office action whereby progress estimates and Regional final estimates are processed directly from the Project Office. The Olympia Service Center final estimate process activates

the Region final when all the required paperwork is in place. Supplemental final estimates are processed by the Olympia Service Center only.

Complete instructions for use of the CAPS computer system are included in the manual for *Contract Administration and Payment System* (M 13-01).

1-3.1B Progress Estimates

Progress estimates should normally be processed on the 5th of the month for odd-numbered contracts and on the 20th of the month for even-numbered contracts. Estimates may be run on other dates if:

1. It is necessary to correct errors or add omissions;

2. It is prudent to delay the estimate for a few days to pay for expensive work that falls just past the normal 5th or 20th estimate dates, such as a major concrete pour; or

3. There is some other reason that waiting until the next estimate date would be unreasonable to the Contractor. This should only be done after careful evaluation of the situation and not done as regular practice.

Estimates may also be run on other dates if the estimate or part of the estimate was withheld to encourage compliance with some provision of the contract and the Contractor resolves the issue that caused the withholding. These estimates should be paid immediately upon resolution by the Contractor.

In the CAPS system, the basis for making any estimate payment is dependent on information from the project ledger. Every entry in the ledger is marked by the computer as either paid, deferred, or eligible for payment. Before an estimate can be paid, a Ledger Pre-Estimate Report (RAKD300C-PE) must be produced. In constructing this report, the computer gathers all the ledger entries identified as eligible for payment, prints them on the report summarized by item, and shows what the amount would be if an estimate was paid at that particular moment. The report also shows any deferred entries or exceptions if they exist and includes a signature block for the Project Engineer's approval. If there are errors or omissions in this report, the ledger must be changed to reflect the correct data. After any corrections are made, the Ledger Pre-Estimate Report must be run again in order to get the corrections into the estimate process. Once the Ledger Pre-Estimate Report is correct, an actual estimate can be paid. Since there is a possibility that several versions of the Pre-Estimate Report may be run prior to paying an estimate, it is important that the correct version used for each estimate, with the Project Engineer's signature, be retained in the project files.

The estimate process is accomplished with a few key strokes in option 2, estimate payments, in the CAPS main menu. At this point, the computer will automatically calculate mobilization, retainage, and the sales tax. The warrant will be produced, signed, and sent to the Contractor along with the Contract Estimate Payment Advice Report and two different sales tax summary reports. Copies of these reports will also be sent to the Project Office. When the Project Office receives their copy of the Contract Estimate Payment Advice Report, the total amount paid for contract items should be checked against the Pre-Estimate Report. This helps to verify that the amount paid was what the Project Engineer intended to pay. In addition, the ledger records that produced the estimate will now be marked by the computer as being paid.

Up to the point of actually producing the warrant, the entire process for making a progress estimate payment is initiated and controlled by the Project Office.

Particular attention should be given to the comparison of the plan quantities and the estimate quantities for the various groups on the project as shown on the Ledger Pre-Estimate Report. Overpayments on intermediate progress estimates are sometimes difficult to resolve with the Contractor at the conclusion of the project.

New groups which do not change the termini of the original contract or changes in groups shall be accomplished by memorandum from the Region to the Olympia Service Center Accounting Office and not by change order. The memorandum shall contain all the information that has previously been included in the change order. It is not necessary to send a copy of the memorandum to the Olympia Service Center Construction Office.

An additional estimate may be prepared if considerable work has been done between the date of the last progress estimate and the date of physical completion when the Engineer anticipates delays in preparing the final estimate. *Should this circumstance occur, the additional estimate should show the work done to date no later than the day before the date of physical completion.*

1-3.1B(1) Payment for Material on Hand

Payment for material on hand will only be considered for material that will be incorporated into the permanent work. Payment for any material on hand shall never exceed the bid item less a reasonable cost for installation of the material.

In the CAPS system, all payment for material on hand as described below is accomplished by making ledger entries in the 900 series item numbers.

Partial payments may be made on monthly progress estimates, at the Contractor's request, to the extent of the cost of materials to be used in the work, if the materials meet the requirements of the plans and specifications and are delivered to or stockpiled in the vicinity of the project or other storage sites approved specifically by the Engineer in accordance with Section 1-09.8 of the *Standard Specifications*. Payment shall be limited to in-State sources or immediate vicinity out-of-State sources which have adequate storage facilities and can be inspected conveniently by WSDOT personnel. However, on some occasions, the Construction Office has granted approval to pay for material on hand for distant out-of-State sources when the absence of such payment caused an extreme hardship to the Contractor and WSDOT was provided protection for such payments by the Contractor and the Contractor's Surety. If the Contractor requests such payment, the Project Engineer shall consult the Regional Operations/Construction Engineer and the Construction Office for guidance. These approvals will be handled on a case-by-case basis and must have the written approval of the Construction Office.

All materials, for which requests for payment are made, must be stored under the Contractor's control, and the Contractor must agree that the material will not be diverted to other work. Materials must be segregated, bundled and tagged, or otherwise identified as pertaining to the project and readily available for inspection and periodic identification by WSDOT.

When payment is approved for materials stored at sites not on or in the immediate vicinity of the project and the Contractor's purchase price includes delivery, the maximum allowance will be the invoice cost less the estimated cost of delivery to the project site.

Where the above-noted items are fabricated and stored in areas outside the Region, then the Region shall make arrangements for inspection with other Regions or the Olympia Service Center Materials Laboratory as necessary for inspection prior to paying for these items.

The cost for material produced by the Contractor, such as sand, gravel, surfacing material, or aggregate, does not require an invoice. The Contractor must furnish written evidence in sufficient detail to determine the actual cost to produce the material.

The cost of other materials shall be determined by invoices from a material supplier. The Contractor shall furnish the Project Engineer a paid invoice within 60 days of the initial payment. If the paid invoice is not furnished in the prescribed time, any payment that had been made will be deducted from the next progress estimate until a paid invoice is furnished.

Payment for materials stockpiled at a materials fabricator or for completed portions of fabricated items, is acceptable. The process will be as follows:

1. The Contractor must request, in writing, payment for materials on hand, for materials stockpiled, or for work in progress at a materials fabricator. As part of this request, the Contractor shall provide a schedule showing a cost breakdown for labor and material for the items involved.

2. The Project Engineer will check the schedule for reasonableness and advise the Contractor by letter that payment for materials on hand will be made on monthly estimates as the Materials Inspector verifies the progress billing. A copy of the letter will be sent to the Materials and Fabrication Supervisor at the Olympia Service Center Materials Laboratory.

3. The fabricator shall update the schedule each month, showing materials on hand and the percentage of labor expended toward fabrication of the items involved.

4. The Materials Inspector will verify the estimated amount of materials and work to date is correct by signing the schedule. At this point the schedule becomes the progress bill.

5. The fabricator forwards the progress bill to the Contractor who in turn submits it to the Project Engineer, on a monthly basis, for payment for materials on hand.

6. The Project Engineer then makes payment on the progress estimate.

7. The Contractor must provide paid invoices or other written documentation, within 60 days of the payment for materials on hand, verifying that the fabricator has been paid. If this documentation is not received, the payment will be deducted from the next progress estimate.

When contracts are estimated to cost more than $2 million and will require more than 120 working days to complete, a General Special Provision (GSP) will be included in the contract provisions that provides a different than normal procedure for handling payment and deduction for Material on Hand (MOH). When that GSP is included, the following procedure is used to determine how much of the MOH payment should be deducted from an estimate. Each month, no later than the estimate due date, the Contractor shall submit a letter to the Project Engineer that clearly states:

1. The amount originally paid on the invoice (or other record of production cost) for the items on hand,

2. The dollar amount of the material incorporated into each of the various work items for the month, and

3. The amount that should be retained in material on hand items.

If work is performed on the items and the Contractor does not submit a letter, all of the previous material on hand payment will be deducted on the estimate.

1-3 .1B(2) Payment for Falsework

On those projects which include a lump sum item for bridge superstructure, payment may be made on request by the Contractor for falsework as a prorated percentage of the lump sum item as the work is accomplished, provided the Contractor furnishes a breakdown of the costs to substantiate the falsework costs to the satisfaction of the Project Engineer. For any given payment request, the Contractor shall furnish invoices for materials used and substantiation for equipment and labor costs as requested by the Project Engineer. Allowances shall not include more than the applicable rental rate actually paid for materials or equipment for the pay period involved or more than 50 percent of materials purchased and put into use as falsework. No allowances shall be made for form work.

1-3.1B(3) Payment for Shoring or Extra Excavation

When Shoring or Extra Excavation Class A is included as a bid item, payment shall be made as the work under the bid item is accomplished the same as for any other lump sum bid item.

When Shoring or Extra Excavation Class B is included as a bid item, measurement and payment shall be made in accordance with Sections 2-09.4 and 2-09.5 of the *Standard Specifications*.

RCW 39.04 provides that the costs of trench safety systems shall not be considered as incidental to any other contract item, and any attempt to include the trench safety systems as an incidental cost is prohibited. Accordingly, when no bid item is provided for either Shoring or Extra Excavation Class A or Shoring or Extra Excavation Class B and the Engineer deems that work to be necessary, payment will be made in accordance with Section 1-04.4 of the *Standard Specifications*.

1-3.1B(4) Payment for Surplus Processed Material

When excess aggregate is produced by the Contractor from a WSDOT furnished source, the Contractor will be reimbursed actual production costs if the excess meets the requirements of Section 1-09.10 of the *Standard Specifications*. If more than one type of aggregate is involved, the provisions of Section 1-09.10 apply to each type.

If WSDOT has a need for the aggregate for maintenance or future contracts, the procedures for purchasing the aggregate are as follows:

a. When Maintenance has a future need for the aggregate, the costs should be charged to the Maintenance Inventory Account and the aggregate placed in inventory.

b. When Maintenance has an immediate use for the aggregate, the costs should be charged directly to the maintenance work order.

c. When the aggregate is to be used on future construction projects, a determination must be made as to whether to charge costs to the Maintenance Inventory Account or to the Construction-on-the-System Program. Payment is made by voucher and not as an item on the contract. A change order shall not be prepared. However, the documentation shall be adequate to verify the amount paid for the aggregate and to verify that the aggregate will be paid for by voucher.

If WSDOT does not have a need for the aggregate, RCW 47.12.066 provides for the sale of personal property at fair market value to any United States agency or to any municipal corporation, political subdivision, or another agency of the State. The price paid to the Contractor for the eligible material shall be the production cost. The price the agency will be required to pay is the production cost, plus the department's unamortized or royalty cost, plus a reasonable amount to cover WSDOT's administrative cost (say 5 to 10 percent). An effort should be made to dispose of the aggregate in this manner prior to declaring it surplus.

If the aggregate cannot be disposed of in accordance with the above, it will be declared surplus and disposed of in accordance with the *Disposal of Personal Property Manual*. Contact the Administrative Services Office, Purchasing and Inventory Section for instructions.

1-3.1B(5) Liquidated Damages

Liquidated damages shall be addressed as described in Chapter 1-2.5G of this manual.

Direct engineering charges as described in Chapter 1-2.5G of this manual and Section 1-08.9 of the *Standard Specifications*, are a form of liquidated damages and shall be listed on the line for liquidated damages on the estimate and *not* listed as "misc. deductions."

Liquidated damages must not be withheld from progress estimates which are processed prior to expiration of the specified contract time or a previously approved extension of contract time.

1-3.1B(6) Credits

Dollar amounts may be deducted as a "below the line miscellaneous deduction" from progress or final estimates when WSDOT is due a credit from the Contractor. *Routine* credits from the Contractor to WSDOT include, but are not limited to, the following items:

1. Engineering labor costs when due to Contractor error or negligence, additional engineering time is required to correct a problem. This includes the costs of any necessary replacement of stakes and marks which are carelessly or willfully destroyed or damaged by the Contractor's operation. Do not deduct amounts less than $100.

2. Lost and/or damaged construction signs furnished to the Contractor by WSDOT. The Contractor should be given the opportunity to return the signs or replace them in kind prior to making the deductions. Do not deduct amounts less than $100.

3. Assessment to WSDOT from a third party that is the result of the Contractor's operations causing damage to a third party, for example, damage to a city fire plug. Actual costs will be deducted from the estimate.

4. Other work by WSDOT forces when the Contractor cannot or will not repair damages that are the responsibility of the Contractor under the contract. Do not deduct amounts less than $100.

5. Liquidated damages not associated with contract time, i.e., ramp closures, lane closures (see Chapter 1-2.5G). Do not deduct amounts less than $100.

The authority to withhold and assess *routine* "below the line miscellaneous deduction" on progress and final estimates has been subdelegated to the Regional Operations/Construction Engineer, and may be further subdelegated to the Project Engineer. The Project Engineer shall give written documentation to the Contractor of the deduction and the impending assessment. A copy of the letter notifying the Contractor of the final assessment must be included in the final estimate package.

The term "withhold" refers to a deduction taken on a progress estimate or final estimate. The term "assess" refers to the official notification to the Contractor that a withheld deduction, or one to be withheld, will be permanently retained.

A change order is required for credit items which are specifically provided for by policy in this manual, such as nonspecification density, nonspecification materials, etc. The dollar amounts for those credit items are entered as "added items" with descriptive titles identifiable to the change order. Change orders are not required for credit items which are specifically provided for by the *Standard Specifications* or contract provisions, such as, those discussed above.

Occasionally a Contractor will send a check directly to a Project Office for payment of money due WSDOT. Whenever a Project Office, or WSDOT employee, receives a check or cash directly from a Contractor, it is imperative that the guidance found in Directive 13-80, Control of Cash Receipts, be followed.

Timeliness for processing cash receipts is important. Rule E in the directive requires deposit within 24 hours of receipt. Also, Procedure F requires the proper identification and entry into the TRAINS system.

1-3.1B(7) Railroad Flagging

All dollar amounts actually incurred by the Railroad Company for railroad flagging, under the terms of the railroad agreement, are billed to WSDOT. The Project Engineer deducts these costs on monthly progress estimates as a below the line item in the Contract Administration and Payment System. The Contractor is responsible for all railroad flagging costs up to the maximum amount specified in the contract provisions. WSDOT will pay for any amount over that maximum.

When the contract is physically complete, WSDOT will estimate any unbilled railroad flagging costs up to the maximum and will retain this amount for a period of 150 calendar days. After the 150-day period, WSDOT will refund to the Contractor the balance of the retained funds or if there are insufficient funds, the Contractor will be billed for the additional costs, up to the specified maximum, incurred by the Railroad Company.

1-3.1B(8) Payment for Third Party Damages

Where WSDOT is financially responsible for repair of third party damage to permanent work, a determination should be made as to whether contract or maintenance funds will be used to pay for repair. If repair is performed under the contract, reimbursement will be under the standard bid item "Reimbursement for Third Party Damage." If this item was not included in the contract, it may be added by change order using a separate group for each Control Section in which the incident occurs. See Directive 16-01, Appendix 10, for details.

1-3.1B(9) Withholding of Progress Payments

Authority for withholding of progress payments is subdelegated to the Regions. Further subdelegation to the Project Engineers will be at the discretion of each Region.

There are several instances where withholding of part or all of a progress payment may be warranted to achieve compliance with a contract requirement. However, withholding contractor/subcontractor payments is a serious matter and should not become routine. The Project Engineer shall make every effort to resolve all issues without withholding payments. If it becomes necessary to withhold payments, it is imperative that the Contractor receive proper advance warning. If it is anticipated that progress payments may be

withheld, continue to process the payment through the Pre-estimate Report so payment can be released as soon as requirements are satisfied. The following procedures should be followed for withholding progress payments:

1. Failure to provide Statements of Intent to Pay Prevailing Wages, Payrolls, EEO/OJT Reports, D/M/WBE Corrective Action Plans, etc. — If a contractor, subcontractor, or lower-tier subcontractor is delinquent in providing the required document(s), the Project Engineer shall immediately write the Contractor requesting the document(s), and warning that no payment will be made for the items of work involved until the document(s) have been received. If the document(s) have not been received by the day of the estimate cutoff, the Contractor shall be given a courtesy call reminding him of the deficiency. If the document(s) have not been received at the time the estimate would normally be issued, the Project Engineer will notify the Contractor in writing of the amount of the progress estimate and that a payment will not be issued. A copy of this letter shall be sent to all subcontractors and the Olympia Service Center Construction Office. If item payments are to be withheld, the Ledger Pre-estimate Report listing the deferred ledger entries and the reason for the withholding shall be sent to the Contractor.

2. Manufacturers Certificate of Compliance — The Contractor may request, in writing, authority from the Project Engineer to install material prior to submitting a required manufacturer's certificate of compliance. A written response from the Project Engineer approving the installation is required. The Project Engineer's letter must include the statement "No payment will be made for the work until an acceptable manufacturer's certificate of compliance is furnished." The Ledger Pre-estimate Report listing the deferred ledger entries shall be sent to the Contractor.

In any of the above instances where the entire estimate has been withheld, and it involves a significant dollar amount, it should be released immediately upon receipt of the required document(s). When the dollar amount is small or a portion of the estimate has been withheld and the required document(s) are received, it will be up to the Project Engineer to determine whether or not issuance of an additional monthly estimate is in order.

If the Prime Contractor is delinquent in submitting the Statement of Intent to Pay Prevailing Wages, the entire estimate is to be withheld. If a subcontractor or lower-tier subcontractor is delinquent in submitting the Statement of Intent to Pay Prevailing Wages, only their item payments will be withheld. In all other instances, it is imperative that we do not penalize the innocent. For example, when the Contractor and only one subcontractor have performed work during an estimate period and the Contractor has failed to submit all the required documents for the subcontractor, it may be appropriate to withhold the entire estimate since both are responsible. However, if other subcontractors are involved and the Contractor has submitted all the required documents for those subcontractors, it is inappropriate to withhold their portion of the estimate. When making a progress payment in this type of situation, the Contractor should be advised of what payments are being withheld, why, which subcontractors are being paid, and the total dollar amount for each subcontractor's items where it is possible to break out the sub's work. Copies of this letter should be sent to all subcontractors.

RCW 39.76 requires that the Contractor be paid within 30 days of the progress payment cutoff date or the Contractor is entitled to interest on the delinquent payment. Where payments are withheld, WSDOT is required to notify the Prime Contractor within 8 days of the estimate cutoff date of any withholding and what remedial action is required to make payment within the next 30 days. However, under our normal policy, this payment would normally occur sooner.

Where we have been delinquent in making a payment to the Contractor and the Contractor requests that interest be paid, the Region should contact the Olympia Service Center Construction Office prior to agreeing to pay interest.

1-3.1C Final Estimates — Regions

The Final Estimate is processed the same as a progress estimate. The physical completion date (or the completion date for contracts prior to 4183) is entered as the work done to date. The Final Estimate processed in the Region will not produce a warrant for payment. The process will produce a final Comparison of Quantities Report, the Contract Estimate Payment Advice Report, the Contract Estimate Payment Totals Report, and the Sales Tax Summary Report.

At this point, the Comparison of Quantities and other reports should be carefully checked to verify the accuracy of items, quantities, and costs accumulated through the progress estimates during the life of the contract. If necessary, corrections can be made to the ledger and the Final Estimate can be rerun as many times as it takes to make it correct before submitting the final estimate.

Once the Final Estimate is verified, a copy of the Comparison of Quantities Report, the Contract Estimate Payment Advice Report, and the Contract Estimate Payment Totals Report is forwarded to the Contractor along with the Final Contract Voucher Certification. Instruct the Contractor to

ensure that the person signing the Final Contact Voucher Certification is authorized to sign per the authorized signatures on file with the Prequalification Engineer.

The final estimate should be submitted to the Contractor for signature as soon as possible. The final estimate package for the Contractor's signature will be transmitted to the Contractor by letter from the Project Engineer's office.

The final estimate package is prepared in the Region and transmitted to the Olympia Service Center Construction Office. The final estimate cannot be processed to the Olympia Service Center Accounting Office until liquidated damages, if any, have been assessed by the Chief Construction Engineer.

1-3.1D Final Estimates — Olympia Service Center

The final estimate package transmitted to the Construction Office shall consist of the following:

1. Project Status Report — one copy, addressing contract time, railroad flagging (amount used), and liquidated damages and miscellaneous deductions. Indicate whether all Affidavits of Wages Paid have been received as addressed in number 8.

2. Final Contract Voucher Certification — Form 134-146, original only.

3. A copy of the letter from the Chief Construction Engineer to the Contractor assessing contract time liquidated damages or direct engineering costs.

4. A copy of the letter from the Project Engineer to the Contractor for assessment of all miscellaneous deductions and liquidated damages not related to contract time, such as lost or damaged signs or lane closure liquidated damages.

5. A claim reservation on the Final Contract Voucher Certification shall be accompanied by the requirements of Section 1-09.11(2) of the *Standard Specifications*. The Project Engineer shall determine if the requirements have been met prior to submitting the final estimate package to the Construction Office.

6. Public Liability and Property Damage Insurance Certification — Form 421-025, on all Federal-aid projects, original copy.

7. Contract Estimate Payment Totals — RAKC300F-EA, one copy.

8. Affidavit of Prevailing Wages Paid — For those contracts that utilize DOT Form 421-021, submit the original only for the Contractor, each subcontractor, and each lower tier subcontractor. For those contracts utilizing Labor and Industries' form, the affidavits are **not** to be sent to the Construction Office. The original or a copy is to be incorporated into Final Record Book Number 1. Indicate in the project status report that all Affidavits of Wages Paid have been received. If an affidavit is not received for a contractor, sub, or lower tier subcontractor, notification of this must be submitted with the final estimate package. The Contractor's retainage cannot be released until all affidavits have been received.

The final estimate package is reviewed by the Construction Office, and if in order, submitted to the Chief Construction Engineer for acceptance. The date the Chief Construction Engineer signs the Final Contract Voucher Certification constitutes the final acceptance date. The final estimate package is then transmitted to the Olympia Service Center Accounting Office.

If the Contractor refuses or is unable to submit a signed Final Contract Voucher Certification (FCVC), the contract can be unilaterally accepted. When it appears that a signed FCVC will not be received, the Project Engineer should write the Contractor informing them that they have 30 days to submit the signed FCVC or the contract will be submitted for unilateral acceptance. If at the end of the 30 days the FCVC has not been received, submit a Region signed FCVC with the final estimate package. The Chief Construction Engineer will send a certified letter to the Contractor allowing them 30 calendar days to submit the signed FCVC. The contract will be unilaterally accepted at the end of the 30-day period if the voucher is not received. The acceptance date shall also constitute the completion date for the contract.

1-3.1E Supplemental Final Estimates and Claim Settlements

1-3.1E(1) Supplemental Final Estimates

Supplemental final estimates are adjustments to the final estimate which may occur after the Contractor has been paid the amount approved in the final estimate. This may happen if it is discovered that part of an item of work was either inadvertently not paid or may have been paid twice. The Region must prepare the supplemental final estimate. Payment will be handled by the Olympia Service Center Accounting Office. The following consists of a supplemental final estimate package transmitted to the Construction Office:

- Final Contract Voucher Certification — Form 134-146 (with new total "final amount").
- Backup information stating the amount and reason for the supplemental final estimate.

The supplemental final estimate is reviewed by the Construction Office, signed by the Chief Construction Engineer, and then transmitted together with authorization for final payment to the Olympia Service Center Accounting Office. The acceptance date will remain the same as was previously established by the original final estimate.

1-3.1E(2) Claim Settlements

A change order is prepared detailing the claim settlement. Documentation must be sufficient to justify the amount of

settlement and the rationale used to show entitlement. The change order must include a release clause (see sample Certification for Release of Claims, below).

All claim settlements approved after final acceptance shall be transmitted to the Construction Office. The Construction Office will process and transmit the change order to the Accounting Office for preparation of a separate warrant. Submittal of a supplemental final estimate by the Region is not required.

Any time liquidated damages are to be released to the Contractor as a result of a time extension granted by change order as part of a claim settlement, the transmittal memorandum to the Construction Office must summarize the status of contract time and provide details on the liquidated damages and/or direct engineering costs that have been withheld and should be released. The Construction Office will then advise the Contractor by letter of the release of liquidated damages under separate cover and by copy of the letter to the Accounting Office will direct them to release the appropriate amount of liquidated damages.

SAMPLE CERTIFICATION FOR
RELEASE OF CLAIMS

SAMPLE NO. 1 (Use when settlement is made after suit has been filed in Superior Court)

The Contractor, (name), by the signing of this change order agrees and certifies that:

Upon payment of this change order in the amount of (amount written out) any and all claims in any manner arising out of, or pertaining to, Contract _____, including but not limited to those certain claims set forth in the complaint filed under Thurston County Cause No. (Contractor's name) vs. State of Washington have been satisfied in full. The State of Washington is released and discharged from any such claims for extra compensation in any manner arising out of Contract No. _____.

SAMPLE NO. 2 (Use when $ amount has been negotiated)

The Contractor, (name), by the signing of this change order agrees and certifies that:

Upon payment of this change order in the amount of (amount written out in figures), any and all claims in any manner arising out of, or pertaining to, Contract No. _____ (including but not limited to those certain claims set forth in the letter to the Department of Transportation under date of _____ and signed by _____ of (company) in the approximate amount of (amount)) have been satisfied in full and the State of Washington is released and discharged from any claims or extra compensation in any manner arising out of Contract No. _____.

1-3.1F Retained Percentage

RCW 60.28 provides that:

1. A sum not to exceed 5 percent of the money earned by the Contractor on estimates be retained by the Contracting Agency.

2. The Contractor may submit a bond for all or any portion of the amount of funds retained by WSDOT.

   a. When a contract is awarded, the Olympia Service Center Accounting Office sends a package to the Contractor for execution. Included in this package will be the appropriate instructions necessary for the Contractor to make application for release of all or any portion of the amount of funds retained. The bond form will be processed by the Olympia Service Center Accounting Office without involvement from Project Engineer's Office.

   b. The Contractor, at any time during the life of the contract, may make a request to the Project Engineer for the release of all or any portion of the amount of funds retained. This request does not need consent of surety since the retainage bond form, for this purpose, requires their consent. The Region shall forward this request by transmittal letter to the Olympia Service Center Accounting Office. The Accounting Office will furnish the appropriate bond form to the Contractor for execution. The Contractor may return the executed bond form directly to the Accounting Office for final approval and signature by WSDOT.

3. For projects that include landscaping — 30 days after physical completion of all contract work other than landscaping, WSDOT may release and pay in full the amount retained during the life of the contract (other than continuing retention of 5 percent of the monies earned for landscaping). Form 421-009 may be filled out by the Contractor and the Project Engineer, designating in the space provided, that landscaping or plant establishment work remains to be completed. A bond is not required.

1-3.2 Final Records for Projects Constructed by Contract

The Project Engineer is required to prepare all necessary records to document the work performed on the contract. Detailed instructions on the records required and methods of preparing them are covered in Chapter 10 of this manual.

1-3.3 Disputes and Claims

1-3.3A Contractor's Protest or Claim

Claim versus Disputes/Protest — Any dispute the Contractor has with WSDOT is a protest and should not be

considered a claim until the Contractor has exhausted the protest process and WSDOT has been unable to, or unwilling to, resolve the protest to the satisfaction of the Contractor.

If the Contractor does not agree with the terms or conditions of a change order (or any other order, direction, instruction, interpretation, or determination from the Engineer), the Contractor is required by Section 1-04.5 of the *Standard Specifications* to give the Project Engineer or the Project Engineer's field inspector an immediate signed written notice of protest before doing the work. If the Contractor is ordered to proceed in spite of this signed written notice of protest and the Contractor desires to continue to protest the order, the Contractor must supplement the written protest within 15 calendar days with a written statement providing all the information required in Section 1-04.5 of the *Standard Specifications*.

Protests related to "changed conditions" must be established by written notice from the Contractor prior to disturbance of the condition (see Section 1-04.7 of the *Standard Specifications*). The Olympia Service Center Construction Office shall be notified at this time so that they may provide guidance and uniformity.

As with all other contract business, protests or claims must be submitted through the Project Engineer. If the Contractor introduces a protest or claim at some other level of administration, it shall be referred through the chain of administration to the Project Engineer.

The *Standard Specifications* (and the Contract Provisions) may provide other time limits for the Contractor to protest, other than Section 1-04.5 and 1-04.7, such as: Section 1-08.5, Time for Completion; Section 1-08.6, Suspension of Work; and Section 1-08.8, Extension of Time. However, if the Contractor desires to pursue any unsettled protest, the provisions of Section 1-04.5 and Section 1-09.11 must be complied with and the Final Contract Voucher Certification must be conditioned upon the claim in the detail described in Section 1-09.11(2). Section 1-09.11(2) also states that if the Contractor does not provide the required information and detail with the Final Contract Voucher Certification the claim is waived. However, WSDOT policy is:

1. When claims submitted with the Final Contract Voucher Certification do not meet the requirements of Section 1-09.11(2), the Contractor shall be immediately notified in writing,

2. The area of noncompliance will be itemized in the letter,

3. The letter shall inform the Contractor that they have 30 calendar days to provide the missing information, and

4. The letter shall also inform the Contractor that if the information is not received in 30 calendar days, the final estimate will be processed and their claims will be waived in accordance with Section 1-09.11(2).

Also, any unsettled claim the Contractor wishes to arbitrate or litigate in court must be filed for arbitration or filed as a lawsuit within 180 calendar days after the date of final acceptance of the contract by the Secretary.

Lawsuits are always filed with the Attorney General's Office. However, arbitration demands may be served on the Project Engineer. The Construction Office shall be notified immediately upon receiving an arbitration demand.

The main purpose of Section 1-09.11(2) of the *Standard Specifications* is to ensure WSDOT has all the information required to fairly and quickly evaluate a Contractor's claim. Therefore, it is important that the claim submittal contain all the information required by the specification.

Upon receipt of a claim from the Contractor, the Project Engineer should immediately check the claim for compliance with the specification. The Contractor should be notified in writing that the Project Engineer has received the claim and:

1. It appears to comply with Section 1-09.11(2) of the *Standard Specifications*; however, the right is reserved to request additional information or perform an audit, or

2. The claim does not comply with Section 1-09.11(2) and identify the specific area of noncompliance.

The Contractor should also be notified if the Project Engineer will be unable to evaluate the claim within the time limits of Section 1-09.11(2).

Some of the common areas where the Contractor's claim may fail to comply with the specification are as follows:

1. The claim submittal uses rates that exceed Blue Book Equipment Rates. Actual equipment costs should be requested. The actual equipment rates shall not exceed the rates established by the AGC/WSDOT Equipment Rental Agreement (See Section 1-09.4 of the *Standard Specifications*).

2. The number of days of delay or a delay analysis is not provided.

3. The claim is forward priced. The specification requires that actual extra costs are to be provided, not estimated.

4. The claim reserves the right to submit additional costs. The specification requires all costs be submitted.

5. The claim certification is missing or altered.

The Construction Office should be made aware of all claims as early as possible after submittal by the Contractor. The only exceptions to this are: (l) Claims or disputes over quantity measurements and payments which may be rectified by recheck of measurements and calculations; (2) disputes over working day charges based on weather condition judgments of the Project Engineer; or (3) claims that can be settled within the authority subdelegated to the Region. These items fall within the administrative authority of the Region or the Project Engineer and need only be referred to higher levels in the event the Project Engineer's or Region's proposed resolution is not accepted by the Contractor. All decisions involving interpretation, changes, additions or deletions to the contract terms, time extensions, and assessment of liquidated damages must be issued or approved by the Construction Office, except where authority has been subdelegated to the Region.

The following instructions shall be used for handling and processing the Contractor's claims. Individual and unique characteristics of any given claim may require some variations but the basic intent should be accomplished if possible.

1. Upon receipt of a claim in compliance with Section 1-09.11(2) of the *Standard Specifications*, the Project Engineer shall analyze the basis for the claim, record any pertinent details, and forward it to the Region with recommendations for resolving the claim or request for guidance.

2. Upon receipt of the Project Engineer's report, the Region shall analyze the claim, obtain such additional information as may be needed, and forward it to the Construction Office with recommendations, unless authority for settlement has been subdelegated to the Region.

3. During the above two levels of review, the Region shall meet with the Contractor to attempt a settlement. If the Contractor brings legal counsel to any such meeting WSDOT's legal counsel should be present if possible. It is the intent that claims be negotiated at the project or Region level if possible. The Olympia Service Center Construction Office will provide guidance and must be kept informed of all details of negotiations. Because of the Statewide significance of any claim settlement and the parallel importance of uniformity in decisions, all settlement agreements must be approved by the Construction Office, unless authority for settlement has been subdelegated to the Region. No commitment to settle shall be made without authorization from the Construction Office if the Region is not authorized to settle.

4. Claims referred to the Construction Office for review and action must be accompanied with the pertinent data, reports, and recommendations. Additional meetings with the Contractor, either with or without legal counsel, will be arranged. Regional personnel will be requested to attend these meetings and to furnish any support data that may be needed. Legal counsel will either be directly involved or consulted by the Construction Office on claim settlements to ensure the legality of all settlements that involve agreements supplemental to the contract terms. Any audits of the Contractor's records necessary to verify submitted data will be arranged by the Construction Office.

5. When arbitration or court action is initiated by the Contractor, the Attorney General's office becomes officially involved and will guide WSDOT's actions relative to the arbitration or lawsuit. WSDOT will then furnish assistance and support to the Attorney General's Office as requested.

1-3.3B Against the Contractor — Damage

Claims received by the Regional Administrator for alleged damage to property or injury resulting from the Contractor's operations should be investigated, and referred to the Contractor for settlement, if considered by the Project Engineer to have been the result of the Contractor's operations.

Copies of correspondence pertaining to impending claims should be transmitted to the Olympia Service Center Construction Office and the advice of the Legal Division will be sought if the responsibility of WSDOT or Contractor is not clearly defined.

1-3.3C Against the Contractor — Money

Claims received by the Regional Administrator for money owed by the Contractor should be referred to the Contractor. A claimant should be advised of the legal right to file a lien against the retained percentage for claims involving labor, equipment, or materials used on the project, but the claimant should be referred to the Olympia Service Center Accounting Office for obtaining the necessary lien forms.

1-3.3D Against Officials and Employees

The statutes provide that claims may be filed against the State of Washington, State officers, and employees, for damages resulting from tortious conduct and prescribes the manner in which the action must be taken. Whenever this occurs the State will usually furnish the legal defense if the act which caused the alleged damage was performed on the job, in good faith, and without negligence.

Some common examples are damage caused by fire, soil sterilization, pollution, drainage, wasting materials, traffic accidents, and traffic control.

It is very essential that records, evidence, and all other pertinent data be assembled whenever a tort claim might be anticipated.

Third parties who have been injured or damaged and desire to file a claim against the State, must file the claim within 120 days of the accident. Forms for filing claims are available in the Regional Office. Complete instructions for filling them out and filing them are printed on the forms.

1-3.4 Stewardship

Passage of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) provides opportunity for significant changes in streamlining the federal program delivery process. This covers virtually all phases of transportation planning, development, and construction. One of the early developments was a Stewardship plan which helped to more clearly define the roles and responsibilities of both WSDOT and FHWA personnel in monitoring the delivery of the program. Within the framework of Stewardship, a Federal-Aid Construction Monitoring Plan has been developed and agreed to by both parties.

Under the terms of the Construction Monitoring Plan, responsibilities are divided as follows:

1. FHWA will be responsible for initial, intermediate, and final inspections on Interstate completion, new, and reconstruction projects. FHWA will also be responsible for all ongoing projects awarded in calendar year 1992 or earlier.

2. The Olympia Service Center Construction Office will be responsible for interim and final inspections on all remaining projects in excess of $3.5 million.

3. Regions will be responsible for interim and final inspections on all remaining projects including railroad and utility projects.

Project inspections arc intended to provide monitoring oversight and continuing input into the construction quality of federal-aid projects and to assure FHWA that we are complying with the contract requirements and Federal-aid regulations. Final inspections will be performed on all Federal-aid projects anytime after 90 percent completion but no later than 30 days after physical completion. The scope of these inspections is dependent on the size and type of the project. All change orders will be reviewed for compliance with the change order checklist and Federal-aid eligibility and a statement confirming eligibility must be on the final inspection report. Interim and final inspections will be reported on WSDOT form “Inspection of Federal-Aid Project,” with copies distributed to FHWA and the Region or the Construction Office as appropriate.

Final acceptance reports will be completed on all interstate projects subdelegated to WSDOT. These reports will be completed by the Construction Office as soon as all project requirements have been met. WSDOT form “Final Acceptance of Federal-Aid Interstate Projects” will be used. Copies will be distributed to FHWA and the appropriate region. Project documentation should clearly show that findings from the final inspection have been resolved.

1-4 Utility and Railroad Relocation

1-4.1 Administration of Work Performed Under Utility Agreements

1-4.1A General

Work performed under a utility agreement can be defined in one of the following three categories:

Category 1 — Work is performed under an agreement attached to a regular construction contract, where the work is completed by the same contractor/subcontractor doing the regular contract work and is an integral part of the contract. See Chapter 1-4.1B of this manual.

Category 2 — Work is performed by the utility’s forces or their contractor within the limits of a regular construction project. The agreement is *not* attached to the regular construction contract, and is not a part of the contract. For example, a utility agrees to relocate a facility to make way for work being performed on a regular construction contract. See Chapter 1-4.1C of this manual.

Category 3 — Work is performed by the utility’s forces or their contractor outside the limits of any regular construction project. The agreement is *not* attached to any construction contract. For example, a utility agrees to relocate a facility to make way for work that is planned for a future construction contract. See Chapter 1-4.1D of this manual.

The Regional Administrators will have administrative responsibility for all work performed under formal agreement with utilities, both public and private, and the direct administration will be handled by either the Regional Operations/Construction Office (Project Engineer) or other designee of the Regional Administrator in accordance with the following instructions. In all cases, the individual assigned by the Regional Administrator to monitor the work will keep sufficient records to ensure that the work is completed in accordance with the approved plans and specifications.

1-4.1B Administration of Category 1 Utility Agreements

When a utility agreement is attached to a regular WSDOT construction contract, as described under

Category 1 in Chapter 1-4.1A above, the utility work will be administered in the same way as the other items of work in the contract. Administration will be under the direct supervision of the Region-appointed Project Engineer.

When material to be incorporated in the utility work is furnished by WSDOT's contractor, WSDOT will sample and test the material in accordance with standard WSDOT testing procedures to ensure the material meets the requirements for the approved plans and specifications.

When material to be incorporated in the utility work is furnished by the utility, the utility will provide certification that the material meets the requirements of the approved plans and specifications.

Construction inspection and documentation for items of work performed under the utility agreement will be administered identically as for all other items of work on the contract.

If unforeseen conditions require a change in the work described by the utility agreement, changes will be documented and approved first by entering into a Supplemental Agreement with the utility as described in Chapter 2-9 of the *Utilities Manual* (M 22-87). After a Supplemental Agreement is approved, a Change Order will be prepared according to the directions in Chapter 1-2.4C of this manual. If at any time during this process it is realized that a Change Order will need approval by the Olympia Service Center Construction Office, the appropriate Construction Office Engineer should be included in all discussions and negotiations with the parties involved.

1-4.1C Administration of Category 2 Utility Agreements

When work on a utility agreement is performed by the utility's forces or their contractor as described under Category 2 in Chapter 1-4.1A of this manual and is taking place within the limits of a regular construction project but is not attached to the construction contract, administration of the utility agreement will be in accordance with the instructions contained in Chapter 2 of the *Utilities Manual*.

The construction contract Project Engineer will treat the utility agreement work as another contractor working in the area and will coordinate the work on the construction contract as described in Chapter 1-2.2H of this manual.

1-4.1D Administration of Category 3 Utility Agreements

When work on a utility agreement is performed by the utility's forces or their contractor as described under Category 3 in Chapter 1-4.1A of this manual is not attached to a regular construction contract, and is not taking place within the limits of a regular construction project, administration of the utility agreement will be in accordance with the instructions contained in Chapter 2 of the *Utilities Manual*.

1-4.2 Administration of Work Performed Under Railroad Agreements

1-4.2A General

Work performed under a railroad agreement can be defined in one of the following four categories:

Category 1 — Work is performed on railroad facilities as part of a regular WSDOT construction contract. The railroad agreement is attached to the construction contract and all work is performed by a WSDOT contractor/subcontractor. See Chapter 1-4.2C of this manual.

Category 2 — Work on WSDOT facilities by WSDOT contract requires encroachment on railroad right of way and/or railroad facilities. An agreement is made with the railroad giving them the right to require any protective services necessary (usually flaggers) to safeguard their facilities and schedules.

Category 3 — Work performed by railroad forces or their contractor within the limits of a regular construction project. The agreement is *not* attached to the regular construction contract, and is not a part of the contract. See Chapter 1-4.2D of this manual.

Category 4 — Work is performed by railroad forces or their contractor outside the limits of any regular construction project. The agreement is *not* attached to any construction contract. See Chapter 1-4.2E of this manual.

The Regional Administrator will have administrative responsibility for all work performed under formal agreement with railroads, and the direct administration will be handled by either the Regional Operations/Construction Office (Project Engineer) or other designee of the Regional Administrator in accordance with the instructions in Chapter 1-4.2C of this manual. In all cases, the individual assigned by the Regional Administrator to monitor the work will keep sufficient records to ensure that the work is completed in accordance with the approved plans and specifications.

1-4.2B Administration of Category 1 Railroad Agreements

When a railroad agreement is attached to a regular WSDOT construction contract as described under Category

1 in Chapter 1-4.2B of this manual, the railroad work will be administered in the same way as the other items of work in the contract. Administration will be under the direct supervision of the Region-appointed Project Engineer.

When material to be incorporated in the railroad work is furnished by WSDOT's contractor, WSDOT will sample and test the material in accordance with standard WSDOT testing procedures to ensure the material meets the requirements for the approved plans and specifications.

When material to be incorporated in the railroad work is furnished by the railroad, the railroad will provide certification that the material meets the requirements of the approved plans and specifications.

Construction inspection and documentation for items of work performed under the railroad agreement will be administered identically as for all other items of work on the contract.

If unforeseen conditions require a change in the work described by the railroad agreement, changes will be documented and approved first by entering into a Supplemental Agreement with the railroad as described in Chapter 3 of the *Utilities Manual*. After a Supplemental Agreement is approved, a Change Order will be prepared according to the directions in Chapter 1-2.4C of this manual. If at any time during this process it is realized that a Change Order will need approval by the Olympia Service Center Construction Office, the appropriate the Construction Office Engineer should be included in all discussions and negotiations with the parties involved.

On all projects where railroad flagging is performed, the Project Engineer will send a letter to the railroad notifying them when all work involving the railroad is physically complete. The railroad then has 120 days to submit their final billing. A copy of the letter will be sent to the Olympia Service Center Accounting Office and the Region. A copy will also be sent to the Olympia Service Center Utilities/Railroad Engineer if anticipated railroad flagging costs will exceed $5,000. Work involving the railroad may be physically complete prior to completion of the project. This will be determined when the Contractor requests to be relieved of carrying railroad insurance. *It is imperative that the railroad and copy recipients be notified no later than five calendar days after physical completion of the project to avoid WSDOT being required to pay railroad flagging costs that would otherwise be the Contractor's responsibility.*

1-4.2C Administration of Category 2 Railroad Agreements

When the work defined in a railroad agreement consists only of protective services as described under Category 2 in Chapter 1-4.2B of this manual, the railroad determines the need for the service, provides the service, and sends a bill to WSDOT. The Construction Project Engineer will administer this type of railroad agreement.

Documentation for the work on this type of railroad agreement will consist of entries in diaries and IDRs that the work did take place, and to verify the billings from the railroad.

On all projects where railroad flagging is performed, the Project Engineer will send a letter to the railroad notifying them when all work involving the railroad is physically complete. The railroad then has 120 days to submit their final billing. A copy of the letter will be sent to the Olympia Service Center Accounting Office and the Region. A copy will also be sent to the Olympia Service Center Utilities/Railroad Engineer if anticipated railroad flagging costs will exceed $5,000. Work involving the railroad may be physically complete prior to completion of the project. This will be determined when the Contractor requests to be relieved of carrying railroad insurance. *It is imperative that the railroad and copy recipients be notified no later than five calendar days after physical completion of the project to avoid WSDOT being required to pay railroad flagging costs that would otherwise be the Contractor's responsibility.*

1-4.2D Administration of Category 3 Railroad Agreements

When work on a railroad agreement is performed by the railroad's forces or their contractor as described under Category 3 in Chapter 1-4.2B of this manual and is taking place within the limits of a regular construction project but is *not* attached to the construction contract, administration of the railroad agreement will be in accordance with the instructions contained in Chapter 3 of the *Utilities Manual*.

The construction contract Project Engineer will treat the railroad agreement work as another contractor working in the area and will coordinate the work on the construction contract as described in Chapter 1-2.2H of this manual.

1-4.2E Administration of Category 4 Railroad Agreements

When work on a railroad agreement is performed by the railroad's forces or their contractor as described under Category 4 in Chapter 1-4.2B of this manual, is *not* attached to a regular construction contract, and is *not* taking place within the limits of a regular construction project, administration of the railroad agreement will be in accordance with instructions contained in Chapter 3 of the *Utilities Manual.*

1-5 Construction Surveys

1-5.1 General

1-5.1A Vacant

1-5.1B Contractor Provided Surveying

When the special provisions for a contract provides for the Contractor to do any part of the surveying, the Project Engineer shall become thoroughly familiar with those requirements in the contract.

1-5.1C Engineering Equipment

Before attempting any surveying work, test the accuracy of all instruments and make the proper adjustments. Thereafter test the instruments at frequent intervals and maintain them in adjustment.

Separate construction note books shall be kept for each contract, using the standard field books furnished by WSDOT. The form of notes shall be in accordance with standards presented by WSDOT. The original field books of the location survey should be obtained to aid in staking the project for construction and preparing the construction notebooks.

1-5.2 Preservation of Permanent Monuments and Markers

1-5.2A Permanent Monuments

Most permanent monuments which are in the construction zone are relocated by the establishing agency. Normally these monuments are relocated prior to beginning of construction, but if monuments are found within the construction zone, they must be preserved until they can be moved. If the urgency of construction does not allow time for the relocation of the monument, it must be properly referenced so it may be reset or relocated at a later time. When a monument is found within the construction area, the proper agency shall be notified promptly and requested to relocate the monument.

1-5.2B Property Corner Monuments and Markers

It is imperative that land plats and property corners be preserved. The 1973 Legislature enacted a Survey Recording Act, RCW 58.09, to provide a method for preserving evidence of land surveys by establishing standards and procedures for monumenting and for recording a public record of the surveys.

When a general land office corner, plat survey corner, or property line corner exists in the construction zone, it is necessary to properly reference it and reset it after the construction work has been done. RCW 58.09.040 requires that a record of the monument be filed with the County Auditor in the County in which the corner exists for all monuments that are set or reset.

1-5.2C Alignment Monumentation

During construction, alignment monumentation may be altered to fit field conditions. Such changes may include:

1. Normally all PCs and PTs are to be monumented. Additional point on tangent (POT) monuments are necessary where line of sight is, or may in the future be obstructed by the horizontal or vertical alignment, buildings, or other barriers.

2. When the right of way and the construction alignment do not coincide, the monumentation shall be such that the exact right of way as acquired can be positioned in the field. This will generally require, as a minimum, that the right of way alignment be monumented.

3. When safety of the survey crew or survival of the monuments is an issue, monuments may be offset from the true alignment. An extra effort in accuracy must be made when setting offset monuments to ensure an accurate reestablishment of the true alignment.

The monumentation, including monument locations, reference distances, stations, and bearings, is to be shown on the as-built plans prior to submittal to the Region Office.

Upon completion of the as-built plans, the Region will update the Record of Survey, see *Design Manual*, Section 1450, with the final monumentation data. The as-built monumentation information must include:

1. Monument locations.

2. Monument stations and offsets.

3. Monument coordinates (if available).

4. All ties from the right of way lines to the most convenient monumented centerline.

1-5.3 Reestablishing Alignment

The first step is to retrace the survey line to confirm accuracy and replace missing stakes. At the same time reference sufficient points, as indicated in the standard transit notes, to recover the line without question. When curvature is sharp and frequent, reference the PCs and PTs. On long easy curves reference the beginning and end of curves, and important intermediate points on the curve. Reference by placing two or more hubs on lines intersecting at the hub to be referenced. Place reference hubs far enough out so that they will not be destroyed in clearing and grading. When clearing is very heavy, the retracing of

the line may be deferred until after the clearing is done but the line must be carefully referenced.

The final location stationing is to be maintained throughout and all records and work must conform to it. In case of errors in one station, maintain the stationing by recording the station long or short, as the case may be, giving its correct length. Equations in stationing shall be made on tangents when practicable. If errors of some importance are found in angles, set new beginning and end points on curve, retaining the original PI and distinctly state in your notes that PI is same as original and that changes of curve points are due to errors in angles. Care shall be taken to show breaks in stationing correctly and to make the equation in stationing clear and definite.

All changes in alignment made after the map of definite location has been filed, must be recorded at once with a tracing showing both old and new line, and a tracing of the profile showing the revision. Such changes must not be used until approved by the Regional Operations/ Construction Engineer.

1-5.4 Check Levels and Bench Marks

Check levels must be run to verify the elevations of the bench marks established on location. Bear in mind that all bench marks are turning points, and it is important that the levelperson turn through each bench as they are being checked. At the time the check levels are being run, establish all necessary construction bench marks at strategic places. On projects of significant size and/or with extensive structures it may be desirable to use three wire levels to set the construction bench marks. Bench marks should be convenient for setting slope stakes, setting blue tops, and for staking structures.

If the terrain is suitable at a structure site, convenient bench marks should be established for construction of the footings and others established for construction of the bridge deck. It is quite important that the bench marks used for vertical control on structures be coordinated, therefore check levels must be run on these bench marks prior to their use in staking the structure. It is also important that a minimum of two bench marks be used at all times. It is then apparent if a bench mark has been altered.

1-5.5 Setting Construction Stakes

On large projects where extensive staking will be required, the Project Engineer should start the setting of construction stakes as soon as possible before the beginning of operations by the Contractor.

Reference stakes need to be set outside the slope stakes beyond the slope rounding where they will not be disturbed.

The Project Engineer should see that stakes are always furnished sufficiently ahead of construction so that the Contractor will not be delayed in undertaking and planning the work.

Stakes destroyed by carelessness or neglect by the Contractor shall be replaced at the expense of the Contractor.

1-5.5A Setting Grading Stakes

Stakes for grading shall be set before any excavation is started. During the process of cross-sectioning, slope stakes shall be set wherever necessary to provide the Contractor with a clear guide for the grading operations.

In cross-sectioning, the center cuts or fills must be determined with the level, and the slope stakes and intermediate grade points set by instrument or hand level, depending upon the nature of the terrain. The center stakes will be marked with the cut or fill on the back and the station on the face. Slope stakes will be marked with the cut or fill, distance from the center line and slope information on the face toward the center line, and the station number on the back. Take readings to at least one break outside of the slope stakes.

Stakes showing the outside limits for slope treatment shall be set in conformance with Standard Plan H-8.

After rough grading of the subgrade has been completed, lines of finishing stakes (blue tops) shall be set at all roadway section breaks between shoulders at intervals of 20 meters (50 feet), or closer if needed because of grade changes, curves, or superelevation. Such stakes should not be set until the grade is near enough to final grade that resetting will not be necessary. If an automatic trimmer is to be used, see Chapter 1-5.7C of this manual for procedures for setting control for reference lines.

1-5.6 Staking for Structures

Before any structure work is staked out, the Project Engineer shall reestablish the alignment in accordance with Chapter 1-5.3 of this manual. The pier locations should be staked in accordance with the Footing Layout included in the plans. Proper staking of all substructure elements of the structure is very important. Errors in locating footings might necessitate extensive revision in the design of the structure or removal of the improperly located foundation. In either case an error will most likely result in increased costs and/or delays in construction.

After the piers have been staked it should be verified that the structure fits the terrain or other improvements as the design intended. Stand back and eyeball the entire layout, if possible, to determine if it looks correct. Ground elevations should be taken along centerline and near the ends of

each bent or pier. The depth of footing below the ground line, cut or fill slopes, or stream bed should be checked. Any deviation from the details shown on the plans or the soils report should be reported to the Regional Operations/ Construction Engineer. Ordinarily footings are designed with 0.6 to 2.4 meters (2 to 8 feet) of cover from the stream bed depending on the potential for scour. Normally, for slopes of 1:1.75 (1¾:1) or flatter, spread footings will be placed one footing width behind the fill or cut slope at the level of the bottom of footing. If the end slope is to be constructed on a 1:1.75 (1¾:1) slope the footing should be 1½ footing widths behind the slope.

The pier locations should be carefully referenced so that they can be replaced easily and accurately. The reference points should be placed so they are clear of other construction features and so they will not be affected by ground movements caused by large excavations or embankments. Set an adequate number of references so that if some are lost the pier locations can still be easily reestablished. References are a very critical item in the layout of structures since they will be the control for all future work. A little extra time spent placing good references can save time later throughout the life of the project.

The layout of the structure and the references should be independently checked by either a different survey crew or by the same crew using a different survey approach. All survey notes should also be independently checked. Precise instruments should be used to layout structures.

Whenever possible, distances shall be taken by direct measurement. All construction points shall be checked by at least two independent measurements. Dimensions on bridge plans are for a normal temperature of 18°C (64 F). It is particularly important to keep this in mind when laying out steel structures.

The laying out for all structures must be carefully and accurately done but the degree of accuracy used must be commensurate with that required for the particular structure. Long, continuous concrete structures and steel structures must be laid out with a much greater degree of accuracy than is required for a short concrete structure. Where foundation problems are likely or expected and where foundation instrumentation, such as settlement indicators, slope indicators, pore pressure indicators, etc., is included, special bench marks may be required. Extreme care will be necessary to ensure that the required bench marks are located well beyond the settlement zone or well away from a retained slope or a landslide. Location of instrumentation bench marks, where required, should be established with the aid of the Regional Materials Engineer.

When foundation instrumentation is required, a copy of the report of settlement measurements, pore pressure measurements, etc., must be forwarded to the Olympia Service Center Materials Laboratory so the Materials Engineer will have the necessary information to analyze the work and be in a position to advise the Region as necessary.

Prior to construction, the Project Engineer shall make a thorough study of the plans, checking all dimensions and elevations and shall immediately report to the Regional Operations/Construction Engineer any discrepancies or errors discovered.

1-5.6A Layout for Structures

The following is a guide to be used in the layout and staking work to be performed for structures.

1-5.6A(1) Footings and Columns for Structures

1. Set centerline straddle reference hubs for footings.

2. Set footing cut stakes for structure excavation to limits shown on the plans. Reference the cut stakes clear of the excavation limits.

3. At completion of the excavation, set blue tops for footing grade. Inspect the soil at footing grade to determine suitability for spread footing per Chapter 2-9 of this manual.

4. For a foundation pile footing, stake all pile locations. Designate batter piles if any. Set elevation for foundation pile cut-off.

5. Place straddle tacks on footing forms.

6. After pouring footing, place straddle tacks in footing from primary reference points to use for aligning columns.

7. Set and check elevation for column pour height. Make allowances for superelevation and grade.

1-5.6A(2) Superstructure — Box Girders

1. For falsework construction, set and check one bench mark per span for the Contractor's use. The Contractor may use columns and piers for falsework alignment or WSDOT will set centerline stakes for the Contractor's use in aligning the falsework. The Contractor will be expected to set grades for falsework pads and falsework pile cut-offs.

2. Set one bench mark for each pier on top of column concrete or steel.

3. Set grades for the bottom slab on risers attached near the ends of falsework bents and at transverse grade breaks. By utilizing a stringline between these grades the Contractor sets the bottom deck forms to grade. WSDOT

then checks form elevations at points of intersection previously established or at more frequent intervals depending upon grade, curvature, and superelevation. If the forms are within 9 to 12 millimeters (0.03 to 0.04 foot), continue to check while the Contractor adjusts the forms to grade. If the forms are not within 9 to 12 millimeters (0.03 to 0.04 foot), mark the amount to be changed and recheck after the Contractor has adjusted the forms to grade. The maximum allowable tolerance for the soffit grade will be 3 millimeters (0.01 foot) high to 6 millimeters (0.02 foot) low.

4. Set tacks on the bottom slab form to establish intersections of all interior webs and diaphragms. Also set tacks for outside edge of box with additional tacks when the structure is on a curve or is flared. The Contractor sets pour heights and WSDOT checks.

5. All elevations set for bottom deck, girder tops, overhang, and top deck should include camber and the estimated falsework take up. Tell tales should be installed at the ¼ points and the center of each span (minimum) to verify falsework take up with each pour.

6. Set elevations for the top deck forms at about 4.5-meter (15-foot) centers. These grades can be set on screed pipe supports or on web stirrups at grade breaks and outside girders. Eyeball the Contractor's string lines for deviation in grade remembering that camber allowances will affect a smooth profile. The Contractor sets the entire deck support system from these grades and then WSDOT checks the forms.

7. The Contractor sets screed rails from elevations furnished and WSDOT checks. Eyeball screed rails after adjusting to grade and make final adjustments. Finishing machine drum may be adjusted to the proper grade by the use of grades set for the top deck forms. Check this adjustment by moving the machine to several other locations on the deck.

8. All deck bulkheads, expansion dams, access holes, and drainage castings should be set to final grade from the drum of the finishing machine after it has been set to final grade. All top mat reinforcing steel and the depth of slab should be checked for proper clearance from the drum of the finishing machine.

9. To set grades for the top of the traffic barrier, profile the deck at the toe of the barrier and plot on a large scale to establish a smooth profile as outlined in Chapter 6-6 of this manual.

10. The Contractor sets anchor bolts for bridge railings, sign supports, and light standards and WSDOT checks.

11. WSDOT establishes location and elevations for all anchor bolts and bearing assemblies.

1-5.6A(3) Other Types of Structures

The same procedures for laying out lines and grades are to be used for all other types of structures.

1-5.7 Grade Control

1-5.7A Subgrade Tolerance

The finish required on roadway subgrades shall ensure a final grade in as close conformity to the planned grade and cross-section as is practicable, consistent with the type of material being placed. Subgrade blue tops shall be set 15 millimeters (0.05 foot) below subgrade elevation and be accurate to + or - 3 millimeters (+ or - 0.01 foot). The finished subgrade surface shall not deviate from the plan subgrade elevation by more than + 0 millimeters to - 15 millimeters (+ 0.00 to - 0.05 foot). Where excessively rocky materials are being placed, deviations in excess of the above may be accepted where, in the opinion of the Engineer, closer conformance cannot be achieved by normal procedures and with a reasonable amount of work and care on the part of the Contractor. Conformance to grade shall be checked by rod and level, string-lining, straight-edging, or other appropriate engineering method of measurement as selected by the Project Engineer.

1-5.7B Surfacing Tolerance

Red and yellow tops for surfacing materials shall be set accurate to + or - 3 millimeters (+ or - 0.01 foot). The finish of the compacted surfacing materials shall conform to the grade established by the blue tops as closely as is practicable and in general, should not deviate from the established grade in excess of the following: ballast and base course, + or - 15 millimeters (+ or - 0.05 foot); top course for bituminous surface treatment, + or - 9 millimeters (+ or - 0.03 foot); top course for asphalt concrete, + or - 6 millimeters (+ or - 0.02 foot); surfacing under treated base course, + or - 9 millimeters (+ or - 0.03 foot); treated base under Portland cement concrete pavement, + 0 millimeter to - 6 millimeters (+ 0.00 or - 0.02 foot).

Conformance should be checked by use of rod and levels from blue tops and/or by string line or straight edge methods as determined appropriate by the Project Engineer. The above schedule refers to conformance both longitudinally and transversely to the traveled way. The outer shoulder line finished grades shall not exceed double the deviations outlined for the traveled way above.

In the event that blue tops are not set for surfacing courses, the grade of the surfacing shall be referenced to the earthwork subgrade blue tops and adequate controls shall be used to ensure the placement of the required thickness of surfacing and a final surface meeting the requirements outlined above.

1-5.7C Automatic Grade Control With Reference Lines

When the use of automated, electronic, or other than manually controlled equipment is specified by the contract or when the Contractor elects to use such equipment, the Contractor shall furnish all related items and labor for the installation of the required reference control lines. This shall include pins, brackets, tensioning devices, line, sensors, skis, feelers, probes, connections, and the continued maintenance of these items. When the paving and grading are included in the same project and a subgrade trimmer or other automatic equipment is used that would require offsetting the control beyond a distance that can be utilized satisfactorily by the paving machines, it shall be the Contractor's responsibility to establish all additional alignment and vertical control required in moving the reference line.

The Project Engineer shall set hubs for line and grade one time only after the rough grading has been completed. The Contractor is responsible for fine grading and paving to this one set of references, and for establishing the specified pavement or surfacing thicknesses. There are occasions when cooperation for purpose of producing a better job will mandate providing additional assistance. When this occurs, the Contractor must acknowledge in writing that all such additional assistance is subject to the Contractor's final determination as to accuracy and that the Contractor assumes full responsibility should any construction problems or errors occur.

The Project Engineer shall establish reference points for vertical and horizontal control at 10-meter (25-foot) intervals on tangent, horizontal, and vertical curves alike. The points should be properly guarded and flagged so that they are readily visible to equipment operators, WSDOT employees, and others. The Contractor should be cautioned to exercise care to prevent disturbance or destruction.

The Project Engineer and the Contractor must thoroughly discuss and coordinate the ideas on where the references are to be established. Careful planning must take into consideration the maximum offset distances that can be utilized by the trimmers for untreated surfacing as well as the paving machines. Problems often occur in areas that require superelevation and crowned sections. The sensing device normally describes the plane of the trimmer or paver. Offsetting of hubs from the edge of the pavement will normally be on the transverse projection of the roadway slope and not offset at the same grade. The Contractor may request that stakes be set through transitions on curves to coordinate mechanical adjustments to the transition position. This staking must be in coordination with the machinery and with transverse slope variations. After the reference lines have been set by the Contractor, the Inspector shall spot check the position with reference to the control hubs and then give them a visual inspection for smoothness.

Nylon reference lines lose their tension rapidly. Investigation has shown that from the time of the original placement until the time of actual use, the nylon reference cords will require additional tensioning that will entail taking up 3 meters (10 feet) to 8 meters (25 feet) per 30 meters (100 feet). Be alert for tie-off or tensioning lines that might guide the sensors off the reference line. The angle of divergence or method of tie-off must be such that there is no chance for diverting the sensors from the reference line. Any system requiring manual assistance (even intermittently) is not satisfactory for paving.

The Contractor should have one person assigned to check the reference line immediately ahead of the operation, on a continual basis, to ensure proper tensioning and adjustment of the line. The Inspector should always be alert to ensure that the Contractor's personnel make the necessary checks of the reference line and adjustments as well as confirm their correctness.

1-5.8 Course Thicknesses

Tabulated below are the permissible deviations and tolerances for specified depths of surfacing and paving.

Material	Metric Max. Average Specified Depth	Allowable Deviation at Any One Point	Depth Tolerance for Entire Project
Untreated Surfacing and ATB	0 – 76 mm	-15 mm	-8 mm
	77 – 152 mm	-18 mm	-9 mm
	153 – 228 mm	-21 mm	-11 mm
	229 – 300 mm	-24 mm	-12 mm
	Over 300 mm	-8%	-4%
Asphalt Concrete			
(single-lift)	24 – 45 mm	-14 mm	-5 mm
(multi-lift)	0 – 76 mm	-9 mm	-3 mm
	77 – 152 mm	-14 mm	-5 mm
	153 – 228 mm	-18 mm	-6 mm
	Over 228 mm	-23 mm	-7 mm

Material	English Max. Average Specified Depth	Allowable Deviation at Any One Point	Depth Tolerance for Entire Project
Untreated Surfacing and ATB	0 – 0.25′	-0.05′	-0.025′
	0.26 - 0.50′	-0.06′	-0.03′
	0.51 - 0.75′	-0.07′	-0.035′
	0.76 - 1.0′	-0.08′	-0.04′
	Over 1.0′	-8%	-4%
Asphalt Concrete			
(single-lift)	0.08 - 0.15′	-0.045′	-0.015′
(multi-lift)	0.00 - 0.25′	-0.03′	-0.01′
	0.26 - 0.50′	-0.045′	-0.015′
	0.51 - 0.75′	-0.06′	-0.02′
	Over 0.75′	-0.075′	-0.025′

For asphalt concrete overlays with a specified depth of less than 2 millimeters (0.08 foot), it will be the responsibility of the Project Engineer to ascertain the adequacy of the overlay depth in conformance to the plan.

1-5.9 Flagging Color Code for Construction Stakes

It is desirable to have a uniform color code system throughout the state so the Contractor's personnel will be able to readily recognize the work item referenced. Whenever flagging is necessary on the project, the following flagging color code should be used.

Activity	Flagging Color
Clearing and Grubbing	White
Right of Way	Red
Slope Stakes	Blue
Centerline	Yellow
Subgrade Blue Tops	Top of hubs painted blue. No flagging.
Base Surfacing Hubs	Top of hubs painted red
Top Surfacing Hubs	Top of hubs painted yellow
Drainage	Blue
Signing and Illumination	White
References	Multi-Color

1-5.10 Color Code for Selective Thinning

In median areas or natural areas calling for the selective thinning or removal of trees, tie ribbon around the trees at a height easily seen by workmen as follows:

1. Orange for trees to be removed.

2. Blue for trees to remain.

1-5.11 Vertical Clearance Under Existing Structures

Vertical clearance information is utilized to determine the possibility of permitting movement of various shaped vehicular loads. Clearances shall be checked at all structures located in areas where resurfacing operations, grade revisions, or structure modifications have taken place. Geometrics associated with roadway and bridge profile grades, superelevation, and crown are often subtle factors affecting the usable clearances. These factors add to the difficulty in locating critical points to measure.

The following guidelines are for use in taking and recording the actual vertical clearance measurements. Figure 1-10, Diagram A, shows the desired form for transmitting the actual vertical clearance information to the Olympia Service Center Bridge and Structures Office. The usable vertical clearance (posted) is normally determined by subtracting 75 millimeters (3 inches) from the actual measurement.

Undercrossing Structures

Most measurements should be taken in a plumb direction. Occasionally grade and/or superelevation of the roadway beneath the bridge will require measurements also be made normal to the lower roadway surface to ensure the minimum clearance is obtained. The bridge shown on Diagram A is parabolic; however, this diagram may also be used to record the clearances for bridges of other shapes. Measurements shall be taken at each lane stripe as shown in the diagram. Geometrics requiring additional measurements are:

1. Superelevation — The effects of superelevation can be very subtle. Special attention is required to determine whether the vertical measurement is the minimum clearance between the roadway surface and the overhead structure.

2. Sag Vertical Curves — Sag vertical curves present an additional problem by effectively reducing the vertical clearance. On a sag vertical curve, a long vehicle, truck/trailer, is further above the roadway surface midway between axles than at the axles. To determine the effective vertical clearance of a structure above a roadway on a sag vertical curve:

   a. Profile the roadway 15 meters (50 feet) on each side of the structure,

b. The effective minimum vertical clearance is the vertical distance from the bottom of the structure to the top of a 15-meter (50-foot) chord of the sag vertical curve,

c. Calculate or scale the vertical distance and record this as the minimum vertical clearance. Include the profile with the vertical clearance information submitted to the Bridge and Structures Office.

Through Structures

Vertical clearance measurements are required at intermediate lane stripes and at the curb. Measurements must be taken at each portal and sway frame to determine the controlling member. This member should be identified on the diagram. When overhead clearance limiting members are parabolic shaped, additional clearance measurements need to be taken on bridges having two lane wide openings. These measurements should be taken at 1.5 meters (5 feet) and 3 meters (10 feet) each side of the parabolic apex. The apex is normally located at the roadway centerline (see Figure 1-10, Diagram B). If the overhead clearance limiting member is haunched, additional clearance measurements should be taken at the end of the haunches and the haunches should be located horizontally in reference to the centerline of roadway (see Figure 1-10, Diagram C).

1-5.12 Contractor Surveying

When contractor surveying is included in a project special provisions, WSDOT, at its discretion, may spot-check the Contractor's surveying. It is not required and should not be done unless the Project Engineer suspects errors have been made.

If the Project Engineer elects to spot-check the Contractor's survey work, the following procedure should be followed:

WSDOT will spot-check the lines and elevations to ensure their accuracy and that they are within the tolerances shown in the plans and special provisions.

When an error is detected, it should be rechecked to ensure that it is an error and then the Contractor immediately shall be notified to correct the error. The Contractor shall correct the error before construction work may proceed. The Project Engineer shall not set or correct points and elevations for the Contractor.

WSDOT will continue spot-checking until the Project Engineer is reasonably sure the error was only an isolated error.

After the Contractor has made the corrections, it is the Project Engineer's decision whether or not to recheck the work to ensure that the error has been corrected.

1:P:DP/CM

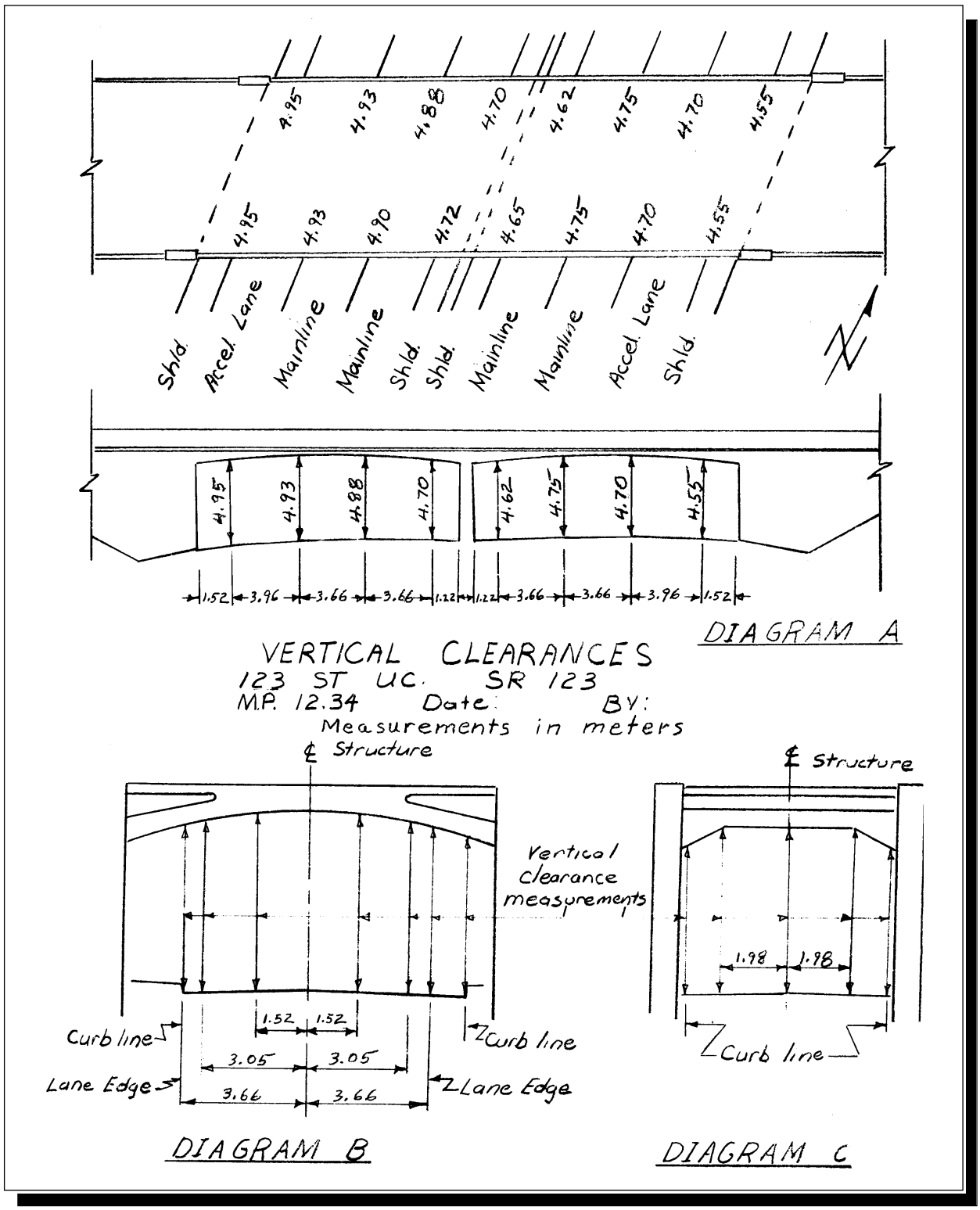
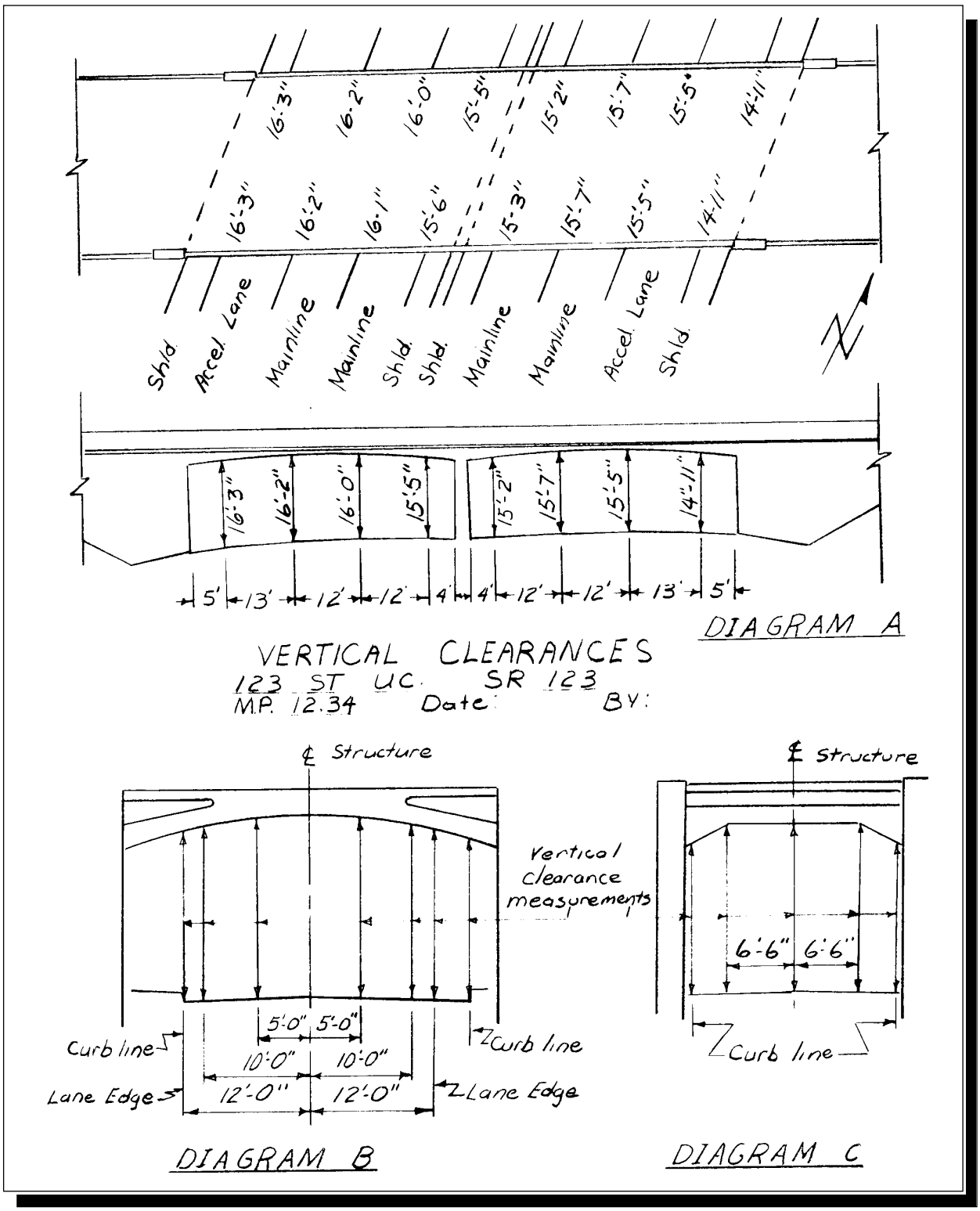


Figure 1-10
Metric



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2A:DP:CM

2-1 Clearing, Grubbing, and Roadside Cleanup

2-1.1 Clearing

2-1.1A General Instructions

Before starting grading operations, it is necessary to prepare the work area by removing all trees, brush, buildings and other objectionable material and obstructions that may interfere with the construction of the road. It is required from the standpoint of roadside appearance and control of erosion on the right of way, to preserve natural growth where possible. The Project Engineer shall consult with the Landscape Architect before starting clearing operations regarding the preservation of natural growth which will not interfere with roadway and drainage construction. Areas to be omitted from clearing or extra areas to be cleared should be determined before starting work and an accurate record made during staking operations.

2-1.1B Staking and Measurement

For clearing work, the centerline of the roadway shall be reproduced and used as the reference base line. Clearing stakes at least 1.2 meters (4 feet) long and marked "Clearing" should be set at the proper offset marking the limits of the area to be cleared. These stakes normally should be set at 25-meter (100 feet) intervals on tangents and at shorter intervals on curves, depending on the sharpness of the curve. Where slope treatment is provided, clearing normally should be staked to a distance of 3 meters (90 feet) beyond the limits of the slope treatment with a distance of 1.5 meters (5 feet) being considered the absolute minimum distance required. Grading stakes should not be set until clearing and grubbing work in a given area is completed. The method of measurement used at interchange areas should be such as to preclude the possibility of duplication or overlapping of measured areas.

When the contract provides for measuring and paying for clearing by the hectare, it is the intent of the specifications to measure and pay for all areas actually cleared and to omit those areas not cleared. To be omitted, the area must be within an existing highway or be a gap in clearing at least 15 meters (50 feet) long as measured parallel to centerline and containing an area of at least 200 square meters (2,500 square feet).

Small, isolated areas to be cleared, located between areas excluded from measurement and which contain less than 200 square meters (2,500 square feet), shall be measured as containing 200 square meters (2,500 square feet). Where isolated areas occur intermittently, the sum of the areas allowed by this method of measurement shall not exceed the total area (containing the several isolated areas) when measured as continuous clearing. This condition can occur when clearing narrow strips less than 8 meters in width.

2-1.2 Grubbing

2-1.2A General Instructions

Grubbing provides for additional preparation of the work area by removal of remaining stumps, roots, and other obstructions which exist on or in the ground in all areas designated for grubbing. **It should be noted that complete grubbing is not required under embankments where the fill height above natural ground, as measured to subgrade or embankment slope elevation, exceeds 1.5 meters (5 feet).** This exception does not apply to any area where a structure must be built, subdrainage trenches are to be excavated, unsuitable material is to be removed, or where hillsides or existing embankments are to be terraced. Grubbing is important to the structural quality of the roadway and every effort should be made to obtain a thorough job. Grubbing should be completed at least 300 meters (1,000 feet) in advance of grading operations.

2-1.2B Staking and Measurement

Grubbing stakes shall be set at the limits of the slopes as specified. Where slope treatment is required, grubbing shall be extended to the limits of the slope treatment. Accurate records of grubbed areas shall be kept in the form of sketches and measurements. As with "Clearing," it is the intent to pay for all areas grubbed and to omit those areas not grubbed. Measurement will be made in accordance with the specifications and in the same manner outlined above for "Clearing."

2-1.3 Clearing and Grubbing — Combined

2-1.3A General Instructions

When clearing and grubbing is included as a combined item, it is the intent that all areas cleared must also be grubbed. With present day equipment, the Contractor may accomplish this in one operation. It should be noted, however, that complete grubbing under fill heights in excess of 1.5 meters (5 feet) is not required unless contract provisions specifically modify the provisions of Section 2-01.3(2) of the *Standard Specifications*.

2-1.3B Measurement and Payment

Clearing and Grubbing — Combined shall be measured and paid for either on a "lump sum" basis or by the hectare (acre). If by the hectare (acre), measurement shall be in the same manner as for "Clearing." If on a lump sum basis, no specific measurement needs to be made, but a record of the time the work was done needs to be kept to document progress payments.

2-1.4 Roadside Cleanup

2-1.4A General Instructions

This work consists of cleaning up, dressing, and shaping the roadside area outside the limits of construction, on a force account basis. In advance of completion of other work on the project, the Project Engineer will go over the roadside cleanup work with the Contractor to determine the work to be done, the equipment and labor necessary, and estimate of the cost of the work.

Any trees or snags outside the limits of areas to be cleared which may endanger traffic on the roadway itself shall be removed under this work. Before removing danger trees outside of the right of way, the matter should be referred to the Regional Office for negotiations with the property owners and subsequent referral to the Olympia Service Center Construction Office for approval. If, however, an emergency arises, which endangers traffic, the danger trees may be removed immediately and the Region shall notify the Construction Office as soon as possible.

The work required in shaping the ends of cuts and fills so they appear natural with the adjacent terrain will be greatly reduced if proper warping of the cut and fill slopes have been accomplished during the grading operations.

2-1.4B Measurement and Payment

This work shall be done on a force account basis and proper records of equipment and labor used shall be kept to provide records for the payment of this work.

2-2 Removal of Structures and Obstructions

2-2.1 General Instructions

Buildings, foundations, structures, fences, and other obstructions which are on the right of way which are not designated to remain, shall be removed and disposed of in accordance with the *Standard Specifications.* All salvable materials designated to remain the property of WSDOT shall be removed carefully and stored in accordance with the special provisions. Foundations shall be removed to the designated depth and basement floors shall be broken to provide drainage of water. Basements, septic tanks, or cavities left by their removal shall be backfilled as specified, and if the areas are within the roadway prism, care shall be taken to see that the backfill is properly compacted. When water wells are encountered, the Project Engineer should determine to fill or cap the well depending on whether the well was hand dug or drilled. Wells having artesian characteristics will require special consideration to avoid water entrapment.

Care shall be taken to see that pavements or other objects which are to remain are not damaged during this operation.

2-2.2 Measurement and Payment

The removal of structures and obstructions shall be paid for at the lump sum bid price. The volume of pavement, sidewalks and curbs to be removed which are in excavation areas, shall be included in the excavation quantities. Removal of pavement, sidewalks and curbs which are in embankment areas shall be included in the lump sum bid.

2-3 Roadway Excavation and Embankment

2-3.1 Roadway Excavation

2-3.1A General Instructions

Present day earth-moving equipment and practices have accelerated grading operations to the point where the Project Engineer must make every effort to plan ahead and forsee conditions which may require changes in plans, special construction procedures, or specific coordination with subcontractors or other contractors. Delays in work progress are costly both to the Department and to the Contractor, and must be avoided whenever possible.

The Regional Materials Engineer will furnish the Project Engineer with a copy of the soil report and a print of the soil profile. The Project Engineer shall become familiar with the report and profile and carefully compare the preliminary soil data with the actual findings, in order that adjustments in the work, such as changes in haul to make best usage of better materials, changes in surfacing depth, or variations in drainage, may be made as the work progresses.

The Project Engineer should examine each newly exposed cut as soon as possible after it is opened in order that necessary changes may be made before excavating equipment has been moved away. This will necessitate an inspection of the cut slopes and the ditch cuts to locate any objectionable foundation materials or faulty drainage conditions which should be corrected. In addition to the visual inspection, a few soil auger holes should be made in the subgrade in order to determine if objectionable materials are present in the subgrade. Objectionable materials are those having characteristics which may cause an unstable subgrade. Among the conditions for which the Project

Engineer must watch are soil moisture contents which are so high as to render the subgrade unstable under the designed surfacing, high water table, and soils in which frost heaving may be serious, such as silts and very fine sands having high capillarity. In the event such conditions are discovered, the Project Engineer shall call immediately upon the Regional Operations/Construction or Materials Engineer for assistance in making corrections in the design.

Section 2-03.3(10) of the *Standard Specifications* provides for selecting excavation material for special uses as directed by the Project Engineer. Judicious application of this provision should be made whenever the project will be benefited.

2-3.1B Staking

See Chapter 1-5 for construction surveying and staking.

2-3.1C Excavation

(a) Roadway excavation shall be classified in accordance with Section 2-03.1 of the *Standard Specifications* and shall include all materials within the roadway prism, side borrow areas, and side ditches. Borrow, unsuitable excavation, ditches and channels outside the roadway section, and structure excavation are separately designated. Area designations shall not be construed to imply classification based on the type of material involved.

(b) Normally, excavation will be made to the neat lines of the roadway section as indicated on the plans. When material shortages occur, additional quantities may be obtained either from borrow sources or from an enlargement of the regular cuttings. Early determination of additional needs is desirable so that necessary enlargement can be made during the original excavation. Should it be necessary to return to a completed cut for additional material, effort should be made to cause no change in the Contractor's normal method of excavation. If the original excavation was dressed to proper slopes, it will be necessary to pay for sloping the second time in accordance with Section 2-03.3(1) of the *Standard Specifications*.

(c) When there is a surplus of material which cannot be handled by changing grade or alignment, it shall be disposed of in accordance with Section 2-03.3(7) of the *Standard Specifications*. If the surplus is wasted by widening the embankments, care must be taken to avoid creating a condition conducive to embankment erosion. If possible, the widening should be made in conjunction with the original embankment and placed in accordance with Method A embankment compaction specifications. If this is not possible, it is preferable to waste along low embankments where Method A compaction can be accomplished. Dumping of loose material on high embankment slopes must be avoided.

When the foundation investigation report from the Materials Laboratory indicates settlement is anticipated in embankments at bridge ends, surplus material shall not be wasted by widening embankments or by building up the adjacent ground line near the structure. Wasting material in this manner adjacent to a structure can result in unanticipated and adverse settlement of the structure even if the structure is founded on piling.

In areas where an overload is required, any required contour grading must be done at the time the overload is constructed. When the overload is removed, the material must be removed entirely from the area and not placed on slopes or wasted in the adjacent area.

(d) Wasting excavation material and borrowing in lieu thereof may be necessary; however, such operations must be kept to an absolute minimum. Carelessness in this respect is expensive and leads to an unsightly job. Careful planning of work and proper selection and mixing of available materials often will eliminate the need to waste and borrow.

(e) Where excavation is in solid rock, the excavation shall be completed full width of the roadway to a depth of 150 millimeters (0.5 foot) below subgrade. Particular attention is directed to the provisions of the specifications regarding drainage of pockets below subgrade in solid rock cuts. Pockets formed by blasting operations must be drained by ditching to the side ditches, and then backfilled with fragmentary rock, gravel, or other suitable material. Silty or clayey soils should not be used.

Most projects involving solid rock cuts will provide for controlled blasting of the faces of the rock slopes to minimize blast damage of the face and overbreak. It is the responsibility of the Engineer to decide which rock faces should be formed by controlled blasting and which ones do not require it. Usually this determination is made at the design stage, but formations may be encountered during the contruction which were not anticipated during the design. The Project Engineer should advise the Regional Materials Engineer when rock excavation is in progress so that the Regional Materials Engineer may monitor the progress of the work and check to see that the slopes are suitable for the rock as revealed. The Project Engineer should also contact the Regional Operations/Construction Engineer and Materials Engineer when for any operational reason it appears desirable to change the method proposed.

It is the responsibility of the Contractor to determine the method of controlled blasting to use, but is required to drill and shoot short test sections to see that the method used is producing a satisfactory face and to develop the best

methods for the particular rock formation encountered. The Engineer shall check on the results being obtained to see that they are satisfactory, and if they are not, to require the Contractor to make necessary changes in procedures to produce satisfactory results.

Most rock faces will probably be formed by the preshear method consisting of drilling and blasting a line of holes on the face of the cut ahead of any other blasting. The cushion blasting method consists of blasting and removing the main part of the cut prior to blasting the line of holes on the face of the cut. It is quite important that the blasting for the main part of the rock does not shatter the rock back of the face of the cut. With either method, proper hole alignment is very important. The depth of lifts of rock excavation is dependent upon the depth that the holes can be drilled and maintain proper hole alignment. A setback of about 0.5 meter (1 foot) minimum is required for each lift of rock since it is impossible to position the drill flush to the wall of the upper bench slope.

The results obtained are dependent not only on the properties of the rock but upon the hole size, spacing, amount and type of explosive, spacing of the explosive in the hole, stemming and the timing of the blast. It is desirable that the Project Engineer keep a record of these procedures used by the Contractor, especially in the early phases of the work while the best methods are being sought.

After excavating the rock cuts, the slopes shall be scaled and dressed to a safe, stable condition by removing all loose spalls and rocks not firmly keyed to the rock slope. Mechanical scaling using dozers, front end loader etc., as the face is developed, is desirable. Any rock exposures which are felt to be a potential hazard to project personnel should be called to the attention of the Contractor. The Regional Materials Engineer should be advised of any such situation and assistance sought in making determinations regarding the competence of the finished slope. Loose spalls and rocks lying outside the slope stakes which constitute a hazard to the roadway shall be removed also and payment made for their removal in accordance with Section 2-03.3(2) of the *Standard Specifications*. Controlled blasting of rock faces may be measured by running a true profile over the top of the rock at each drill hole and quantities computed using cut-off elevations established for the bottom of the drill hole.

(f) Should soft areas exist in the subgrade of a completed earth cut, excavation below grade and replacement shall be accomplished in accordance with Section 2-03.3(3) of the *Standard Specifications*. Particular attention should be given to areas of transition between cut and fill. Top soil and other organic or unsuitable material should be removed from these areas and replaced with material suitable for subgrade in accordance with Section 2-03.3(14) of the *Standard Specifications*.

(g) The subgrade of cut sections must be checked for density as it is required and necessary that the entire roadway subgrade meet the compaction requirements specified for the project and set forth in Section 2-03.3(14) of the *Standard Specifications*. Density tests shall be taken for each 150 meters (500 feet) or fraction for each roadway. If the density of the subgrade is less than the required density, the subgrade material shall be removed, replaced and compacted in accordance with Section 2-03.3(3) of the *Standard Specifications*.

(h) Overbreak as defined in the *Standard Specifications* is that portion of the material which is excavated, displaced or loosened outside of and beyond the slopes or grade as staked or re-established, excepting such material which occurs as slides, regardless of whether any such overbreak is due to blasting, to the inherent character of any formation encountered, or to any other cause. All overbreak so defined shall be removed by the Contractor at no expense to WSDOT, except as hereinafter described.

Overbreak, as such, should not be paid for in any manner except when the planned roadway excavation is not sufficient to complete the embankment and borrow excavation has not been included in the proposal. With the approval of the Engineer, overbreak material may then be used to complete the embankment and payment made at the unit contract prices for Roadway Excavation and Haul.

When approved by the Engineer, available overbreak material may also be used in forming embankments that were originally planned to be constructed with borrow excavation. Payment for overbreak material used to replace borrow excavation will be made either at the unit contract price for Roadway Excavation or Borrow Excavation, whichever proves to be the most economical for WSDOT. Haul will be paid in accordance with the provisions set forth in the original proposal. If Haul was included in the proposal as a pay item, the Project Engineer will have to compare the cost of Roadway Excavation plus the cost of the Haul involved with the cost of Borrow Excavation plus the cost of the Haul involved to determine which method is the most economical for WSDOT. Haul will be paid for the distance actually hauled up to but not exceeding the haul distance of the replaced material.

In the event that conditions causing the overbreak justify re-establishing the slopes to include part or all of the overbreak section, the material reverts to roadway excavation material and shall be so paid for. Justifiable reason for re-establishing the slopes may be uncontrollable overbreak resulting from the existence of natural cleavage or faults in rock formations, planned slopes resulting in an unsafe and unstable condition, or other such reason. When a question

occurs as to justification for re-establishing slopes because of overbreak, the Project Engineer shall consult with the Regional Construction Engineer.

When overbreak is surplus material and re-establishment of slopes is not justified, the materials shall be removed and wasted as provided for "Surplus Materials" under Section 2-03.3(7) of the *Standard Specifications* except that the work shall be at the Contractor's expense, including the cost of hauling and wasting.

Where pay quantities of material are wasted and overbreak is used in lieu thereof, no allowance will be made for such overbreak. Haul in this case will be paid upon the basis of the pay quantities of excavation.

(i) The Project Engineer's attention is directed to Section 2-03.3(11) of the *Standard Specifications*, providing for the removal of slides in cut slopes and in embankment slopes. Any slides coming into the roadway after the slopes have been finished by the Contractor shall be removed by the Contractor at the unit contract price per cubic meter (yard) for the excavation involved. If the Project Engineer orders the slope to be refinished, such refinishing shall be paid for on a force account basis.

In case of slides in embankment slopes, the Contractor shall replace the embankment material from sources designated by the Project Engineer at the unit contract prices for the excavation involved.

In the event the slide is such that quantities cannot be measured accurately, or if the Contractor must use a different type of equipment for removal than that available on the project, payment may be made upon a force account basis or by negotiated price agreement.

(j) The Project Engineer's attention is directed to Section 1-07.14 of the *Standard Specifications*, providing for the Contractor's responsibility for sloughing and erosion of cut and embankment slopes. The ordinary sloughing and erosion of cut and embankment slopes shall not be considered as slides, and the Contractor is responsible for providing temporary control facilities to prevent this.

The following guidelines are provided to assist in determining responsibility for repairs to eroded areas:

1. Slides

   Slide repair costs will be borne by WSDOT, where there is no evidence of neglect by the Contractor.

2. Erosion of Slopes

   A. In places where water has run over the edge of the roadway and where the Contractor has neglected to provide adequate protection, the Contractor must assume the costs of repair.

   B. Where rain on cut and embankment slopes cause rivulets and wash, the Contractor must assume the cost of repairs except as noted hereinafter.

   C. Where erosion of cut or embankment slopes occur from ground water seepage, WSDOT must assume the cost of repairs.

3. Repairs

   A. In 2 B above, the Contractor must, at no expense to WSDOT, remove eroded material from the toe of slope, ditches and culverts and restore the eroded areas with this material where practicable. If additional top and/or embankment material is needed or different materials are ordered by the Engineer, it will be furnished and placed by the Contractor at unit contract prices.

   B. In 2 A where erosion has occurred and repairs are the Contractor's responsibility, the Contractor must restore the area at no expense to WSDOT, including the seeding, mulching and fertilizing.

   C. In 1, 2 B and 2 C where seeding, mulching, and fertilizing have been damaged, payment will be made for restoring same at the unit contract price for seeding, mulching and fertilizing.

2-3.1D Embankment Foundations

(a) The natural ground upon which an embankment is to be constructed may be such that it will impair the stability of the completed roadway. Such conditions must be corrected prior to starting embankment construction. Unsuitable ground such as peat, soft organic clay and silts must be removed or otherwise stabilized to prevent unequal or excessive roadway settlement or embankment failure. Areas requiring special foundation treatment will be shown in the plans and/or specified in the special provisions with the exception that possible detrimental soil at the transition between cut and fill and under shallow embankments may not be indicated. Particular attention should be given to these areas, and, in the event that highly compressible or unstable top soil or other undesirable material exists, it should be removed in accordance with Section 2-03.3(14) of the *Standard Specifications*. Materials removed under this provision within the 0.6-meter (2-foot) depth below subgrade allowed shall not be classified as "Unsuitable Foundation Excavation" but as "Roadway Excavation." If removal extends below the specified 0.6-meter (2-foot) depth limit, an agreed price or force-account arrangement must be made for the material below the 0.6-meter(2-foot) limit.

In the event that other unsuitable foundation material exists and is not indicated in the contract and is not within the limits of depth below subgrade as outlined above, the Olympia Service Center Construction Office should be contacted through the Region for a decision on treatment procedure.

Where embankments are built on hillsides or existing embankment slopes, the existing surface soil may form a plane of weakness, unless the slope is terraced or stepped by plowing deeply to key the new embankment to the slope. Keying the embankment to the slope is also important when constructing an embankment across a rather steep draw. This operation is a standard requirement for embankment construction as specified in Section 2-03.3(14) of the *Standard Specifications.*

(b) Where specified in the contract plans and/or the special provisions, unsuitable foundation materials shall be removed or otherwise stabilized as required. When removal is required, inspection should determine that the removal is complete to solid foundation. Where water exists in the excavation areas, it should be drained, if possible, by ditching so that excavation and backfilling can be accomplished in the dry. Where backfilling must be done under water, granular material should be used, and special care must be taken to avoid trapping unsuitable material in the backfilled area.

(c) Removal of unsuitable foundation material by displacement with or without the use of explosives should be attempted only where specified, or where recommended by the Olympia Service Center Materials Engineer and approved by the Construction Office.

(d) Embankment settlement can be accelerated by the use of overloads, vertical sand drains, or by vacuum pumping to lower the water table. These treatments should not be attempted unless specified by the contract provisions or recommended by the Materials Engineer and approved by the Construction Office.

(e) Settlement indicating devices are occasionally called for on the contract plans and special provisions when it becomes necessary to determine the extent and rate of embankment settlement. Settlement data is necessary for establishing construction schedules for adjoining or adjacent structures where the downward movement of the embankment and its foundation will influence the stability of the structure.

There are several types of settlement indicating devices in current use. The principals of each type and the instructions for installation and monitoring must be understood by all involved project personnel. The Regional Materials Engineer or the Olympia Service Center Materials Laboratory personnel should be consulted in these cases.

2-3.2 Embankment Construction

2-3.2A General Instructions

(a) It is expected that the Contractor will construct roadway embankments in accordance with the plans and specifications using construction methods and equipment considered suitable for the type of work involved. All operations must be directed toward constructing a uniform, well-compacted embankment true to grade and cross-section.

(b) It is necessary sometimes to construct an embankment across wet and swampy ground which will not support the mass (weight) of heavy construction equipment. It is the responsibility of the Contractor to select a method of construction and type of equipment which will least disturb the soft foundation. It is permissible to start the embankment by dumping and spreading the first layer to a thickness capable of supporting construction equipment across the soft ground, however, this initial lift should be held to the minimum thickness required for equipment selected in conformance with the above. The remainder of the embankment shall be constructed in layers and compacted as specified. Compaction will be required on initial embankment lifts wherever conditions will permit placement and compaction as specified.

(c) Proper compaction of roadway embankments and embankment slopes is of vital importance to the structural quality of the final roadway and strict adherence to specification requirements is essential. The type and thickness of the final surfacing and pavement is designed on the basis of the strength of the underlying materials, and the strength of these materials is affected greatly by their state of compaction, therefore, it is essential that the specified density be obtained. To enable the Project Engineer to determine that embankments are being compacted properly, control test procedures and density standards have been developed for his use during construction. It is expected that these aids will be utilized to the fullest extent necessary to determine that all embankments are constructed in accordance with specifications. Complete instructions for making maximum density and optimum moisture content determinations for soils and for making field density control tests are furnished with the appropriate testing equipment and in Chapter 9 of this manual.

(d) The Project Engineer and the Inspector should understand thoroughly the elements of the compaction process and compaction control procedures. The following brief resume should be supplemented by study of appropriate publications on this subject and by consultation with the Regional Materials Engineer. In general, it can be stated that each soil has a maximum density to which it can be compacted with a given compactive effort. For this compactive effort, the maximum density will be obtained

only at one moisture content. Increases or decreases in moisture cause a reduction in the density obtainable with the given compactive effort. When the moisture content is lower than optimum, additional compactive effort is necessary to achieve the specified density. When the moisture content is above optimum, low densities will result, and a soft, spongy condition may develop during the compaction process. In most cases, the moisture content of the material should be less than optimum when the material is covered, due to the fact that frequently materials are over-compacted by the heavy construction equipment now in use. Once the material is covered with another layer of material, it is very unlikely that the moisture content of the material will decrease.

(e) Certain soils, primarily fine grained soils having high silt content may become unstable by virtue of being over compacted even at moisture contents at or slightly above optimum but within specification limits. When working with these soils, the moisture content should be reduced below the maximum allowed if at all feasible, this may require aeration. Specifications provide for payment for this work. Also the Contractor should be requested to compact only to the minimum requirements; however, this is difficult to control. With modern heavy hauling and compacting units, over-compaction occurs with increasing frequency. When high fills are involved, not only may the subgrade be unstable, but the over-all stability of the fill may be reduced to the point that slump failure will occur. When such soil and moisture conditions are encountered, the Project Engineer should recognize the potential danger and notify the Regional Operations/Construction Engineer. Should corrective measures be necessary, one or more of several procedures may be used. When low fills are involved, increasing the surfacing depth, mixing with granular materials available, or allowing the fill to set undisturbed for a period of time may prove satisfactory. When a high fill is to be built, sandwiching layers of free-draining material, incorporating a system of trench drains, or mixing with other materials may prove satisfactory. In all cases, the correction must be aimed at neutralizing the excess pore-water pressure or changing the character of the material. Section 2-03.3(14)J of the *Standard Specifications* provides for the use of gravel borrow material for this type of work.

The gravel borrow may be mixed with the embankment material by placing a layer of the embankment material on a layer of gravel borrow and mixing the two materials using aeration equipment. The materials shall be mixed and the moisture content reduced to a satisfactory level. During drying weather, the gravel borrow material will tend to speed the reduction in moisture of the embankment material. After the moisture has been reduced to a satisfactory level, the layer of material must be compacted to the required density before another layer of material is placed. It is quite important that the moisture be reduced to a satisfactory level or the advantage of mixing with the gravel borrow will be lost.

An alternate method is to intersperse layers of gravel borrow throughout the embankment to reduce the pumping action of the soil and provide drainage for excess moisture. This method is prefered over mixing. The embankment material must be uniformly graded and sloped to the outside of the embankment so any excess moisture will have a chance to drain off. Care must be taken in placing the layer of gravel borrow so ruts or pockets are not formed in the embankment material which will trap moisture and prevent its draining off. The depth of the layers of embankment materials that will maintain the desired embankment stability shall be determined by field tests.

Drainage problems occur quite frequently when an existing embankment is widened, if there is moisture present in the existing embankment, through capillary action, subterranean drainage, or otherwise. If the new embankment traps the water in the existing embankment, usually the moisture saturates the embankment to a point that slump failure occurs. Whenever an existing embankment that could receive moisture is to be widened, drainage must be provided through the new embankment area. If the new embankment material is not free draining, one method of providing drainage is to layer the new embankment with gravel borrow layers at approximately 3-meter (10-foot) intervals vertically. Where seepage is noted the Regional Materials Engineer should be consulted so that an adequate drainage system is provided.

(f) When it is anticipated that certain cuts or borrow areas will contain considerable amounts of material with moisture content in excess of the optimum for proper compaction of embankments, aeration equipment may be included in the proposal for the project.

The inclusion of aeration equipment in the proposal will not relieve the Contractor of the responsibility of employing sound and workmanlike procedures in the prosecution of the work which are effective in constructing embankments with wet materials. Ditches to remove surface or subterranean drainage should be constructed whenever they can be effective and preferably in advance of excavation thus permitting time for drainage.

The function of aeration equipment is to provide thin, loose layers of material from which moisture can evaporate. Most soils tend to form a crust which retards the evaporation of moisture. Unless this material is worked to break up this crust, evaporation is quite slow. During good drying weather, a sheepsfoot roller is quite effective in certain soils in breaking up the surface of the soil and, in thin lifts of material, leaves large surface areas of soil exposed to

the air. However, no separate payment for a sheepsfoot roller will be made and the costs of same are incidental to embankment compaction.

If the material has a considerable amount of moisture above the optimum for proper compaction of embankments, it may be necessary to operate aeration equipment in the excavation areas as well as the embankment areas to increase the amount of material exposed for evaporation. The amount of moisture that will evaporate from the material is dependent on the prevailing weather conditions, the surface area of material exposed and the length of time the material is exposed to the air.

It must be kept in mind that thin loose layers of material will also soak up large amounts of moisture if it rains, so the surface of the materials must be sealed and sloped to drain off moisture whenever rain is imminent. It is the responsibility of the Contractor to seal the material against rain and in many cases this will have to be done at the end of work each day to protect against sudden, unexpected storms.

(g) The maximum density and optimum moisture content for a soil are determined by testing the soil in accordance with WSDOT Test Method No. 609 prescribed in Section 2-03.3(14)D of the *Standard Specifications* and described in Chapter 9 of this manual. This data is used to establish the density required by specifications. Each different soil may, and probably will, have a different maximum density and optimum moisture content, and it is necessary that tests be performed in the field for each different soil encountered. As each of the materials is being tested, a representative sample should be taken and placed in a sealed sample jar to serve as a future reference for identifying the materials on the grade during construction. It is the responsibility of the Project Engineer to arrange for all field testing necessary to supplement data furnished with the soils report.

Noncohesive sandy and gravelly soils and surfacing aggregate cannot be tested by the above-noted test method. Samples of these materials must be sent to the Regional Materials Engineer with a request for maximum density determination. This test method is described in Chapter 9 of this manual. A gradation vs. density curve will be established for use by the Inspector during construction.

(h) To determine if the embankments are being compacted properly, in-place density tests must be taken at frequent intervals. Results of these tests are compared to the density standard established for the soil (noncohesive granular material) being compacted, and are used as the basis for accepting or rejecting the work of the Contractor. Each lift of embankment should be tested before subsequent lifts are placed. When loose free draining sandy material is used for embankment construction the Inspector should dig down 300 millimeters (1 foot) and run a density test on the undisturbed material. In selecting an area to be tested, the Inspector should choose sites where the least compactive effort has been applied. A continuous record of the Contractor's method of compaction should be kept and compared to test results to assist in selecting a routine procedure which will yield required results. Compaction is required to the neat lines of the embankment, which include the shoulders and slopes. Proper compaction of embankment slopes will tend to minimize slope surface erosion which occurs often on newly constructed embankments.

Care must be taken to see that uniform density is obtained throughout each fill rather than to have some areas compacted greatly in excess of the density requirements, while other areas are below requirments. In order to achieve uniform density, it is essential that the water content be uniform since the density obtainable with a given soil is a function of the water content for any one compactive effort. In most cases the required density can be obtained with the least effort if the water content is very close to, but less than, the optimum established by standard moisture-density test. Noncohesive granular soils usually compact most easily when wetted to near saturation. The Contractor should be encouraged to establish a definite routine for compaction that will result in uniform compactive effort. When a considerable amount of grading equipment is concentrated in a small embankment area, it is difficult to maintain uniform compaction methods on each lift and the Inspector must be especially alert. When the size of the embankment area can be increased, uniform compaction methods can be more readily established, thinner lifts of material can be placed and moisture content can be better controlled.

The Speedy Moisture Tester is a good tool for the Inspector to use to check the moisture content of the material while it is being worked in the embankment. This will quickly tell the Inspector whether moisture must be removed or added before the layer is covered with additional material. The Inspector must be cautioned that due to the small amount of material used in the speedy moisture tester, it is essential that the sample used is actually representative of the material being worked. If the moisture content of the material being worked is quite uniform, this does not present too much of a problem.

When embankment construction is first started, the Inspector should give particular attention to the compaction methods and take more than the minimum number of density tests to determine the most advantageous compaction pattern that will give the desired compaction results. After a satisfactory compaction pattern has been established for the type of material being placed, the

density testing may be reduced to the minimum rate specified.

Where it is necessary to add water for compacting, this may be done either in the cut (or borrow pit) or on the fill. Water must not be added to material obtained from a borrow pit before weighing when payment is by mass. Addition of water in the cut allows the scrapers and hauling equipment to mix the water into the soil so that rolling can proceed immediately after spreading. Sprinkling should be done on a rough loose surface rather than on one which is smooth and tight because the water will not be so apt to run off or form ponds.

Daily compaction reports shall be submitted on Form 351-015. If there are questions concerning operational procedure on moisture-density tests, in-place tests, and reporting of results on the above form, consult the Regional Materials Engineer for advice and assistance.

Special attention shall be given to compaction around structures and bridge ends, where rollers cannot operate. Mechanical tampers or other approved compactors are to be used in these areas. Sufficient density tests shall be taken to ensure that compaction is continued on each lift until the specified density is attained. Failure to do so can result in settlement near the structure.

2-3.2B Rock Embankments

As established compaction tests cannot be applied to coarse granular material with any degree of accuracy, embankment construction has been divided into 2 classes: rock embankments, and earth embankments, as defined in Section 2-03.3(14) of the *Standard Specifications*. It should be noted that this designation is made for the fundamental purpose of determining the method of embankment construction and compaction control to be used, and that it depends only upon the gradation of the excavation material. It is not necessary that an embankment be built entirely of rock material to be designated as rock embankment. Rock embankment is defined as "all, or any part, of an embankment in which the material contains 25 percent or more by volume of gravel or stone 100 millimeters (4 inches) or greater in diameter." The Inspector shall make visual inspection of the embankment material to ascertain whether it contains 25 percent or more of material 100 millimeters (4 inches) or greater in diameter. For rock embankment, in lieu of controlling compaction by performing tests, a given amount of compactive effort is specified in Section 2-03.3(14)A of the *Standard Specifications*. Where the stability of a rock embankment is in question, moisture and density control as specified in Section 2-03.3(14)B and C of the *Standard Specifications* shall pertain. It is considered that uniform compaction to the full width of the embankment normally will not be achieved by routing hauling equipment over the roadway. Rolling equipment shall be required as specified whenever it is possible to operate such equipment on the material being placed. Decision to require or delete the use of rollers as specified shall be based on feasibility of operation rather than on an arbitrary estimate of benefits achieved, as this factor is very difficult to evaluate without conducting extensive and expensive tests.

2-3.2C Earth Embankments

(a) Procedures for constructing earth embankments as described in Section 2-03.3(14)B of the *Standard Specifications*, require compaction in accordance with one of three methods designated as Method A, Method B, or Method C. Unless otherwise specified in the special provisions, Method B will apply. The basic requirements of all three methods are the same in that each requires lift construction, uniform compaction throughout the embankment width and depth, control of moisture content to not more than three percent above optimum, and the addition of moisture should it be necessary for proper compaction. The difference between the three methods lies in the thickness of lifts specified, the degree and control of compaction required, and the degree of control of moisture below optimum. The use of suitable compaction units is required for Method B and Method C, although routing of hauling units may be used to obtain partial compaction.

(b) Method A normally will not be specified for state highway work, but may be applied on county or city projects or on certain secondary state highway projects. Embankment lifts up to 0.5 meter (2 feet) in thickness may be placed, and compaction is achieved by routing the hauling equipment over the entire width of the embankment. Inspection should determine that the routing schedule is such that all parts of the fill receive the same amount of compaction, including the outer edges of the fill. Drying of soil or addition of moisture may be required, if necessary.

(c) Method B will be used on all state highway projects except where other methods are specified. This method requires that the embankment be constructed in lifts not exceeding 200 millimeters (8 inches) in loose thickness except that lifts in the upper 0.5 meter (2 feet) shall not exceed 100 millimeters (4 inches) in loose thickness. Ninety percent of maximum density is required throughout the embankment except that 95 percent of maximum density is required in the upper 0.5 meter (2 feet). Control density tests must be performed to verify compliance with specifications. The Contractor shall be required to dry soil or add moisture as necessary to ensure proper, uniform compaction. The selection of compaction equipment or methods is the responsibility of the Contractor; however, the use of any method or equipment that does not achieve

the required density within a reasonable time may be ordered discontinued. The entire embankment, including the side slopes, shall be compacted to specification requirements.

(d) Method C will be required when it is considered essential to the structural quality of the embankment that the entire fill be compacted to a high density. This method differs from Method B in that the entire embankment must be compacted to 95 percent of maximum density. Also, a limit is specified for minimum moisture content in addition to the maximum to ensure moisture content uniformity. In all other respects, the two methods are the same, and each requires a high standard of compaction control.

2-3.3 Borrow Pits

The material in borrow pits must be satisfactory for the use it is intended. If the character of the materials is not readily visible, adequate sampling and testing should be done to verify the quality and the quantity of material available. The Project Engineer should check the records to see that this determination has been made, and if any doubt exists to the adequacy of the source, the Regional Materials Engineer should be contacted to see if further testing is indicated. This detail could save considerable time, expense and future problems if it is determined that a pit is unsatisfactory before extensive work is performed in opening the pit and then discovering that the material is not acceptable.

Sections 2-03.3(14)K, 9-03.20, and 9-03.21 of the *Standard Specifications* provide for the use of select and common borrow for use in construction of embankments. Materials which meet these specifications are intended for use where it is not necessary to strictly control the strength properties of the borrow. Select or common borrow materials should not be used as backfill for mechanically stabilized earth walls, to backfill unsuitable material excavation below groundwater, or as foundation material for any structure, unless specifically approved for use by the Olympia Service Center Geotechnical Branch. The material requirements for select and common borrow will not ensure that the materials will be workable and able to be compacted under inclement weather conditions. Because select or common borrow materials may be subject to moisture sensitivity as described above and in Chapter 2-3.2A(e), compaction of these materials may require control using WSDOT Test Method 609 (Standard Proctor) which provides a moisture density relation for the particular borrow material. Section 2-3.3(14)D of the *Standard Specifications* specifies when Test Method 609 is used in lieu of Test Method 606.

Common borrow, as specified by Section 9-03.14(3) of the *Standard Specifications*, may be virtually any soil or aggregate, either naturally occurring or processed, which is substantially free of organics or other deleterious material, and is nonplastic. The specification allows for the use of more plastic (clayey) common borrow when approved by the Engineer. The use of more plastic (clayey) material may require approval of the Regional Materials Engineer or the Olympia Service Center Materials Lab. The 3 percent maximum organic material requirement for common borrow may be determined visually, or, as necessary, by one of the following test methods: AASHTO T 194 (Organic Content by the Wet Combustion Method) or AASHTO T 267 (Organic Content by Loss on Ignition). The correct test method is determined based on the type of organic material present in the soil sample. The Regional Materials Engineer should be consulted as to the appropriate test method. The sample may be field determined to be nonplastic if the fraction of the material which passes the 0.425 mm (U.S. No. 40) sieve cannot be rolled into a thread at any moisture content using that portion of AASHTO Test Method T 90 (Determination of the Plastic Limit of Soils) which describes rolling the thread.

The requirements of Section 2-03.3(13) of the *Standard Specifications* must be observed in the operation and cleanup of borrow pits. With the requirement for reclamation of all pits, a plan must be developed to meet the requirements of the specifications and special provisions and approved before the start of pit operations. See Chapter 3-3 of this manual.

2-3.4 Temporary Water Pollution/Erosion Control

Section 1-07.15 of the *Standard Specifications* covers the requirements for controlling erosion and water pollution on the project. These provisions limit the area of erodible earth material which may be exposed at one time and provide that the Contractor will be paid for construction of temporary pollution/erosion control work.

Prior to the start of the applicable construction, the Contractor is required to submit for acceptance a plan and schedule for accomplishment of temporary water pollution/erosion control and permanent erosion control work. This plan and schedule shall be submitted prior to the beginning of work. No progress payment will be made until this plan and schedule are received. This plan should be reviewed to see that the Contractor has attempted to anticipate all the erosion and water pollution problems that may exist and has outlined and scheduled positive methods to alleviate or control them. If the plan appears to be adequate, acceptance shall be given by the Region with a copy submitted to the Olympia Service Center Construction Office.

Scheduling of permanent erosion control shall be incorporated as activities in the required progress schedule

for the project and shall be evaluated as to adequacy on the basis of scheduling at the earliest time practical.

Preplanned or obviously required temporary water pollution/erosion control measures may be included in the required progress schedule or scheduled separately. Where appropriate, they should be keyed to project schedule activities.

Temporary water pollution/erosion control needs that cannot be predicted may be outlined as procedures that will be used should certain conditions develop.

To meet the requirements of the specifications at the beginning of the project while the Contractor is preparing a CPM project schedule and pollution control plans, the Contractor may submit a letter covering the erosion control plans and schedule for the initial phase of the construction. This letter must be followed up with plans as soon as practicable. The following are some of the features that should be covered in the Contractor's proposal:

a. Time period initial earthwork is to be accomplished (by date).

b. Station limits of earthwork related items.

c. Mobilization effort and scheduling of adequate personnel, equipment and material.

d. Outline of basic earthwork construction features.

e. Outline of specific problem areas and methods to take care of them.

f. Applicable contract plan sheets marked in red.

On smaller projects, this letter schedule would be adequate in fulfilling the contract requirements.

On larger, more complex projects, the pollution/erosion control work could be included in the CPM schedule or covered in several letters and plans covering each phase of the project as the work progresses.

Where erosion is likely to be a problem, the specifications limit the area of erodible earth material that may be exposed at one time by clearing and grubbing to 70,000 square meters (750,000 square feet), without the approval of the Engineer. If clearing is done separately from the grubbing work, erosion may not be a problem and therefore, the area of clearing would not have to be limited, but the area of grubbing would if the area is erodible. If the Contractor feels that the area limitation for grubbing is too restrictive to accommodate the grading operations, a request should be submitted for approval to open a larger area and outline the proposed plan and schedule for all temporary or permanent pollution/erosion control that may be necessary. The temporary erosion and water pollution control measures to be taken must be consistent with the potential for the amount of damage that may be anticipated.

The area of excavation, borrow, and embankment operations in progress is also limited by the specifications to 70,000 square meters (750,000 square feet) and must also be commensurate with the Contractor's capability and progress in keeping the finish grading, seeding, mulching and other permanent erosion and water pollution control measures current in accordance with the approved schedule. If the Contractor feels this area limitation is too restrictive, a request should be submitted the same as outlined for the clearing and grubbing work.

Evaluation of the Contractor's request for increased areas shall be the Region's responsibility and shall recognize that the job progress is of critical importance and should not be impeded except when clear probability of detrimental erosion potential exists.

Any pollution/erosion control work provided in the plans, shall be paid as specified in the contract. Other water pollution/erosion control work performed in accordance with the approved plan or ordered by the Engineer will be paid for as detailed below:

1. **WSDOT Provided Sources, Contractor Provided Sources and Haul Roads for Same (when no sources are provided in the contract), and Haul Roads Provided in the Contract.**

Such water pollution/erosion control work which does not differ materially from specified contract work shall be measured and paid for at unit contract prices.

Such water pollution/erosion control work not covered by contract items will be paid for on a force account basis in accordance with Section 1-09.6 of the *Standard Specifications*.

2. **Equipment Storage Sites, Contractor Provided Sources and Haul Roads for Same (in lieu of WSDOT provided sources).**

All temporary water pollution/erosion control requirements as detailed in the specifications will apply.

All work as scheduled will be performed by the Contractor at no expense to WSDOT.

3. **Commercial Sources.**

The exception to Contractor provided sources will be commercial sources. All water pollution control requirements are the responsibility of the owner and/or operator of any commercial sources.

To further clarify areas of payment and nonpayment, the following examples are listed:

1. Operational expenses incurred on water pollution control facilities will be paid for by force account. This shall include servicing and cleaning settling basins, diversion ditches, and temporary culverts.

2. Settlement ponds for control of pollution while dewatering of excavations or cofferdams are eligible for payment. Temporary water pollution control measures required as a result of stream diversion to allow construction of permanent facilities are also eligible for payment.

3. Any temporary erosion and water pollution control work that is required due to the Contractor's negligence, carelessness or failure to install permanent controls as part of the work as scheduled, shall be constructed by the Contractor at no expense to WSDOT.

These are but a few examples and it is realized that isolated circumstances will arise which will need further study. Any questions should be referred to the Regional Operations/Construction Engineer and if necessary, to the Olympia Service Center Construction Office.

Since the Contractor is responsible for any erosion or pollution damage which may occur on the project, the Contractor must anticipate potential erosion and pollution problems and propose methods to take care of the problems. Any reasonable proposed method should be carefully reviewed to avoid placing ourselves in a position of being responsible in case of damage because of our denial of the Contractor's proposed method.

In the Fall months, prior to the "rainy season" or a winter shutdown, the Project Engineer must schedule an on-site review of the project with the Contractor for the specific purpose of identifying appropriate erosion prevention measures that can be taken, such as constructing temporary ditches, sumps, pipes, ditch lining, slope cover, etc., which will reduce and minimize the potential for erosion during the winter months.

2-3.5 Measurement and Payment

2-3.5A General Instructions

Quantities and items involved in grading operations including compaction of embankments shall be measured and paid for in accordance with Sections 2-03.4 and 2-03.5 of the *Standard Specifications*, and Chapter 10 of this manual.

2-3.5B Use of Electronic Computer

The electronic computer may be used to determine earthwork quantities, finished roadway or subgrade elevations, slope stake data, and haul quantities.

For complete instructions for submitting earthwork data to the Computer Section, refer to the *Washington Computer Manual* M017-01.

The method followed to determine the earthwork quantities in the location and design of a project has a direct bearing on the method of utilizing the electronic computer immediately previous to and during construction of the project. The type and size of the project and the amount of time that can be saved will be considerations in the selection of the method of submitting data to the Computer Section.

All applicable records of computed data shall be kept and will become a part of the final records to be forwarded to the Olympia Service Center when the job is completed.

If the computer was not used in the design stage of the project it may still be convenient and economical to prepare data to submit to the Computer Section for construction quantities.

2-3.5C Use of Photogrammetry Service

The photogrammetry service may be used to obtain ground line elevations for the cross-sections. As is the case with utilizing the computer, the type and size of the project and the amount of time that can be saved will be considerations in the selection of the method of obtaining the ground line cross-sections. The Project Engineer must also ascertain that the work schedule of the Photogrammetry Section will permit them to provide the cross-sections by the time they are required. If proper ground control was established on the project during the design stage, considerable savings in time may be realized by using this service.

The ground line is obtained from aerial photographs and will show the ground as it existed at the time the photographs were taken. This ground line data is measured in the Stereo plotter and transferred to a computer file. The Photogrammetry Branch will copy this file and identify it with a name that will be accessible to the Project Engineer. The file name will be printed on a listing of the ground line data which is sent to the Project Engineer. The Photogrammetry Branch will retain the original file under a secure name to be used as a "back up" in case the working file is lost.

When remeasure cross-sections are required, it may be advantageous to request them from the Photogrammetry Section. Again, the Photogrammetry Section will furnish the Project Engineer a listing with a working file name of the remeasured ground line while retaining a secure "back up" file. It is the responsibility of the Project Engineer to send the required information to the Computer Section to compute the quantities desired. The Project Engineer is cautioned that this ground line represents the ground as it existed at the time the photographs were taken and they may include such things as slope treatment, surfacing,

waste materials, force account work, or other similar items. If the area viewed on the day the photographs were taken include any such items, the Project Engineer must make corrections for these items. The Project Engineer may request the Photogrammetry Branch to compute the remeasured quantity, especially in the case of pit sites where there are no other engineering factors to consider.

2-4 Haul

2-4.1 General Instructions

Haul is the transportation of excavated material. Measurement and payment for haul is made on material hauled.

The measurement of haul is expressed as a unit of one hundred cubic meters (yards) hauled 100 meters (yards).

Haul quantities will be computed routinely by the Computer Section on all earthwork submitted to them, and the limits of each segment of haul and the "Haul" units will be listed.

Haul in units will be shown as indicated on the Standard Mass Diagram.

Haul shall be calculated and included in the section from which the material is hauled. Haul on roadway quantities, including borrow obtained by the widening of cuts and including waste deposited along roadway embankment slopes will be computed on the basis of transporting material along the centerline or base line of the highway.

2-4.2 Mass Diagram

A mass diagram is prepared on grading projects in order to determine the economical haul of the material from excavation to fill and thereby eliminate any unnecessary borrowing and wasting. Although wasting materials and borrowing in lieu thereof may sometimes be necessary, such operations should be kept to an absolute minimum. The wasting of soils unsuitable for use in the roadway section is entirely justifiable.

A mass diagram consists of one or more horizontal balance lines and an undulating line prepared from computed ordinates, which may weave back and forth across the balance lines. Horizontal ordinates represent distances in stations, and vertical ordinates represent volumes in cubic meters. The diagram shows clearly where it is best to waste or borrow, in what direction the material should be hauled and how far. Standard practice has adopted the policy of laying out a mass diagram from left to right. This is important because if this practice is not followed the computations may become quite involved.

Keeping in mind that the mass diagram is laid out from left to right, ascending lines represent either excavation or an excess of excavation over embankment; and descending lines represent either embankment or an excess of embankment over excavation. Excavation quantities will swell or shrink when placed and compacted in embankments. Most natural soils will compact to a volume which is less than the natural volume. The mass diagram accounts for the "swell" or "shrinkage" by decreasing or increasing, respectively, the neat line embankment volumes by an appropriate percentage factor. It must be indicated on the mass diagram, what factors were used and where they were applied.

It is common practice to assign a value of "zero" to the beginning ordinate rather than some assumed value and this method is preferred. The ordinate for the first station beyond the beginning of the project is determined by adding or subtracting the difference between the "adjusted volumes" of excavation and embankment; an excess of excavation being additive, an excess of embankment being subtractive. Succeeding ordinates are computed for each station to the end of the project. These ordinates are then plotted to a convenient vertical scale and connected.

A perfectly balanced grading project would be one in which the ordinate at the beginning and at the end of the project equal zero, and the undulating ordinate line crosses and recrosses the balance line at approximate uniform distances along its length. Ordinarily, the grades should be lowered or raised so as to attain this objective within reasonable limits; however, there may be other controls in the particular project which will prevent this. The haul above the balance line is forward or to the right, and the haul below the balance line is backward or to the left. Between any two points where the ordinate line intersects the balance line, the amounts of excavation and embankment are equal. Any point where the ascending ordinate line reverses to a descending line represents a change from excavation to embankment; and, conversely, any point where the descending ordinate line reverses to an ascending line represents a change from embankment to excavation.

Careful consideration shall be given to the economical limit to which material can be hauled. It is economy to stop haul at the points where the cost of hauling equals the cost of procuring the material in some other way. Haul, as a rule, should stop at obstacles beyond which it is not considered reasonable to move materials.

Change in kind of materials will require a change in the shrinkage or swell factor, and does not permit the practice of using uniform factors for the entire project regardless of material encountered. The factor used shall be shown for each hauling operation between balance points.

Shrinkage or swell (compaction factor) may be submitted by the Engineer to the Computer Section as plus or minus

percentages, or he may submit a list of balance points, and allow the computer to determine the compaction factors.

The mass diagram can be machine plotted in accordance with the Design Standard, on either white paper or on tracing paper, when earthwork quantities have been determined through use of the electronic computer.

2-4.3 Haul on Borrow or Waste

Quantities of material hauled from a borrow site to the roadway or from the roadway to a waste site are computed normal to the long axis of the borrow or waste site. When computing the amount of haul, determination of the direction of movement of the mass and the distance it is transported requires good, practical judgment by the Engineer. The size and shape of a borrow pit and egress from the pit to the highway improvement must be considered in the proper determination of the amount of haul. The same conditions are true in the case of waste sites. Instructions herein for computing haul from borrow pits shall be applicable to computing haul to waste sites.

The long axis of the borrow pit should be used for the base line of the cross-section which, theoretically, would pass through the centers of gravity of the sections; however, the base line may approximate the centers of gravity of the sections. Borrow pits which are provided by widening of the roadway cuts would be an exception to this since the *Standard Specifications* define them as “Roadway Excavation” and not “Borrow.”

The measurement of the distance from the pit to the center line of the roadway should originate at the center of mass as measured in the pit and be computed via the most direct and feasible route to the nearest practical point on the center line of the roadway.

The route of haul will be indicated on the plans, and, where possible, will be via existing roads. If no road exists, provision will be made in the plans for constructing a haul road and for rights therefor.

If the Contractor chooses to haul over a route shorter than the computed or designated route, payment for haul will be based on the length of the actual haul route. If the Contractor chooses to haul over a longer route than the computed or designated route, payment for haul will be based on the length of the computed or designated route.

A separate mass diagram shall be made for each borrow pit which is isolated from the roadway cut. Where an embankment is built from more than one isolated borrow pit, separate mass diagrams showing the distance from each shall be made. All such supplementary mass diagrams shall be shown on the same sheet as the diagram for the roadway, when possible.

2-5 Slope Treatment

2-5.1 General Instructions

Earth cuts, soft or decomposed rock cuts, and overburden in all rock cuts shall have the tops of the slope rounded in accordance with Standard Plan H-8 to produce an aesthetic and pleasing appearance. The slope treatment shall be constructed at the time of excavation so the material resulting from the rounding of the slopes may be disposed of along with the excavation from the cut.

The Project Engineer should go over the slope treatment procedure with the Contractor at the beginning of the excavation operation to ascertain that proper rounding is being constructed and reduce extensive reworking.

2-5.2 Measurement and Payment

Slope treatment shall be measured and paid for in accordance with Section 2-03.3(5) of the *Standard Specifications*.

2-6 Subgrade Preparation

2-6.1 General Instructions

The subgrade shall be constructed in accordance with the lines, grades, and typical sections shown on the plans or as established by the Engineer and the *Standard Specifications*.

The subgrade should be uniformally compacted to the density specified rather than to have some areas just meeting the requirements while other areas are considerably above the minimum requirements. The subgrade shall meet the tolerance in Chapter 1-5.7A of this manual. On some separate grading projects where the surfacing Contractor will be required or elects to trim the subgrade with an automatically controlled mechanical trimmer, the tolerances for the subgrade must be changed to provide material for the subgrade trimmer to trim, but the trimmed subgrade must meet the tolerance stated above.

After the subgrade is prepared, the Contractor shall maintain it in the finished condition until the first course of surfacing or the pavement is placed on it.

2-6.2 Measurement and Payment

The quantities of work involved in constructing and maintaining the subgrade shall be measured and paid for in accordance with the provisions of Section 2-06.5 of the *Standard Specifications*.

2-7 Watering

2-7.1 General Instructions

Water shall be applied as ordered by the Engineer, in accordance with the specifications, uniformly to the material so that all of the material will have approximately the same moisture content. It is more economical and effective to apply water at night or in the early morning hours when loss from evaporation is lower. In many instances this is the only time that it is possible to increase the moisture content to that required.

The Inspector should be alert to see that the subgrade is not damaged from too much water being applied or that more water is being applied than is necessary. Usually light applications applied more frequently are more advantageous than heavy applications. The water should not be applied on surfacing materials with such force that it will wash the fine particles off the coarser ones causing segregation.

2-7.2 Measurement and Payment

Water shall be measured and paid for in accordance with the provisions of Sections 2-07.4 and 2-07.5 of the *Standard Specifications*.

If water is a pay item, the Project Engineer shall verify the size of the water truck by measuring or weighing and if gauges are used, he should also verify the accuracy of the gauge. A record of measurements or masses (weights), and calculations must be made for future references.

The water truck driver must make a Daily Delivery Record, Form 422-024, showing the time of each load and where it was placed. At the end of each shift, the Inspector will issue a ticket for the amount of water used for the shift. The Inspector shall make spot checks to verify the accuracy of the truck drivers record and record these checks in the diary.

2-9 Structure Excavation

2-9.1 General Instructions

Before starting structure excavation, stakes should be set to locate the structure and cross-sections should be taken to determine the quantities of material involved.

During the progress of excavation, the character of material being removed and exposed should be examined to determine if it is suitable for use as backfill and to ensure that acceptable foundation conditions exist. This should be done especially on streams subject to high velocity flood water and which carry drift. Open pit excavation or “glory holes” are not allowed without permission. This specification is of special importance in application to the construction of foundations in or adjacent to running streams, where the approval of the Olympia Service Center Construction Office should be secured.

Material obtained from structure excavation may be used for backfilling over and around the structures, for building embankments, or it may be wasted. When this material is stockpiled for backfilling the Contractor is required to protect it from contamination and the elements. If not properly protected, the Contractor must replace the lost material with acceptable backfill material at no expense to WSDOT. The backfilling of openings made for structures must be made with acceptable material from the excavation, other acceptable backfill materials indicated in the plans and special provisions, or as specified in Section 2-09.3(1)E of the *Standard Specifications*.

When water is encountered in the excavation area it must be removed before backfilling. Cost for accomplishing this is considered incidental and is done at the Contractor’s expense.

All excavation 1.22 meters (4 feet) or more in depth shall be shored, or protected by cofferdams or shall meet the open-pit requirements of Section 2-09.3(3)B of the *Standard Specifications*. The Contractor must submit 6 sets of drawings showing the proposed method of shoring. These drawings must be approved before construction begins. WSDOT’s approval, however, does not relieve the Contractor of responsibility of satisfactory results.

The Contractor is required to submit detailed plans of cofferdams for approval when cofferdams are required. This requirement shall be strictly followed. When a cofferdam is required on a railroad right of way, excavation must not be commenced before the plans have been approved by the railroad company. The Contractor should be notified of this requirement well in advance of starting such work, as it usually takes several weeks to get plans approved by the railroads. See Chapter 6-1.5 of this manual for the number of copies to submit and distribution of approved plans.

Cofferdams, in general, must be removed to the bed of the stream, or to below the low water mark. In some cases, it may be advisable to leave the cofferdam in place. The Cofferdam is, however, the property of the Contractor.

When timber sheet piles are used for cofferdams, the Project Engineer shall see that the timbers are held tightly together during driving and placing, so that no cracks or holes are left, through which water can flow. Cofferdams should be built slightly larger than the neat size shown on the plans. This is to allow for inaccuracy of driving sheet piles.

Where bearing piles are to be driven, the excavation should be carried deeper to allow for upheaval of soil due to pile driving. This extra depth will depend on the

character of the material. Usually in sand and gravel from 150 millimeters (6 inches) to 300 millimeters (1 foot) and a river or tide mud from 300 millimeters (1 foot) to 450 millimeters (18 inches) is sufficient. Such over-excavation is the Contractor's responsibility. Over-excavation shall be backfilled with gravel backfill to the footing elevation if the upheaval is less than anticipated.

In soft mud when the driving of piles tends to liquify the foundation material it is sometimes necessary to excavate below plan grade and backfill with gravel before concrete is placed. When the Engineer considers this to be necessary and approval of the Construction Office has been secured, the additional excavation shall be paid for at the unit contract price for structure excavation and the gravel backfill shall be paid for on force account basis or at an agreed price.

Excavations shall be carried to the elevation shown on the plans or as established by the Engineer. The Project Engineer should take into consideration the fact that when a clamshell bucket is used, it is very difficult to clean the hole to an exact given elevation. For direct-bearing footings, the corners and sides of the excavation should be cleaned out as well as possible and there should not be an excess of loose material left in the bottom. If the character of the material found at plan elevation is questionable, consult the Regional Materials Engineer.

When the excavation for the footing has been completed, elevations to establish the footing elevation shall be taken in the corners of any footing and recorded in the project records.

The material on which spread footings are to be constructed must be adequate to support the design soil pressure per square meter (foot) shown in the plans. Usually this can be determined by visual inspection by the Project Engineer. If there is any doubt that the soil will support the design load without excessive settlement the Regional Materials Engineer should be consulted. If a change of design or the lowering of a footing appears to be advisable, the Olympia Service Center Construction Office should be advised.

Occasionally bents adjacent to large piers are founded at a higher elevation than the pier foundation. In these cases, the Contractor must carry on operations so that the foundation for the bent will not be disturbed when excavation is made for the lower pier.

Backfilling holes made for piers and column bents up to the surface of the surrounding ground may be done at any time after the forms are removed, providing the backfilling is brought up evenly on all sides of the pier or column.

Backfilling around piers and bents in streams shall be done carefully with material suitable to resist scour, and be brought up to a height not less than the original bed of the stream. Embankment backfill against abutments, piers, walls, culverts or other structures, shall not be placed until the concrete has attained 90 percent of its design strength and has cured for at least 14 days.

It is very important that drainage be provided in back of retaining walls, tunnels and structures having wing walls or abutments to eliminate excessive soil pressure. Weep holes shall be placed as shown on the plans and as low as possible. Gravel backfill for walls, or other suitable materials shall be placed directly behind the structure. If drainage is a major problem, it may be necessary to also construct perforated drain pipe or French drains behind the structure.

The construction of embankments and backfill around bridge ends shall be in accordance with Section 2-03.3(14)I of the *Standard Specifications*. The fill around bridge ends shall be brought up equally on all sides of the bracing, columns and bulkheads to avoid distortion and displacement of these members by earth pressure. The embankment and backfill at both ends of all rigid frame concrete structures which do not have provisions for expansion, shall be brought up and compacted simultaneously to avoid lateral displacement of the structure due to unbalanced earth loading.

Around structures and bridge ends, where rollers cannot operate, compaction shall be obtained by the use of mechanical tampers. Density tests shall be taken frequently enough to ensure that compaction is continued on each lift until the specified density is attained.

Structure excavation is classified into 2 classes. The excavation necessary for the construction of bridge and retaining wall footings, and seals is classified as Structure Excavation Class A. All other Structure Excavation is classified as Structure Excavation Class B. See Sections 2-09.3(3) and 2-09.3(4) of the *Standard Specifications*.

2-9.2 Measurement and Payment

Structure excavation shall be measured and paid for in accordance with the provisions of Sections 2-09.4 and 2-09.5 of the *Standard Specifications*.

2-10 Ditch and Channel Excavation

2-10.1 General Instructions

Areas where open ditches are to be constructed shall be cleared and grubbed the same as areas for roadway excavation.

The excavated material may be used for the construction of dikes, berms or otherwise disposed of as shown on the

plans or as directed by the Engineer. The materials should not be placed in embankments unless it is suitable for embankment construction.

2-10.2 Measurement and Payment

Ditch and channel excavation shall be measured and paid for in accordance with the provisions of Sections 2-10.4 and 2-10.5 of the *Standard Specifications*.

2-11 Trimming and Cleanup

2-11.1 General Instructions

This work shall consist of dressing and trimming the entire roadway or roadways improved under the contract. The shoulders, ditches, and back slopes shall be trimmed to the specified cross-section to produce a neat and pleasing appearance. All waterways, culverts, and drainage structures shall be opened up and cleaned to ensure designed drainage. This includes existing drainage within the project limits specified in the contract.

2-11.2 Measurement and Payment

Trimming and cleanup will be measured and paid for in accordance with the provisions of Section 2-11.5 of the *Standard Specifications*.

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3A:DP:CM

3-1 Production

3-1.1 General Instructions

In the production of crushed and screened materials, continuous and effective inspection throughout all phases of the work is essential in order that WSDOT will obtain the best possible product from the available material. The Project Engineer is responsible for the enforcement of all specifications governing pit operations, crushing and screening procedures, and handling and placing of the product, as well as the various specifications governing gradation and quality.

The Project Engineer must see that the Inspectors are equipped with the proper tools to test and inspect the materials, and that facilities are available at the plant site to enable the Inspector to carry out the work in the proper manner and obtain test results which are accurate and complete. The Engineer must make certain that the Inspector understands the nature of the work to be performed, and is acquainted thoroughly with the applicable specifications, and that the Inspector is proficient in the various testing techniques.

The Inspector shall be familiar with the methods and procedures involved in crushing and screening operations so that the Inspector can appraise intelligently the causes of troubles when they occur. The Engineer or Inspector must never attempt to tell the Contractor how to conduct their operations (except where required by the specifications), but a good working relationship with the Contractor, based on a mutual respect for each other's knowledge and ability, will do much to ensure an efficient operation and a good product.

3-1.2 Preparation of Pit or Quarry

The portion of the quarry or pit site to be used must be stripped and prepared in accordance with the requirements of Section 3-01 of the *Standard Specifications*. The strippings from the pit must be stockpiled or disposed of in accordance with the reclamation plan as covered in Chapter 3-3 of this manual. Care must be taken in this operation so that usable material is not fouled or lost for future use. In most cases, the manner in which the site is worked will determine how much work will be required to dress it up in accordance with the reclamation plan.

3-1.3 Sampling and Testing

It is imperative that the Engineer keep the Contractor informed of test results at all times. If the material being produced does not meet the requirements of the specifications, the Contractor must be informed immediately that it is unacceptable, so that corrections may be made. The Inspector must keep a record of daily test results, using Form 422-020, Inspector's Record of Field Tests.

Several field control tests are required by the specifications for the class of material involved. These tests are: (1) screen analysis for gradation, (2) sand equivalent test for detrimental fines, (3) examination of the material to determine percentage of fractured pieces, (4) moisture determination test, (5) organic matter content test.

The Inspector shall conduct these tests as often as necessary each day, following the instructions for sampling and test methods described in Chapter 9 of this manual. When production is first started, and until the production has resulted in a uniform product well within specification requirements, tests need to be taken more frequently than the minimum specified. Special care must be exercised to ensure that the sample taken for testing is representative of the material being produced.

The Inspector's Record of Field Tests is made in sets on NCR paper. The white copy is to remain in the book and become a part of the temporary final records. The canary copy is to be forwarded to the Project Engineer daily. The pink copy is to be delivered or mailed to the Prime Contractor daily. The goldenrod copy is for the Contractor's Foreman in charge of producing the materials and should be delivered as soon as practical after completion of each test. When the test results show the material fails to meet specification requirements, the Inspector shall explain in the remarks section on the test form what action was taken to correct the deficiency. This form has the twofold purpose of providing a record of the test results and of keeping the Contractor informed of the quality and gradation of the material being produced.

Samples shall be taken as provided in Chapter 9 of this manual and forwarded to the Olympia Service Center Materials Laboratory in the amounts and at intervals therein specified.

Job site samples shall be obtained, tested, and recorded in accordance with the *Standard Specifications*, the

contract special provisions, and Chapters 9-5 and 10-3.5 of this manual.

When materials are being produced and separated into two or more sizes, as in the case of aggregates for asphalt mixtures, screen tests of each size shall be averaged over a reasonable period of time and a mathematical combination of the total aggregates made, taking into account the proportional amount of each size being produced. The Contractor shall be advised of the results as soon as possible so that adjustments necessary to produce materials having the desired gradation can be made. A great many difficulties encountered during production of the asphalt mix may be avoided by careful attention of both the Contractor and the Inspector during the production of aggregates.

Samples of aggregate for bituminous mixtures shall be submitted to the Materials Laboratory for determination of a mix design. These samples must be representative of the average grading of separate materials produced and information concerning the proportions of coarse and fine aggregates produced shall be included in the letter of transmittal. If it is apparent from results of field tests that blending sand will be required, a sample of this material shall be included in the shipment.

Ample time for testing of the materials must be allowed. A minimum time of a week to two weeks will be required by the laboratory to complete the tests and advise the Project Engineer of the recommended mix design. The *Standard Specifications* require allowance of ten working days for mix design work after receipt of material and data in Tumwater.

3-1.4 Pit Operations

The Inspector must be alert to detect changes in test results, and look for evidence of changes in the character of the pit, or changes in crushing or screening procedures, as possible causes of variations. The use of production control charts provides an excellent visual means of detecting changes in the material being produced. Use of these charts is recommended for any significant production operation. Some quarries and pits contain pockets or areas of unsuitable material. The Inspector should keep familiar with the condition of the pit so if areas of unsuitable material do appear, steps can be taken to by-pass these materials.

Many quarries and pits require scalping to remove a portion of the fine material. When scalping is required, it is necessary for the Inspector to check to be sure the scalping screen does not become coated or plugged so the fine material is being incorporated in the finished product. When a scalping screen of a certain size is required in the special provisions, the Inspector shall check to see that it is of sufficient size and capacity that most of the material finer than the specified size is removed.

The Inspector must watch for evidence of segregation of the material on conveyor belts, in bunkers, or in discharging material into trucks. If any evidence of segregation is found at any stage of manufacture or handling, corrective devices, such as baffles, mixing chutes, rock ladders, etc., must be required.

3-1.5 Outline of Inspector's Duties

Some of the most important duties of inspection are listed below:

1. See that overburden is stripped from pit in proper manner.

2. Check special provisions for special requirements in pit operation (area to be excavated, depth of excavation, etc.).

3. Watch for radical changes in character of material in pit.

4. When required, see that washing and/or scalping are conducted in proper manner.

5. Watch for evidences of segregation of material. Advise Contractor to take steps to correct any segregation.

6. Frequent sampling of product for tests: screen analysis, sand equivalent test, fracture, moisture, etc.

7. Keep complete records of field tests.

8. See that both the crushing and prime Contractors are informed of test results.

9. When required, submit samples for mix design. Be sure to allow ample time for testing.

10. Submit samples for determination of standard density.

3-1.6 WSDOT Furnished Material Sources

WSDOT furnished material sources normally are to be used on future projects as well as the present one so it is necessary that the material be removed in such a manner that the future usefulness of the pit is not impaired. The Project Engineer must require the Contractor to submit a plan for approval of the proposed operations in the pit before starting work in the pit so that it can ascertained that the Contractor will not impair the future usefulness of the site.

In addition to the material source containing sufficient material for the project, there should also be adequate area for the plant setup. If the project includes treated materials, consideration should also be given to provide sufficient

area for the temporary stockpiling of the aggregates for the treated material and the mixing plant.

Disposal of strippings and scalpings in the site is of utmost importance if satisfactory reclamation of the site is to be accomplished with the minimum amount of work.

Surplus screenings accumulated during the production of specified materials will remain the property of WSDOT and must be stockpiled in the pit area where directed by the Engineer in accordance with the Specifications for stockpiling material.

If more than one source is provided in the special provisions, the Contractor may obtain the material from any of the sources. If the Contractor sets up in a site, and it is found that the quantity of raw materials from that site, when the site is exhausted, is less than that specified by WSDOT, then WSDOT may pay for moving the crushing plant in accordance with the provisions of Section 3-01.3(5) of the *Standard Specifications*. If the new source of material necessitates a longer haul of the materials, WSDOT may also pay for the additional haul as specified.

3-1.6A Pit Evaluation Report

When the Contractor has completed work in a WSDOT furnished material source, the Project Engineer shall prepare a pit evaluation report on Form 350-023. The information contained in these reports is needed to determine the future use of the pit. Also the information is very helpful in preparing plans for future projects in estimating stripping or special requirements that may be necessary to produce satisfactory products.

3-1.7 Contractor Furnished Material Sources

If the Contractor is required to furnish a source of materials or elects to use materials from a source different from those provided by WSDOT, the Contractor shall make arrangements for obtaining the materials and testing the source at no expense to WSDOT. Use of the materials will not be permitted until after the materials have been tested, the source approved, and authority granted for the use of it. Acceptance of the materials will be based on their meeting the requirements of the specifications.

If a source is set up in the project and the Contractor wishes to provide their own, the request from the Contractor and the Region's recommendation shall be forwarded to the Olympia Service Center Materials Engineer for approval. In addition, a Request for Approval of Material Source, Form 350-071, is required and a preliminary sample of the material may be required. If no source for the material was set up in the project, no letter will be required from the Contractor but the Request for Approval of Material Source, Form 350-071, is required and a preliminary sample of the material may be required.

Before preliminary samples of the materials are taken, the Contractor is required to have done enough testing of the source to ensure the quantity of material available so samples can be obtained which are representative of the material available from the source. The material in the Contractor's source must be of a quality equal to or better than that of the WSDOT provided source if the test values are listed in the special provisions, otherwise they must meet the minimum specification requirements. Any surplus screening accumulated during the manufacture of specified material will remain the property of the Contractor.

If the specific gravity of the material in the Contractor's source is greater than in the specified source, Section 3-01.4(1) of the *Standard Specifications* require that any additional material required to construct the minimum specified surfacing depth shall be furnished by the Contractor at no cost to WSDOT. The following procedures shall be used to administer the specification:

If the Contractor's source of materials has a greater specific gravity than the WSDOT provided source, a variation up to and including 0.05 above the specified source will be considered within the limit of working variation and will not affect course depths by a measurable amount. A variation in specific gravity greater than 0.05 will require a correction item for a credit deduction in treated and untreated items to compensate for the heavier materials. The credit deduction will be based on the following formula.

$$T \times \frac{C - (S + 0.05)}{(S + 0.05)} = D$$

where T = Gross Mass (tonnage) of Product Furnished in Tonnes (tons)

C = Specific Gravity of Contractor's Source

S = Specific Gravity of WSDOT Furnished Source

D = Credit Mass (tonnage) to be Deducted in Tonnes (tons)

Payment under the item will be made for
T - D = Net Tonnes (tons)

The preparation, production, and cleanup of the Contractor's material sources shall conform to the requirements of Section 3-01.4 of the *Standard Specifications*. Clearing, grubbing, and stripping are not to be paid for on Contractor's sources.

3-1.8 Vacant

3-1.9 Measurement and Payment

Clearing, grubbing, and stripping WSDOT furnished quarries, pits, plant sites, and stockpile sites are pay items only when they are included as bid items in the contract. The area to be used to obtain material, for plant setup and any necessary stockpiles shall be staked and measured for clearing and grubbing as specified in Chapter 2-1 of this manual. The area to be stripped must be staked and final ground measurements taken to determine the volume of material excavated. It is important that an area be stripped which is slightly larger than the area required for the material. This will permit stripping additional area without leaving some material to contaminate the pit and it will also prevent working the pit to the edge of the strippings.

Measurement and payment for particular aggregates produced shall be as specified in the appropriate sections of the *Standard Specifications*.

3-2 Stockpiling

3-2.1 General Instructions

Stockpiles shall be constructed in conformity with the provisions of the *Standard Specifications*. The area upon which the material is to be stockpiled must be prepared carefully by removing all vegetation and constructing a uniform, flat ground surface. Preparation of a good base for the stockpile will minimize wastage of material, and will prevent contamination of the material when removing it from the stockpile.

The Engineer must indicate to the Contractor the location of each proposed pile by placing properly marked stakes at each corner of the area to be used. If the material is to be stockpiled for later use by the Contractor, as in the case of aggregates for bituminous mixtures, the Engineer must consult with the Contractor and locate these stockpiles to conform with Contractor's plans for erecting the mixing plant, etc.

Piles shall be located to ensure easy access by trucks and loading equipment and care must be exercised to see that a sufficient distance is maintained between the various stockpiles so there will be no possibility of mixing the various classes of materials.

The material shall be placed in the stockpile in layers not to exceed 1.22 meters (4 feet) in height, and in such a manner that segregation of the fine and coarse portions of the material does not occur. The Inspector must be watchful constantly to see that segregation is held to a minimum. End dumping or dozing material over the side of the pile, allowing it to roll down the slope, will not be permitted, as severe segregation will occur as a result of such procedures.

After completion of each lift of material during the construction of a stockpile, it is common practice to use a pneumatic dozer to level the top of the lift before placing the next layer. This practice may be permitted but the Inspector must see that the operation of the dozer is limited to the minimum amount of work required to level the top of the layer, as excessive operation of the dozer on the pile can result in serious degradation of the material. If it is known that the stone is rather soft and subject to severe degradation under abrasion, the use of dozers on the pile must be prohibited, and the pile leveled by hand or such other methods as will eliminate the possibility of excessive degradation of product.

The stockpiles must not be allowed to become contaminated with mud or other material tracked onto the stockpile. If the surrounding ground is wet and soft, or for any reason contaminates are carried onto the stockpile, the Contractor shall be required to place granular material on the haul routes and provide means of keeping equipment tires clean.

When the Contractor is stockpiling two or more classes of materials at the same time, the Inspector must be alert to see that the materials are placed in the proper stockpiles. A few loads of fine screenings inadvertently placed in a stockpile of coarse screenings can destroy or greatly reduce the quality of a large amount of material.

The Inspector is cautioned to be especially alert when stockpiling is being done during hours of darkness to see that all phases of the work are carried out in accordance with the specifications. In many instances, when difficulties are encountered in the use of stockpile material, it is found that the trouble occurred during the night shift when inspection and testing work are very difficult to accomplish in the proper manner.

If the Contractor elects to stockpile aggregates prior to use in the immediate work, the requirements of Section 3-02.2(4) of the *Standard Specifications*. must be complied with.

The Project Engineer's attention is directed to Section 3-02.3 of the *Standard Specifications* for additional requirements for stockpiling certain aggregates.

Some of the important duties of the inspection are listed below:

1. See that stockpile area is prepared properly.
2. Stake each corner of proposed area for piles.
3. Watch to see that material is placed in stockpile in approved manner.

4. Watch for evidence of degradation or segregation of material in pile.

5. See that piles are kept separate and are neatly finished.

3-2.2 Measurement and Payment

Clearing and grubbing of the stockpile site are pay items only when they are included as bid items in the contract. The area to be used for stockpiles shall be staked and measured for clearing and grubbing as specified in Chapter 2-1 of this manual.

Measurement and payment of stockpiled aggregates will be in accordance with Sections 3-02.4 and 3-02.5 of the *Standard Specifications*.

3-3 Site Reclamation

3-3.1 General

All surface mines are to be reclaimed in accordance with RCW 78.44, Surface Mining Act and the *Contract Reclamation Plan*. Section 3-03 of the *Standard Specifications* covers the requirements for site reclamation.

The intent of site reclamation is to develop an area that remains useful and aesthetically pleasing in appearance after the materials are removed from the site.

Costs involved in complying with the requirements and restrictions imposed by WSDOT, the Department of Natural Resources, or other agencies in order to comply with the Surface Mining Act do not constitute a basis for additional compensation. Any request for an extension of time resulting from plan approval delays will be considered only if complete and adequate plans were submitted in a timely manner.

To permit positive identification of the pit sites when the various surface mining forms are filled out, the pit site number should be included in the description box in the upper right hand corner of the forms.

3-3.2 Contractor Furnished Sources

Upon completion of seeding and/or planting, form SM-3 shall be completed by the Operator and forwarded to the appropriate DNR Area Management office.

Sites operating under a valid reclamation permit issued by the Department of Natural Resources will not require a plan to be submitted to the Engineer, nor the Department of Natural Resources form, since the Contractor will be corresponding directly with the Department of Natural Resources. Evidence of the permit and the conditions contained therein shall be furnished by the Contractor to the Project Engineer. The Department of Natural Resources shall perform the inspection and administration of these sites.

Pit sites of less than 1.2 hectares (3 acres) of newly disturbed land or with walls less than 9.15 meters (30 feet) in height and one to one or flatter slopes, waste sites, and stockpile sites are not surface mines and do not come under the provisions of the Surface Mining Act but must be reclaimed in accordance with the contract plans.

3-3.3 WSDOT Furnished Sources

Contract reclamation plans for sources furnished by WSDOT will normally be included in the contract plans. When this is not done, or when a change to another state source is required, the plan shall be prepared by the Project Engineer and approval secured from the Olympia Service Center Construction Office. The Project Engineer shall prepare the plan and related papers in accordance with the instructions issued by the Environmental and Engineering Service Center and submit them to the Construction Office through the Regional Operations/Construction Engineer.

Upon completion of seeding and/or planting, the Project Engineer shall complete the SM-3 form and forward to the appropriate DNR Area Management office for all sites that come under the provisions of the Surface Mining Act.

3-3.4 Reclamation of Stockpile and Waste Sites

Reclamation plans are not required for stockpile or waste sites. However, all stockpile and waste sites are to be graded to the extent necessary to control erosion and provide satisfactory appearance consistent with anticipated future use.

Compliance with the State Environmental Policy Act (SEPA) is required for sites involving more than 76 cubic meters (100 cubic yards) of excavation or landfill throughout the lifetime of the site unless the local agency in which the project is located establishes a greater amount. Sites involving more than 382 cubic meters (500 cubic yards) of excavation or landfill throughout the lifetime of the site always require compliance with SEPA.

As an assurance of compliance, it is recommended that a site plan for reclaiming stockpile and waste sites be agreed upon by the Regional Administrator and the Contractor. A copy of the agreed upon site plan should be forwarded to the Olympia Service Center Construction Office.

In areas where local City or County ordinances exercise control of stockpile or waste sites, the Contractor shall submit copies of the governing agency's permit and evidence of approval by the property owner to the Project Engineer.

In all cases, the Region will be expected to inspect the sites, devoting special attention to aesthetics and ensuring that any diversion of drainage waters due to the wasting or stockpiling operations will not produce any adverse conditions.

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4-2 Gravel Base

4-2.1 General Requirements

The instructions listed in Chapter 3 and Chapter 4-2 of this manual apply to the construction of gravel base. If keystone is required, the instructions in Chapter 4-4.6 also apply to the construction of gravel base.

4-2.2 Gravel Base

When gravel base is specified in the contract, gravel borrow may be used in lieu of gravel base provided the stabilometer value of the gravel borrow is a minimum of 67 and 30 millimeters (0.10 foot) of crushed surfacing top course is substituted for the top 30 millimeters (0.10 foot) of the depth specified for gravel base. This top course surfacing must be received and measured as gravel base and not as top course surfacing.

4-4 Ballasting and Crushed Surfacing

4-4.1 General Instructions

The instructions listed in Chapter 3 of this manual apply to the production of ballast and crushed surfacing.

4-4.2 Loading, Hauling and Spreading

The subgrade for ballast or bases must be prepared in accordance with the appropriate specifications. Any soft or spongy areas must be removed and/or stabilized before the ballast or base course material is placed over it.

Ballast and surfacing materials shall be hauled and placed on the roadway with the equipment and in the manner outlined in the specifications. The objective of the various requirements is that the material shall be placed in courses of the required depth in a state of uniform gradation from coarse to fine throughout the surfacing courses. When the material is placed with a minimum of segregation, the task of preparing and compacting the course to receive the next lift is greatly facilitated.

It is imperative that the Inspector watch for segregation of materials during all stages of manufacture, hauling, and placement. The design of the total pavement is based on the assumption that all materials will meet **uniformly** all requirements of the specifications, including gradation requirements. If surfacing materials are deposited on the roadway in a badly segregated condition, the only corrective measure available is processing of the material on the roadway, using blades or other mixing equipment.

Excessive processing of material on the roadway is a poor substitute for placement of material in the proper condition in the first place. Therefore, it is very important that every effort be made to ensure correct handling of the materials at all stages of surfacing operations.

In order to facilitate placing materials with a minimum of segregation and also in the proper amount and to the correct cross-section, various types of equipment have been developed. Some of these operate from grade control wires to ensure placing the material to the proper elevation and transverse slope. When the material is mixed with water in a central plant before placing on the roadway, and is placed with a spreading machine, it can be compacted and shaped to the proper grade and cross-section with a minimum of handling and shaping on the roadway. If this type of operation is proposed to be used by the Contractor, the Project Engineer should become familiar with the operation and intricacies of the equipment.

Before each succeeding course of surfacing is placed, the Inspector must see that the underlying course is uniformly graded from coarse to fine and compacted properly. The Inspector must also see that each course is finished to a true, smooth profile with no irregular humps or hollows. A good way to locate local irregularities in the roadway profile or crown is by careful observation, or “eye-balling” the grade. In this way, additional material can be spot-placed to eliminate low and irregular areas, and the material bladed and compacted to a true, smooth surface.

The Engineer and inspectors must require the Contractor to place the courses of surfacing material in such a manner as to minimize any deleterious effect on the quality of the material caused by hauling equipment traveling over each course beginning at the extreme end of the haul and proceeding toward the point of loading. In this way, the least amount of hauling over completed courses will be required.

4-4.3 Compaction

Each layer of surfacing material (including gravel base) must be compacted with approved compaction equiment to a minimum of 95 percent of standard density as determined by the compaction control test for granular materials before the next succeeding layer of material is placed.

The Engineer shall submit representative samples of each surfacing material to be used on the project to the Regional Materials Engineer sufficiently in advance of the time of its intended use to permit completion of the test (see Chapter 9).

For each surfacing material, the Engineer will receive from either the Regional or Olympia Service Center Materials Laboratory, a Maximum Density Curve worksheet. This worksheet shows the standard density for all gradations of the tested material as related to the percent passing the 4.75 mm (U.S. No. 4) sieve.

During construction, each layer of surfacing material placed shall be checked for compliance with density specifications at the latest time practical before the next layer of material is placed. Field in-place density tests shall be performed in accordance with the test procedures outlined in Chapter 9 of this manual. Supplemental to those instructions, it is necessary to determine the percent passing the 4.75 mm (U.S. No. 4) standard sieve for the material obtained from the field density test hole. This information is needed for determining from the Maximum Density Curve worksheet the standard density applicable to the specific material being tested. To obtain this data it is necessary only to supplement the normal field density test procedure by screening the dried moisture-content sample through a 4.75 mm (U.S. No. 4) sieve, weighing the fractions, and calculating the percent passing based on dry mass (weight).

Field density tests for surfacing materials shall be performed on each layer placed on the main line at a frequency of approximately one test for each 300 meters (1,000 feet) of two-lane roadway or equivalent. On ramps or interchanges, one test shall be made for each 1,000 tonnes (1,000 tons) placed with a minimum of one test on each ramp including its shoulders. On shoulders of the main roadways, one test shall be made for each 2,500 tonnes (2,500 tons) placed with a minimum of one test on each shoulder. When individual layers are placed to a depth of less than 25 millimeters (1 inch), testing of two layers at one time is permissible.

During processing and compaction, the moisture content of the material shall be maintained at the highest level practical for that material without causing free water to drain through the material and build up in lower courses or on the subgrade. Frequent light applications rather than periodic heavy applications are preferable as this tends to avoid build-up below the surface.

If the special provisions require that the surfacing courses be trimmed with an automatically controlled trimming machine, the top of each course of different surfacing courses shall be trimmed to grade and cross-section. The Project Engineer must be aware that the trimming machines now in use only trim the top surface and do not move material longitudinally from high spots to low areas. The Project Engineer shall see that the materials are placed in reasonably correct amounts and slightly higher than the finished elevations. Most of the existing trimming machines do a good job of trimming if they are cutting a nominal amount and they tend to chatter and leave an unacceptable washboard surface when operating over a surface that is at or below the finished grade elevation.

4-4.4 Surfacing Depth Determination

Upon completion of placing, processing and compaction of the surfacing section, and before construction of the surface treatment or pavement the Project Engineer shall ascertain the depth of the total surfacing and base course section by checking the depth at the frequency stated in Chapter 9-7.2 of this manual. If any deficiencies in depth are found, the extent of the deficient area shall be determined by additional depth checks, and the necessary correction made by placing additional surfacing material. Refer to Chapter 1-5.8 of this manual for depth tolerances. A record shall be made of the depth determinations described herein, showing the location of each depth check, the total surfacing depth found, measures taken to correct any deficiencies, and the name of the person making the determination.

The record of surfacing depth determinations shall be entered in the Inspector's notebook or diary, or as a separate record. In any case, the depth determination record shall be included in the project records.

4-4.5 Maintenance of Surfacing

Upon completion of the surfacing courses the Contractor must be required to maintain and water the surface if any traffic is allowed to travel upon the roadway. When traffic is heavy, considerable damage can result if maintenance is not performed daily. It is much better to perform frequent light maintenance on a surfacing course than to wait until considerable rutting, pot-holing and segregation occur, in which event heavy processing and blading will be required. Testing for density in the top surfacing course shall be deferred until just prior to commencing paving operations.

The specifications provide that WSDOT may perform routine maintenance of a traveled roadway only in the event of a suspension of work for an extended period, as in the case of a shut-down for the winter.

4-4.6 Keystone

If the ballast or base material and the Contractor's operation are such that a considerable amount of float rock accumulates on the surface of the completed course of base, keystone shall be constructed in accordance with the requirements specified in Section 4-04.3(6) of the *Standard Specifications*. If the contract includes crushed surfacing top course, the Engineer may order the construction of keystone and include the quantity in the measurement and payment of top course surfacing. If the contract does not

include the item of crushed surfacing top course, approval for adding the item to the contract must be obtained before it may be used.

The specifications require that when keystone is necessary, it be placed each day on the course prepared that day. This requirement is especially important when traffic is being carried through the project to protect the course just completed and also to maintain a satisfactory roadway for the traffic.

4-4.7 Inspector's Checklist

Some of the important duties of inspection are listed below:

1. Watch for segregation of material on roadway.

2. Make sure each course of surfacing is prepared properly and meets density specifications before allowing next course to be placed.

3. When applying water to surfacing course, see that it is distributed evenly over entire course. Avoid over-watering which may cause soft spots in subgrade.

4. Make frequent checks of yield to see that specified quantity of material is placed.

5. See that surfacing courses are completed and compacted true to profile and section. See that humps and sags in profile are removed.

6. See that surfacing is maintained properly.

7. Make required depth determinations.

8. Make daily moisture checks on material paid for by the ton when excess moisture is present.

4-4.8 Measurement of Quantities

The *Standard Specifications* require that surfacing materials be weighed and paid for by the tonne or measured by the cubic meter in the hauling vehicle at the point of receiving the material.

Water in excess of the maximum permissible amounts, as specified in Section 3-01.5 of the *Standard Specifications*, will be deducted from the mass of material to be paid for on a daily basis. The deduction will be determined by the following formula:

Based on dry mass (weight): $$D = \frac{T(M - A)}{100 + M}$$

where D = daily mass (tonnage) deduction for excess moisture
T = total daily mass (tonnage) over the scales
M = percent of moisture
A = allowable moisture

4-4.8A Measurement by the Tonne (Ton)

Refer to Chapter 10-2.2 for instructions for measuring materials by the tonne.

The following is a list of the scaleman's duties:

1. Keep the scale diary continually through the day.

2. Check scale for zero at least twice during a day.

3. Tare each truck at least twice a day and enter on tare sheet.

4. Check the scales often and enter in diary.

5. Fill in appropriate spaces on each ticket.

6. Monitor and adjust tickets for overloaded vehicles.

4-4.8B Measurement by the Cubic Meter (Yard)

Refer to Chapter 10-2.3A of this manual for instructions for measuring materials by volume, truck measure.

4-6 Asphalt Treated Base

4-6.1 General Instructions

In areas where suitable materials are available, asphalt treated base is an economical method of protecting the subgrade from the weather and lengthening the construction season for paving. If the subgrade becomes saturated after it has been completed, a considerable amount of time is required during good drying weather before it is possible to proceed with construction of the base course. In many instances, the construction of the ATB to seal the subgrade from the rain water is the only way that the subgrade may be satisfactorily completed within a reasonable length of time.

In order to take full advantage of ATB, the specifications require that the subgrade be covered as soon as 10,000 square meters (yards) of subgrade on any roadway which is to receive ATB has been completed. This requirement is important, especially when periods of inclement weather are approaching, and is not limited to contiguous areas on the project.

When the Contractor is ordered to prosecute the work under less than favorable conditions, it is incumbent upon WSDOT to pay for repair work which was caused by this prosecution of the work. The Project Engineer should ensure that during this work condition, the areas for which WSDOT would be responsible for repairs are properly defined.

The construction requirements and procedures are much the same as for asphalt concrete pavement except as they are modified in Section 4-06.3 of the *Standard Specifications*. Chapter 5-4 of this manual also applies to the construction of ATB except as modified by the *Standard Specifications*.

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5-2 Bituminous Surface Treatment

5-2.1 General Instructions

Refer to Chapter 5-4.1 for a general discussion of responsibilities and attitude of the Inspector on bituminous paving work.

It is very important that the Inspector on construction of Bituminous Surface Treatment Class A (penetration treatment) and Classes B, C, and D (seal coat) be entirely familiar with the specifications and methods applicable to the work, as construction of these types of surfaces proceeds very rapidly. If the work is begun without proper preparation and planning, it is entirely possible that a major portion of the job will be completed before correction of any improper methods or procedures can be made.

Careful review of Section 5-02.3(10) of the *Standard Specifications* concerning unfavorable weather and calendar cutoff dates should be made well in advance of any bituminous paving work. In no case should bituminous surface treatments be placed before May 15 or after August 15 of any year without review by the Olympia Service Center Roadway Construction Section and written order of the Regional Administrator.

The following table gives the number of liters (gallons) per tonne (ton) @ 16°C (60 F) for the various asphaltic materials. To correct the volume of the material to 16°C (60 F), there are several handbooks that contain tables of temperature volume corrections for the different asphaltic materials.

Grade	Liters per Tonne @ 16°C	Gallons per Ton @ 60 F
Cutback Asphalts		
70	1056	253
250	1039	249
800	1023	245
3,000	1006	241
Paving Asphalts		
AR 16,000	981	235
AR 8,000	981	235
AR 4,000	981	235
AR 2,000	289	237
AR 1,000	998	239
Emulsified Asphalts		
All Grades	1002	240

When payment for asphaltic materials is by the tonne, they should be measured by weighing. When it is impractical to weigh the materials, the quantity of asphaltic material used may be measured by the liter and the number of liters converted to tonnes with the appropriate temperature volume correction.

5-2.2 Duties Before Construction

See Chapter 5-4.3B for preliminary duties of the Inspector.

Traffic Control

Refer to Chapters 1-2.3 and 5-4.3B of this manual for instructions concerning preliminary arrangements to be made for control of traffic.

Inspection Tools and Equipment

Before construction begins, the Inspector shall secure from the Project Engineer all equipment necessary to carry out the inspection duties. This equipment shall include air and asphalt thermometers, sieves and scale, tapes and rules, canvas sample sacks, containers for sampling asphalt, notebooks, ticket books and diary book.

Inspection of Contractor's Equipment

Prior to construction of the bituminous surface, the Inspector shall make an inspection of the Contractor's equipment. The Inspector shall check to see that all required equipment is available, and see that the equipment is in good condition and is properly adjusted.

A careful check of the asphalt distributor shall be made to ensure that it meets the requirements of the specifications. The capacity of the distributor shall be determined, and ensure that the volume gauge is calibrated to correctly indicate quantities in the tank.

Special attention should be given to the condition and adjustment of the asphalt pump, spray bar and spray nozzles. The nozzles should be set uniformly at the proper angle from the axis of the spray bar, normally 15 to 30 degrees, to eliminate interference of the sprayed material from one nozzle with that from an adjoining nozzle. Each nozzle should be set at the same angle. The height of the spray bar must be checked to see that the correct overlap of the spray from each nozzle is obtained. This can be accomplished by plugging alternate nozzles and adjusting the height of the spray bar until the edges of the spray fans from the unplugged nozzles just meet at the roadway surface. When all nozzles are spraying, an exact double

coverage of asphalt will be obtained, resulting in an application of asphalt free from longitudinal streaking.

The asphalt pump must be checked to ensure that the required pressure can be maintained uniformly.

The Inspector must check the motor patrol graders, rollers, spreader boxes, etc., to ensure that they are in good operating condition. The Inspector should see that the motor patrols are equipped with the required mold-board brooms. The capacity of hauling trucks and water tanks must be determined from measurement obtained on the job, the results being recorded for future reference.

5-2.3 Inspection of Bituminous Surface Treatment, Class A

Preparation of Roadway

The roadway to be treated shall be processed, shaped and compacted to a smooth, uniform grade and cross-section before application of the asphalt. It is essential that the grading of the surfacing material be uniform over the area to be treated to allow uniform penetration of the asphalt. The quality and smoothness of the finished roadway depends to a great extent on the quality of the work done in preparing the roadway. Careful inspection during this operation will lay the groundwork for a smooth riding and uniform appearing finished project.

In many instances, the surfacing course upon which the bituminous surface treatment is to be placed will be segregated, rutted and pot-holed by traffic using the roadway prior to oiling. Such a surface must be completely processed to the depth of the ruts or potholes, and relaid. Do not allow the Contractor to merely lightly blade the surfacing course, filling the holes with loose, segregated material. Such procedures are sure to result in a rough uneven pavement, due to differential compaction and penetration.

The surfacing must be thoroughly rolled to obtain a dense, unyielding base for the bituminous surface treatment. A final coverage with the steel-wheeled roller will produce a smooth surface upon which to apply the prime coat.

The blading and rolling of the surfacing shall be coordinated so the asphalt will be applied while the surfacing material is still damp. If the surfacing material compacts to a very tight surface, the asphalt material will not penetrate as much as if the material is more open. If this is the case, the inspector should be careful to not apply too heavy a coat of asphalt.

Application of Asphalt and Aggregate

Immediately prior to starting an application of asphalt, the Inspector should require that the spray bar and nozzles be tested to see that the asphalt will be sprayed properly. The distributor should be placed with the spray bar off the roadway and the nozzles opened so that the spray may be checked visually for evidence of non-uniformity.

Building paper shall be placed at the joint, each time the distributor starts, in a manner that assures a uniform asphalt spread across the area of the joint.

During the application of the asphalt, the Inspector shall maintain a close inspection of the roadway to see that the asphalt is applied in a uniform manner. If any evidence of improper application is apparent, the operation must be stopped at once and required corrections be made to eliminate the trouble. The Inspector must check to see that the asphalt pump pressure and the speed of the distributor are maintained at uniform rates to ensure even application of the asphalt. A record shall be made of each distributor load applied, showing area treated, liters spread, temperature of asphalt, etc. The Inspector should compute the yield of each spread in liters per square meter.

Part of the prime shot asphalt applied to the surfacing penetrates the material and the rest remains on the surface and surrounds the aggregate, usually 12.5 mm ($^1/_2$ inch) screenings. The clean screenings (chips) are used in place of coverstone to promote the venting of volatiles from the cutback asphalt needed for penetration. Constant checking needs to be made to ensure that enough asphalt product is being applied to fill the voids and stick the aggregate. This may change during the day because of weather or the preparation crew's efforts to stay ahead of the oiling crew. Some bleed can be tolerated on the prime shot as it can be corrected on the second (tack) shot if uniform in nature. The final mat will be thicker and better if the maximum amount of asphalt possible, without excessive bleed, is shot on the first (prime) shot. Succeeding shots are placed as seal coats described in Chapter 5-2.4 of this manual.

The stockpiled aggregate shall be inspected to determine the grading of the material, and to see that it is damp at the time of loading onto trucks for hauling to the roadway. If dry or dusty, the material in stockpile must be watered to produce a surface damp condition. The asphalt does not readily coat a dry dusty surface. During good warm weather, the moisture on the surface of the aggregate will quickly evaporate after the aggregate is spread on the asphalt on the roadway.

The Inspector must frequently check the truck loads of aggregate at the point of delivery on the roadway, to see that the trucks are completely loaded and that the material is damp. Tickets shall be issued for each load of material received or a receiving report record made as the loads of material are received and a record made of the quantities of material used on each section.

Following the application of asphalt, the Inspector is responsible for seeing that the aggregate is applied in accordance with the specifications, watching especially that the aggregate is applied at the correct rate within the time limit allowed. The roadway shall be inspected for signs of skips or omissions in the application of the cover stone and to see that any omissions are immediately covered by hand-spotting methods. The Inspector must not allow excessive amounts of aggregate to be applied, which will only result in waste of the material, and require harmful excessive brooming.

Careful inspection and control of the rolling operation must be made to see that the requirements of the specifications are met. It is important that rolling be conducted as soon as possible following application of the aggregate in order to properly imbed the aggregate in the asphalt.

Chips are broomed the day following the shot because loose chips are of no value in protecting the mat and any loose aggregate on the roadway promotes wheel tracking. Areas of severe bleed will need to be blotted with 6.3-mm ($^1/_4$-inch) material during the cure period. Cutback asphalts are curing as long as you can smell the volitiles on a warm day. Emulsions do not really cure except to shed water when they break. Either asphalt will be tender for awhile, although probably ready for the next construction step.

When the asphalt has started to cure and the chances of it bleeding are remote, the excess aggregate on the edge of the roadway should be broomed off as it is a hazard to traffic and reduces the usable width of the roadway.

5-2.4 Inspection of Bituminous Surface Treatment, Classes B, C, and D

Preparation of Roadway

Prior to the application of the seal coat, the Inspector shall see that the existing surface is broomed clean and that holes and breaks are patched as required. The Inspector should inspect the existing surface carefully over the length of the job, noting the surface characteristics of the roadway, so that the rate of application of asphalt best suited to the conditions can be determined. The Inspector should make note of varying conditions and plan to vary the application of asphalt accordingly.

Any areas of the roadway showing failure caused by soft subbase or poor drainage must be removed and the cause of the failure corrected.

If any open or porous surfaces, particularly on recently constructed bituminous pavements, are found in the area to be treated, the Inspector shall require the application of a “pre-seal” treatment to be applied before construction of the seal coat. If this pre-seal treatment is not shown on the plans, the Inspector will inform the Project Engineer of the situation, so that a supplemental agreement may be reached with the Contractor.

The Inspector is responsible to see that a newly constructed bituminous surface be allowed the required time for curing before allowing construction of the seal coat over the affected area.

Construction of Seal Coat

Refer to Chapter 5-2.3 for instructions covering inspection duties during application of asphalt and screenings or cover stone.

In the construction of a seal coat, the quantity of asphalt spread is very critical, due to the thinness of the layer of aggregate placed on the asphalt. Constant checking must be done to ensure that embedment of the major stone in the asphalt is 50 to 70 percent. Where 12.5-mm ($^1/_2$-inch) chips are used on routes with moderate traffic volumes, 6.3-mm ($^1/_4$-inch) material may be used either ahead of or immediately behind the main rollers. Some bleed is inevitable at intersections, on steep hills, and at severe horizontal or vertical curvature. This is less objectionable than losing rock on long sections in between, due to insufficient asphalt.

The Inspector must maintain continual inspection of the application of aggregate on the freshly spread asphalt, to see that the material is placed within the allowable time. The Inspector must make certain that the spread of asphalt is not extended beyond the area which the Contractor is capable of covering within the allowed time.

Omissions or skips in the spreading of aggregates must be immediately covered by the handspotting crew.

The best seal coats are obtained on those jobs where the time elapsed between spreading of asphalt and application of aggregates is held to the shortest possible time.

The Inspector must see that the rolling operation is not allowed to lag far behind the spreading of aggregates. It is important that the particles of aggregate be rolled into the asphalt film as soon as possible following application.

Spreading Fine Screenings

When constructing Bituminous Surface Treatment Class B or Class C, the specifications require the application of fine screenings following spreading and rolling of the coarse aggregates. The Inspector must exercise judgment in determining the time for applying the fine screenings. When using emulsions, the fine screenings should be applied immediately, sometimes even before initial rolling.

Fine screenings, applied at the proper time, will key the interstices between the particles of coarse aggregate and provide a smoother riding surface, as well as absorb any

free asphalt which might "bleed" to the surface of the coarse particles.

By observing conditions and results carefully, the experienced inspector will determine the procedure producing the best results under any particular condition.

If the sealed roadway is rained on before the asphalt has cured and the asphalt starts to emulsify under the traffic, the roadway can usually be saved from damage by applying fine screenings on the roadway to prevent the traffic from picking up the asphalt.

5-2.5 Inspection and Sampling of Materials

Asphalt

The shipments of asphalt arriving on the job by tank truck shall be inspected by the Inspector. Each shipment must be accompanied by a weigh bill and shipper's certificate. The tank must be inspected after unloading to see that no asphalt remains in the tank.

The Inspector must check and record the temperature of each load of asphalt delivered to the roadway for spreading.

Samples of the asphalt shall be taken as required in Chapter 9-4.2 of this manual, and shall be submitted to the Olympia Service Center Materials Laboratory for Testing.

Aggregates

No aggregate shall be used without the approval of the Olympia Service Center Materials Laboratory. If material available in stockpile for use on the contract has been approved at some previous date, screen analysis must be made of a sample of the material to see that the material meets grading requirements. If any question arises concerning quality of the material, a sample shall be sent to the Materials Laboratory for testing before use and preferably during plan preparation.

5-2.6 Miscellaneous Inspection Duties

Protection of Structures

When spreading asphalt near curbs, bridge rails, or other structures, adequate protection must be provided to prevent asphalt from splashing or blowing on the structures. The Inspector shall see that any asphalt sprayed on a structure is satisfactorily removed by the Contractor.

Control of Traffic

Frequent checks should be made of traffic control operations to see that traffic is being conducted through the job in a safe, orderly manner. When spreading asphalt, traffic should not be allowed to travel past the distributor. Control of the speed of traffic is very important, especially during the early curing stage of the asphalt, so that the aggregate covering the asphalt is disturbed as little as possible. Control of traffic must be maintained as long as required to prevent excessive pick-up and whipping-off of the aggregate. The Inspector must see that all warning signs are properly in place throughout construction. See Chapter 1-2.3 of this manual for further instructions on construction signing.

Maintenance and Finishing Roadway

The Inspector shall see that the newly completed roadway is properly maintained during the required five-day maintenance period. The Contractor shall be required to keep sufficient equipment on the job to adequately handle any situation that may develop. Before the work is accepted, the Contractor shall be required to finish the roadway and clean up any debris resulting from their operations, as required in the Specifications.

Measurement of Stockpiles:

Before construction is begun, stockpiles from which materials are to be removed shall be measured and quantities computed. Upon completion of the work, the Contractor shall be required to leave the remaining materials in neat, presentable stockpiles, and the stockpiles shall again be measured and quantities determined. The difference in quantities obtained by this procedure will aid in checking pay quantities determined by truck volumes. It will also serve as an accurate basis for reporting quantities withdrawn from stockpiles.

Notice to Maintenance Superintendent

The Project Engineer should keep the area Maintenance Superintendent informed of the Contractor's proposed progress schedule so that maintenance operations can be coordinated to accommodate the construction work. The Project Engineer must also notify the Maintenance Superintendent of the date when the Contractor's maintenance period will expire so that maintenance of the roadway may be taken over by WSDOT and maintained without interruption. These notices should be given sufficiently in advance to enable the Maintenance Superintendent to provide equipment and organize the work.

5-2.7 Reports and Records

A Daily Report of BST Operations, Form 422-644, shall be made at the end of each day's work, showing type of work, areas treated, quantities used, etc. This report shall be submitted in duplicate for the Project Engineer and Region.

Records of quantities of asphalt and aggregate used shall be kept in the Inspector's notebooks, and shall be checked daily against quantities shown on tickets issued to the Contractor. Accurate, neat records are invaluable to the

Project Engineer in preparing estimates and final records. See Chapter 10-2 of this manual for instructions concerning quality control procedures.

The Inspector shall enter in the Inspector's Daily Report all pertinent information concerning each day's work.

5-3 Stress Absorbing Membranes

5-3.1 General

Stress absorbing membranes are seal coats similar to bituminous surface treatments except that paving grade asphalt mixed with rubber is used for the binder. The grades of asphalt allowed are specified in the contract special provisions as are the rubber requirements. The rubber is usually a ground or powdered substance manufactured from used tire carcasses. There are two types of stress absorbing membranes:

(1) SAM; a stress absorbing membrane used as the finish wearing surface of the roadway.

(2) SAMI; a stress absorbing membrane interface used between an existing roadway surface and a new layer of asphalt concrete to prevent existing cracks from reflecting through to the new surface.

5-3.2 Duties Before Construction Begins

See Chapter 5-4.3B of this manual for preliminary duties of the Inspector.

5-3.2A Traffic Control

See Chapters 1-2.3 and 5-4.3B of this manual for traffic control arrangements.

5-3.2B Inspection Tools

Before construction begins, the Inspector should gather together the tools needed to perform inspection duties: the equipment required includes air and asphalt thermometers, sieves and scale, tapes and rules, sample sacks, quart cans for sampling asphalt, notebooks, forms, ticket books, and diary book.

5-3.2C Inspection of Contractor's Equipment

Section 5-02.3(1) of the *Standard Specifications* details the equipment requirements. In addition, self-propelled power brooms will be required to clean the existing pavement. The only rollers allowed will be self-propelled with pneumatic tires. The Inspector should also review Chapter 5-2.2 of this manual.

5-3.3 Inspection of Mixing Process

There are two mixing processes currently being used. The specifications for both processes require that the asphalt and rubber be combined in the proportions of one kilogram (two pounds) rubber to 4.2 liters (one gallon) of asphalt. The Inspector must determine the percentage by mass of the asphalt and rubber incorporated into the mixture. When a diluent is used, it must have a boiling point of at least 176°C (350 F) and should be mixed as rapidly as possible when introduced to the asphalt along with the rubber. The other process utilizes an extender oil, with the mixture then being heated to 205°C (400 F).

5-3.4 Inspection of Application and Sampling Materials

The following application procedures are used for SAMs and SAMIs.

(1) The existing surface is cleared and patched as required by Section 5-04.3(5)A of the *Standard Specifications*. Existing cracks 6 mm or larger should be filled before application of stress absorbing membranes. The use of a power broom is required.

(2) The hot rubber mixture is applied at a rate of 2.25 (0.50) plus or minus 0.2 liters (0.05 gallons) per square meter (yard) dependent upon the absorption of the mixture into the existing pavement, surface texture of existing pavement and absorption of the mixture into the cover stone.

(3) Aggregate spreading *must* start within 15 seconds after application of the hot rubber mixture. The amount of aggregate spread is 13.5 to 22 kilograms (25 to 40 pounds) per square meter (yard) for a SAM. The SAMI will be overlaid with a course of asphalt concrete pavement, therefore only the minimum amount of aggregate needed to protect the membrane from equipment is needed. This is estimated to be 13.5 kilograms (25 pounds) per square meter (yard). If preheated aggregates are used they should be kept at specification temperature or slightly above or there will be problems with the spreader belts elongating.

(4) Rolling is started immediately following the aggregate spread. At least four complete passes are required to imbed the aggregate in the hot rubber mixture. A 22-tonne (25-ton) roller is desirable for best results.

(5) If traffic is to be allowed upon the fresh surface and precoated aggregate is used, then an additional layer of aggregate, 6.3 mm - 0 (1/4 inch-0), may be required after rolling. The aggregate would be applied at a rate of 2.7 to 5.4 kilograms (5 to 10 pounds) per square meter (yard). If the aggregate imbedment is less than 50 percent, a fog seal is recommended. Also, discontinue the application of 6.3 mm - 0 (1/4 inch-0).

(6) Samples of the rubber and asphalt mixture shall be taken as required in Chapter 9 of this manual, and shall be submitted to the Materials Laboratory for testing.

5-3.5 Reports and Records

Same as Chapter 5-2.7.

5-4 Asphalt Concrete Pavement

5-4.1 General Instructions

Good work and a successfully completed job depends on good equipment, skillful operation of the equipment, and competent supervision and inspection.

Intelligent and adequate inspection throughout the period of preparing and laying asphalt concrete is of the utmost importance. Inspectors should be well trained for their particular duties and thoroughly familiar with all details of the specifications. They should be instructed by the Project Engineer as to their responsibilities and the limit of their authority. They should exercise tact and good judgment in securing maximum cooperation on the part of the Contractor.

In the construction of asphalt concrete pavement, it is extremely important that the plant-mixed material meets all requirements of the specifications. It should be remembered that specifications are not arbitrarily arrived at, but have evolved through the years as a result of experience and research.

Experience has shown that pavements which do not meet all specifications will not perform satisfactorily, resulting in high maintenance costs. The responsibility for obtaining a mixture in close conformance with the project mix design and meeting the specification requirements rests with the Contractor. The importance of this cannot be overemphasized, since the best possible construction at the lowest cost to WSDOT cannot be obtained unless the mixture produced at the plant is uniform and of good quality. It is the Plant Inspector's responsibility to see that testing for job site control is performed in conformance with Chapter 9-5 of this manual. Plant and street inspectors should plot the mix design and production mixes on 0.45 power charts (DOT Form 350-564) to predict and better understand construction and future performance of the mix.

Careful review of Section 5-04.3(16) of the *Standard Specifications* concerning unfavorable weather conditions and calendar cutoff dates should be made in advance of any asphalt concrete paving work so that paving can be planned and completed prior to any unfavorable weather. Pavement performance is as dependent on the weather conditions in the first weeks and months following paving as it is on the weather conditions on the day of placement. Invariably, when these specifications are not closely adhered to, early pavement performance problems occur. Therefore, between October 15 and April 1, no wearing course shall be placed without explanation of the circumstances and permission of the Chief Construction Engineer.

It is recommended that wearing courses of open graded mixes and dense graded mixes of 30 millimeters (0.10 foot) or less shall not be placed between September 1 and April 1.

It is highly desirable that before construction begins, the Engineer and inspectors confer with the Contractor's superintendents and foremen and carefully plan the entire operation.

With the advent of Quality Assurance (QA) specifications the role of the plant inspector has evolved from one that was highly involved in the operation of the asphalt plant to one that is more involved in verification that the material that the Contractor produces is in conformance with the mix design and in accord with the specifications. However, it is still important that the Inspector be knowledgeable in the workings of asphalt plants and the effect that adjustments or maintenance of the plant operation can have on mix quality and consistency.

The method of obtaining the best possible asphalt mixture can be stated very simply — *careful inspection and control of the component materials and of the mixing process, in accordance with the specifications and instructions*. Various testing procedures are available to the Inspector to ensure that the component materials and the completed mixture meet the requirements of the specifications. However, since only relatively small samples of each day's production can be tested, the Inspector's duties and responsibilities involve a great deal more than merely performing the required tests. The Inspector must be familiar with the workings of the asphalt plant, particularly the various controls. The Contractor is responsible for the uniform application of these controls, so that the end product is of uniform quality. Only when the product is uniform can samples be considered representative of the material produced. The Inspector must not become so involved in testing to fail to observe and confirm the uniform operation of the plant.

There is one key word to describe quality production of asphalt mixtures. It is UNIFORMITY. The aggregates in stockpile must be of UNIFORM quality and gradation; they must be fed into the plant in a UNIFORM, controlled manner; the heating and drying of the aggregate must be UNIFORM; the separation of the aggregate in the bins must be UNIFORMLY controlled; and the aggregates and asphalt must be combined and mixed in a UNIFORM, consistent manner.

In order to achieve this uniformity of quality, it is necessary that the entire operation be conducted so that each phase of the production operation is in balance with all other phases. The production of the pugmill cannot exceed that of the dryer or screens, for instance. The productive capacity of the plant is limited to the capacity

of the least productive unit in the production cycle, whether it be dryer, screens, pugmill or any other unit.

Attitude of the Inspector

The attitude of the Inspector toward the Contractor and plant personnel should be one of cooperation, consistent with the requirements of the specifications and instructions. The Inspector must remember that the Contractor has rights under the contract as well as WSDOT, and these rights must be respected. The Inspector should assume the attitude that the Contractor is honestly trying to fulfill the contract and that errors and difficulties which may arise are the result of a lack of information, or as a result of misunderstandings, rather than a desire on the part of the Contractor to do dishonest or poor work. Generally, if the Inspector shows a cooperative attitude the Contractor will meet them halfway. When troubles occur, the Inspector shall notify the plant foreman immediately and make every effort to locate the cause of the trouble. The plant foreman shall be responsible for making the necessary corrections. If violations or misunderstandings of the specifications arise that cannot be promptly settled, the Project Engineer must be notified immediately.

The Plant Inspector must be in close communication with the Street Inspector. A few minutes spent at the paving site will indicate whether or not the mixture has the workability and other characteristics desired. Close cooperation between the Plant and the Street Inspector will aid greatly in achieving a satisfactory job.

Instructions shall be issued to the Contractor or to the foremen, rather than to the workers, whenever possible. A diary must be kept, showing all instructions received from the Project Engineer and all instructions issued to the Contractor.

5-4.2 Inspection

5-4.2A Testing Equipment

Before production commences, the equipment listed in Chapter 9-3 of this manual should be requisitioned from the district office and be available at the field lab.

The Inspector is charged with responsibility for care and safekeeping of all testing equipment which is issued. Equipment must be handled carefully to avoid breakage. The equipment must be maintained in a clean and proper operating condition to ensure accuracy of test results. Special care must be exercised in the use and maintenance of sieves to see that they do not become clogged or damaged. Thermometers must be handled carefully to avoid breakage.

Electronic scales are expensive, desirable, and delicate equipment. Particular care should be taken to protect them from theft or voltage spikes.

Also, the nuclear asphalt content gauge is a delicate and expensive instrument along with its associated legal handling and storage requirements. It is mandatory that the Inspector be thoroughly familiar with the care and operation of the gauge and be licensed to operate the gauge. The WSDOT gauge license has rigid security and storage requirements that must be followed.

Given reasonable care, the testing equipment will give long and satisfactory service.

5-4.2B Required Tests

The Plant Inspector is responsible to the Project Engineer for the required “QA” field tests as well as for submission of required samples to the Materials Laboratory for testing. It is the intent of “QA” specifications that the Contractor be made totally responsible for the maintenance and operation of equipment and the production of the asphalt concrete. It is the Inspector’s role to sample and test the material to assure that WSDOT is getting a uniform and specification product. However, it is not possible or desirable for the WSDOT Inspector to take a “hands off” approach to the production of asphalt concrete. If the Inspector notices anything at all that affects the quality of the asphalt concrete, this information should be brought to the Contractor’s attention in a cooperative manner so that the situation can be corrected.

Field Tests

On all projects involving asphalt concrete, job site samples shall be obtained, tested and recorded in accordance with the *Standard Specifications*, the contract special provisions, and Chapters 9 and 10-3.5 of this manual. Asphalt content and gradation of the mix shall be determined by means of the nuclear asphalt procedure, WSDOT Test Method 722, and the Quick Determination of Aggregate Gradation using Alternate Solvent Procedure, WSDOT Test Method 723.

Samples Required by Materials Laboratory

When taking a sample of the mixture for asphalt content and gradation analysis, a sufficient quantity of the mix should be obtained so that a portion of the same sample may be submitted to the Materials Laboratory for testing. Samples shall be taken as provided in Chapter 9 of this manual and forwarded to the Materials Laboratory in the amounts and at intervals therein specified.

Sampling Methods

Samples of the complete asphalt mixture should be taken from the hauling conveyance in accordance with WSDOT Test Method 712, and quartering down to the desired size for testing. Remember that the value of material quality testing is dependent on exact parallel tests of identical splits from representative samples.

Verification of the Nuclear Asphalt Content Gauge Correlation

To ensure the WSDOT's tests for asphalt content on asphalt cement concrete pavement are accurate and representative of material produced, a verification process is established. This process is provided for use at the onset of production from a new mix design utilizing a combination of asphalt, aggregate source, and production plant with no previous history. By this process it will be demonstrated whether the nuclear gauge calibration is appropriate for the materials on hand as proposed for use on the project. These guidelines establish a procedure to reduce the number of questions concerning asphalt content, insure that WSDOT is receiving a satisfactory product, and assure the Contractor that a fair and equitable determination of pay will be made on each project.

1. Verification of the nuclear asphalt content gauge calibration for all new asphalt concrete mix designs shall be done by constructing and testing a single point check pan at design asphalt content. The aggregate (including RAP if required) and asphalt cement proposed for use on the project shall be sampled and obtained from the asphalt plant cold feed and onsite asphalt cement storage (before project production if possible). Normal gauge variation is plus or minus 0.2 percent. Gauge calibration verification can be waived by the Engineer if recent history indicates that the design and calibration have correlated satisfactorily. **Caution! Make certain that the onsite asphalt cement contains the same type and amount of antistrip agent used in the mix design process, the asphalt cement is the same grade and from the same supplier as shown on the mix design, the aggregate is from the same source as indicated on the mix design, and that the aggregate blending is approximately the same as indicated on the mix design.**

The check pan process shall be performed in accordance with WSDOT Test Method No. 725, by a person who has either completed "Asphalt Plant Technician training," or received updated training after January 1994.

2. If the single point check pan does not verify the gauge calibration with plus or minus 0.2 percent (0.3 percent for RAP), proceed to perform a new 4 pan calibration using aggregate and asphalt cement from production. If production paving has started, suspend QA incentive and disincentive for AC content and 0.075 mm (No. 200) sieve, and temporarily assume a 1.00 pay factor for these properties until a new calibration is available and verified. Once an acceptable new gauge calibration has been determined, the pay factors for AC content and percent passing the 0.075 mm (No. 200) sieve shall be recalculated based on the gauge calibration difference. If the gauge calibration cannot be verified during the life of the project, a 1.00 pay factor will be assumed for AC content and the percent passing the 0.075 mm (No. 200) sieve until such time as a consistent gauge offset can be determined from production data established in accordance with guideline No. 5 below.

3. The Contractor shall operate the plant at the ordered target AC rate, using accurate and current aggregate moisture content. When the gauge results do not match the Contractor's production AC values, the production AC input shall not be adjusted to a value other than the target asphalt content solely for the purpose of causing the nuclear asphalt content gauge to read the target asphalt content.

4. Only change target AC content based on stability and void test data or obvious field placement problems. A change of more than plus or minus 0.3 percent from the recommended mix design will require approval from either the Olympia Service Center Construction Office or the Olympia Service Center Materials Lab. When stability and void tests are required to aid in determining a mix performance problem, the Olympia Service Center Materials Lab shall be notified by the Engineer and the material samples shall be hand carried to the Olympia Service Center Materials Lab immediately.

5. If production history indicates that nuclear asphalt content gauge readings differ from actual production even after verification of nuclear asphalt content calibration (single point check pan) and/or even after a new calibration (4 pan recalibration) recalculation of QA payment for AC content and percent passing the 0.075 mm (No. 200) sieve, shall be made if requested by the Contractor. The recalculation shall cover the entire amount of mix represented by any JMF and shall be based on the actual nuclear asphalt gauge readings adjusted by a constant determined by comparing the amount of asphalt cement used from production records with the amount of asphalt cement determined from gauge readings.

The Contractor shall track and record daily the amount of asphalt cement used in production. The Inspector shall periodically witness and verify the Contractor's daily tank measuring operation. The amount of asphalt cement used will be based on storage tank measurements, deliveries, and withdrawals. When commercial asphalt plants are being used there must be an accounting of all mix produced for each day.

Example:

Assume 2 days production
Day 1 production = 2600 tonnes
AC consumed by tank measurement = 135.2 tonnes
∴AC from production = 5.2 percent

AC Gauge		Tonnes (Tons)	Calculated Tonnes AC (Tons)
Test #1	5.6%	600 (600 × 5.6%)	33.6
Test #2	5.4%	1400 (800 × 5.4%)	43.2
Test #3	5.6%	2200 (800 × 5.6%)	44.8
Test #4	5.8%	2600 (400 × 5.8%)	23.2
			144.6

Day 2 production = 2044 tonnes
AC consumed by tank measurement = 107.3 tonnes
∴AC from production = 5.3 percent

AC Gauge		Tonnes (Tons)	Calculated Tonnes AC (Tons)
Test #5	5.5%	550 (550 × 5.5%)	30.3
Test #6	5.6%	1300 (750 × 5.6%)	42.0
Test #7	5.7%	2044 (744 × 5.7%)	42.4
			114.7

Correction Factor = 135.2 + 107.3 / 144.6 + 114.7 = 0.94

AC Gauge		Correction	Corrected AC%
Test #1	5.6%	0.94	5.3%
Test #2	5.4%	0.94	5.1%
Test #3	5.6%	0.94	5.3%
Test #4	5.8%	0.94	5.5%
Test #5	5.5%	0.94	5.2%
Test #6	5.6%	0.94	5.3%
Test #7	5.7%	0.94	5.4%

The corrected AC percent is then used to calculate the percent passing the 0.075 mm sieve and then both of the corrected values for AC and 0.075 mm (No. 200) sieve are used in the statistical evaluation of the lot.

When a gauge offset is found, it will typically be higher or lower than the AC content determined from production. When consistent deviation between gauge readings and production results, gauge results that deviate both higher and lower from production data and/or individual gauge readings differing more than plus or minus 0.2 percent from the running average are found, a joint review of testing processes and plant operations should be made by the inspector and the Contractor as follows:

1. Sampling and testing procedures and calculations with particular emphasis on moisture determination and the confirmation requirements contained in Chapter 9-5.4 of this manual.
2. Rice density differences.
3. Asphalt plant operation.
   a. Production AC calculations including tank measurement calculations.
   b. Correct AC content input and aggregate moisture content.
   c. Plant calibration, proportioning and/or operational problems.
4. Street operations.
   a. Noticeable differences in the mix.
   b. Noticeable differences or difficulties with density.

When investigation fails to pinpoint a reason for the high to low variation, the plant inspector shall correct the Project Engineer.

The calculation of and the application of AC content adjustments shall cover each days production and entire quantity of mix represented by any JMF. This procedure is not intended to be applied except on a consistent day by day, start to finish basis. The Contractor shall be responsible for providing to the Project Engineer the production data (AC consumed by tank measurement, withdrawals and deliveries) necessary to complete the calculation for the AC content adjustment.

5-4.2C Mix Design

The *Standard Specifications* require the Contractor to submit representative samples of the various aggregates to be used, along with gradation data showing the stockpile averages of the aggregate as produced, together with their proposed combining ratios and average gradation of the completed mix. The Olympia Service Center Materials Laboratory will then determine the initial asphalt content and the percentage of antistrip additive if any from the aggregates and data provided.

The Contractor should be reminded of these requirements during the production of aggregates so that adequate time is available for determining the mix design. If, for any reason, the Laboratory's recommended mix design is not available at the time of the Plant Inspector's assignment to the project, the Contractor shall immediately be advised of the requirements. Upon submittal of the samples, the Inspector should advise the Materials Laboratory of the reason for late submittal along with explaining the urgency of the situation as paving shall not start without an approved mix design.

5-4.2D Inspection of Mixing Plant

Immediately upon assignment to the project, the Plant Inspector shall discuss the schedule of the work with the Project Engineer, the Street Inspector and the Contractor. The Plant Inspector must be familiar with the plans and specifications applicable to the work. As soon as possible after arrival on the job, the Inspector should see that a suitable field laboratory is available at the plant site and that all necessary testing equipment is on hand.

Before mixing begins, the Inspector will make a thorough inspection of the plant to see that it meets the requirements of the specifications and that it is in good operating condition. Particular attention should be given to examination of gates, feeders, drier and dust collector, screens and bins, pugmill, and all thermometers, pyrometers, and weighing scales. Any deficiencies noted should be called to the attention of the Contractor, and corrections must be made before commencing production of the mixture. This inspection is usually performed by the Regional Independent Assurance Sampler and is documented on DOT Form 350-126 "Asphalt Plant Inspection."

The mixing plant requires regular cleaning and maintenance to keep it in good running order. Special attention is usually given the plant at the end of each week's operation when the plant is cold.

Cold Aggregate Feeders

(1) Single Stockpiles

In the production of asphalt concrete, the *Standard Specifications* and Special Provisions may not require separation of aggregates into two stockpiles. The purpose of the single stockpile is to reduce cost on projects of large size requiring the use of automatic batch, continuous mix or drum plants and/or on projects specifying Class F asphalt concrete pavement.

Bin control will be as noted below under multiple stockpiles, except as related to one aggregate only.

(2) Multiple Stockpiles

The purpose of this requirement is to ensure closer control of the gradation of materials passing over the screens, thereby avoiding variations in gradation of materials in the bins, especially the fines bin. A separate cold aggregate feeder is required for each size of material, including coarse aggregate, fine aggregate, and blending sand.

It is very important that complete separation of each of the materials be maintained in the stockpile and at the cold aggregate feeders, if the benefits of aggregate control are to be realized. If the coarse and fine aggregates intermingle in the stockpiles or over the tunnel or feeder trap, control of the cold aggregate gradation will be lost.

A reasonably accurate calibration of the rate of feed of each of the cold aggregate feeders should be made so that the proper proportion of each size will be fed into the plant. Although proportioning of the aggregates in the mix for batch plants is actually accomplished from the hot aggregate bins, the cold aggregates must be fed in the proper proportions if a smooth, balanced operation is to be achieved.

With a rotary drum plant it is essential to have accurate calibration of the rate of feed of each of the cold aggregate feeders for uniformity. This controls the gradation of the final mix.

Drier and Dust Collector

After passing through the cold feeders onto a belt or elevator, the aggregates are fed into the drier. In this unit the aggregates are heated to the required temperature and moisture is removed from the materials. The fuel used to fire the drier is usually fuel oil, although some stationary plants use gas. Fuel oil is atomized and oxidized at the burner nozzle by steam or low pressure air, and the flame and hot gases are drawn through the length of the drier drum by the exhaust fan. The aggregates are heated and dried as they pass through the drum, entering at the exhaust end and travelling toward the burner end of the drier.

The drier drum is set on a slope so that the aggregates will travel rather slowly down the length of the drum as it revolves. Flights, or lifting troughs, are attached to the inside of the drum to lift the aggregates from the bottom of the revolving drum and spill them in a thin curtain through the hot gases. It is important that these flights be in good condition. If the troughs are warped, bent, or missing entirely, the efficiency of the drier is seriously impaired.

As mentioned before, the exhaust fan creates a draft through the drier to remove the moisture vapor as the material is heated. The exhaust gases and vapor, along with a quantity of the very fine portions of the aggregate, are discharged through the dust collector, or cyclone, where

the dust can be reclaimed and reintroduced into the mixing plant through an auger. Means should be provided at the auger to waste a portion of the reclaimed fines, if required to maintain grading limits.

The temperature of the dried materials is measured at the discharge chute of the drier by a pyrometer or thermometer. This heat indicator is necessary to maintain control of the temperature of the heated aggregates. Variations in temperature of the material will affect the quality of the mixing, and overheated aggregates will result in excessive hardening of the thin asphalt coating during the mixing operation. The accuracy of the pyrometer or thermometer should be checked against results obtained with a thermometer of known accuracy.

Screening and Gradation Unit (Batch-Type Mixing Plants)

The heated aggregates are elevated to a screening unit, which separates the material into the required number of size fractions and deposits the various sizes into separate compartments. The screens must be clean and unbroken to function properly. A plugged screen will result in carryover of fine material into the coarse aggregate bins, and control of gradation will be lost. During the preliminary inspection of the plant the Inspector should note the sizes and condition of the screens.

The compartments, or bins, of the gradation unit must be constructed so that complete separation of the various sizes of aggregate is maintained. Overflow vents are provided, and must be so constructed as to prevent material building up in any bin to the point that it will spill into an adjoining bin. Baffles should be installed in the fine aggregate bin to prevent segregation of the material.

Scales (Batch-type Mixing Plants)

With batch-type mixing plants, the separate sizes of aggregates and the asphalt are proportioned by mass before mixing. Each time the asphalt plant is set up and at least every 6 months thereafter, the weighing scales must be checked by either a scale company with a copy of the test report furnished the Inspector or the Weights and Measures Section of the State Department of Agriculture and their certification attached to the scales. The scales shall be rechecked periodically during the life of the job. Test masses (weights) shall be furnished by the Contractor and shall be readily available for this purpose. If any question develops concerning accuracy and adjustment of the scales, the Contractor must have them checked and adjusted by a competent commercial scale testing service.

Due to the pollution control requirements, the modern batch plant is constructed with sealed compartments which make access to check the scales a time consuming operation and can only be done when the plant is cold. The proportioning scales shall be checked as follows:

1. Initial plant setup test and report to be repeated at least every 6 months.

2. Check batch masses (weights) by comparing them with actual net mass (weight) of truck load of mix at least daily. Check amount of asphalt by nuclear asphalt content gauge tests and from production data, i.e., sticking asphalt tanks, delivery tickets, meter readings, checking asphalt scales.

3. When proportioning scales are used for measurement for payment, in addition to the above scale checks, a check of the proportioning scales shall be made at least daily to establish the reliability for the quantity of material received, by weighing a loaded truck of the mixture or by testing the scales with the test masses (weights).

It should not be necessary for the Inspector to be present all the time while the Contractor is opening the plant and cleaning the scale parts. Usually the Contractor can tell the Inspector ahead of time when they will be ready to check the scales.

Gradation Unit Control Gates (Rotary Drum Plants)

In rotary drum plants, the proportioning of the separate sizes of aggregates is accomplished through adjustable gates on the feeder. The asphalt is discharged through a calibrated metering pump. The aggregate feeder and the asphalt pump are geared to a common power source so that proportions of aggregate and asphalt remain constant, regardless of variations in power supply.

Pugmill Mixer

After proportioning, the aggregate and asphalt are introduced into the pugmill for mixing. The mixers of batch plants and continuous mix plants are essentially of the same design, excepting for variations in arrangements of the paddle tips. In a continuous mix pugmill, the materials are introduced at one end of the mixer and the paddle tips are set to transport the materials to the discharge end as the mixing is accomplished. In the batch plant mixer, the materials are dumped into the center of the mixer and the paddle tips are arranged to give an end-to-center mixing or a run-around (figure eight) mixing pattern. Most modern mixers are designed to mix with the run-around pattern.

In any case, efficient mixing is dependent upon the number and shape of paddle tips, clearance between paddle tips and liner plates, speed of the mixing shafts, length of mixing time, temperature of the materials, and quantity of materials in the mixer. Paddle tips should be full-sized, without excessive wear of corners and edges. The clearance between the paddle tips and the liner plates should be about 19 mm. If the clearance exceeds this distance, the paddle

tips will not pick up the materials efficiently and "dead spots" in the mixer will result. It may be necessary to replace paddle tips and/or liner plates to obtain the correct clearance.

Mixers of the several manufacturers are designed to operate at different speeds, varying from about 50 rpm to 72 rpm. A check should be made before beginning production to make certain the mixer is operating at its design speed.

The mixing period is defined as beginning at the time the hot aggregate is introduced into the mixer and ending when the mixer discharge gate is opened. The time required to discharge the mixer and close the gate is not considered part of the mixing period. The asphalt is introduced into the mixer immediately after all aggregates are in the mixer. The mixing time shall be sufficient to produce a minimum of 95 percent coated particles (Ross Count); see Chapter 9-3.2I of this manual.

The mass (weight) of any batch must not exceed the rated capacity of the mixer as shown on the mixer name plate, nor must the production rate of a drum mix plant exceed the manufacturer's rated capacity of the plant.

Asphalt Storage, Heating, and Measurement

Allowable methods of heating the asphalt are stated very clearly in the specifications, and the limits of the range of application temperatures are also specified. An asphalt thermometer is required to be installed in the asphalt line. This thermometer should be checked for accuracy before work starts. Close control of variations in temperature of the asphalt cement is very important, especially on continuous mix plants where the asphalt is measured volumetrically, since the volume of the asphalt varies with the temperature.

A daily record of asphalt used is very useful in checking the asphalt content of the mixture. When there is a separate bid item for Paving Asphalt AR-4000W, this becomes mandatory in accordance with Section 5-04.4 of the *Standard Specifications*. The actual quantity of asphalt used can be determined from production data based upon batch scale masses (weights) on batch plants or from converted volumetric measurements obtained from the asphalt flow meter on continuous mix plants. In order to do the latter, it will be necessary to periodically check the asphalt temperature as described above, and record the accumulated flow volume. This should be done at the beginning and end of each shift and after each delivery of asphalt is made, as a minimum.

A check on the quantity of asphalt used should also be made by sticking the storage tank and by checking against the weigh bills of loads delivered. Again, when there is a separate bid item for asphalt, it becomes incumbent upon the Inspector to periodically stick the tank before and after a load is delivered as well as weighing the transport vehicle for gross and tare masses (weights).

Section 5-04.3(1)A of the *Standard Specifications* requires that a valve be placed in the asphalt line to the mixer for sampling the asphalt. This valve should provide a safe method of obtaining samples of the asphalt material which are representative of the material being incorporated in the mixture. Samples may also be taken from the tankers on arrival at the asphalt plant. All samples must be taken in the Inspector's presence.

Storage of Asphalt Concrete Mixture

Storing or holding of asphalt concrete mixture in approved storage facilities will be permitted during the daily operation but in no event shall the materials be held for more than 24 hours. Materials held for more than 24 hours after mixing shall be rejected and disposed of by the Contractor at no cost to WSDOT. The storage facility shall have a visible device located at the top of the cone or about the third point to indicate the amount of material in storage. No material shall be accepted from the storage facility when the material in storage is below the top of the cone of the storage facility, except at the end of the working day.

Plant Safety

During the preliminary inspection of the asphalt mixing plant, the Engineer should note any violation of safety rules concerning machinery safeguards, such as lack of guards on belts, sprockets and the like. The Engineer should call to the attention of the Contractor any such violations and request that corrections be made. If the violations directly affect the functions of the engineers and inspectors, the Project Engineer should refuse to allow mixing to begin until conditions are safe for sampling, inspecting, etc. Section 1-05.6 of the *Standard Specifications* requires the Contractor to provide safe facilities for inspection of the plant and the work.

5-4.2E Establishing Mix Proportions

The Plant Inspector shall obtain from the Project Engineer the mix design recommended by the Materials Engineer. The plant operator shall calculate the batch masses (weights) (or gate openings and pump sprockets for other plants) required to produce a mixture that will conform as closely as possible to the *recommended mix design*.

It must be borne in mind, however, that the *mix design is intended as a guide* and is based solely on the information and samples furnished the Laboratory concerning the aggregates produced. It is often necessary to make final adjustments in aggregate gradation and asphalt content on the job to fit field requirements such as workability,

compatibility and void content in order to make the most effective use of the available materials, within specification limits. However, should it become desirable to alter the asphalt content by more than plus or minus 0.3 percent from that recommended in the mix design, Olympia Service Center's approval must be obtained from either the Materials Laboratory or from the Construction Office.

Guidance for these final adjustments is provided through the use and *proper* interpretation of the compaction test sections and compaction control testing results as compiled on forms for that purpose. See also Chapter 5-4.3D of this manual.

The Contractor's plant operator shall be advised of all results of sampling and testing performed so that the proper gate settings may be established at the cold aggregate feeders.

5-4.2F Inspection During Mixing Operations

After the mixing begins, and throughout the day, the Inspector shall make the required tests of the mixture. It is very important; however, that the Inspector spend some of the time observing the operation of the plant and the condition of the mixture being produced. Changes in the mixture can quickly be detected by observing changes in appearance or color of the mixture.

Periodic checks of the temperature of the aggregate and the asphalt, as well as the mixture produced must be made to ensure uniform material production. The Contractor will choose the desired temperature of the mixture within specification limits, depending on weather conditions, length of haul, and other factors. Generally the temperature of the mixture shall be as low as possible, consistent with the requirements for mixing and paving. The Plant Inspector shall watch for excessive variation in temperatures, and shall notify the plant foreman of any variation that occurs. The Inspector shall insist that the temperature be kept as uniform as possible.

When stockpiled aggregates contain a high percentage of moisture, difficulty may be encountered in heating the material to the proper temperature. Usually, the plant fireman will try to correct this condition by increasing the amount of fuel oil fed to the burner. This can be done satisfactorily until incomplete combustion of the fuel oil occurs. Black smoke coming from the exhaust stack is an indication that incomplete combustion is occurring. The Inspector should watch for this condition, as the unburned fuel will deposit a sooty, oily film on the aggregate particles which is detrimental to proper coating of the material with the asphalt film. A reduction in the amount of cold aggregate feed to the drier will usually correct the situation and allow proper heating and drying of the material.

Frequent inspections of the condition of the mixture leaving the plant should be made, noting the consistency of the mix, the distribution of asphalt and aggregate throughout the mixture, and the temperature of the mixture. If the quality of the mixture varies from batch to batch, an immediate check should be made to locate the source of trouble. Uniform distribution of the asphalt throughout the mix is extremely important. If portions of each batch vary from rich to lean, the Inspector shall advise the Contractor to correct the problem. It may be necessary to increase the mixing time to correct this situation. By examining the mixture in bright light, the experienced Inspector can quickly detect nonuniformity in the mixture.

While maintaining an attitude of cooperation with the Contractor, the Plant Inspector must insist that the requirements of the specifications be met. If tests show that he mixture consistently fails to meet these requirements, it shall be the Inspector's duty to notify the plant foreman and immediately contact the Project Engineer for further instructions.

5-4.2G Miscellaneous Duties of the Plant Inspector

The Plant Inspector shall supervise the work of the scale person on truck weighing scales at the plant, and shall see that the required tests of the scales are performed. The Inspector must see that tickets are properly made out and issued for each truckload of mixture delivered, and shall also see that daily totals are promptly obtained and entered on the daily report.

Before trucks are allowed to be loaded at the plant, a check shall be made to see that the truck beds are properly lubricated as required in the specifications. No pools of bed release agent shall be allowed to remain in the truck bed following this operation. The truck bed should be raised to allow any excess material to be drained off.

Upon completion of the project, the Contractor must be required to shape up any remaining aggregates into neat stockpiles, and remove all debris from the plant site, when the Contractor is occupying a site furnished by WSDOT.

5-4.2H Multiple Asphalt Plants

When two or more asphalt plants are used on one project, separate pavings spreads are required and the mix from each plant must be applied with separate spreaders and compaction equipment. This is necessary because of the required adjustments on each spreader to accommodate the different mixes and the various rolling patterns which may be necessary. Otherwise the test sections would not reflect true data for compaction by nuclear controls due to different characteristics for the different aggregates or asphalt plants.

5-4.2I Plant Inspector's Check List

Some of the most important details of inspection on asphalt plants are listed below:

1. See that testing tools, equipment, and samples are on hand at the plant site and in good condition. Make sure you understand all tests.

2. Inspect all components of the asphalt plant; make sure all deficiencies are corrected *before* production is begun.

3. Verify that all proportioning and weighing scales are currently certified in accordance with Section 1-09 of the *Standard Specifications*.

4. Post mix designs, including all revisions.

5. See that stockpiled aggregates are kept separate; see that no intermingling occurs at cold feeders unless single stockpile is used.

6. See that cold aggregate feeder gates are being monitored and that cold aggregates are feeding continuously.

7. Watch for evidence (dark smoke from plant exhaust and oily coating of aggregate) of incomplete combustion of burner fuel.

8. Check frequently the temperature of the asphalt and volume accumulation from flow meter.

9. Observe plant operator occasionally to see that correct masses and proportions are obtained, including asphalt content.

10. See that the asphalt concrete mixture is mixed to ensure that a minimum of 95 percent of the particles are coated as determined by WSDOT Test Method No. 714.

11. Make frequent visual inspections of mix leaving plant for evidence of non-uniformity or incomplete mixing.

12. Check temperature of mix frequently.

13. Inspect truck beds before loading; see that bed is free of congealed chunks of mix and excess bed release agent.

14. Check frequently with Street Inspector concerning workability and uniformity of mix at the paving machine and nuclear tests results.

15. Take samples of mix for field tests and submission to laboratory.

16. Make accurate, complete record of all test results, asphalt used, and other pertinent data.

17. Have copies of all test reports available for review.

18. Fill out the required daily reports per Chapter 5-4.3G of this manual.

19. Keep in constant communication with the plant foreman and the street inspector and give immediate notification regarding any problems.

5-4.3 Responsibilities and Duties of the Street Inspector

5-4.3A General

In the construction of asphalt pavements, it is the responsibility of the Street Inspector to see that construction methods and equipment used, as well as the finished pavement, meet the requirements of the specifications. In order that the Inspector may properly discharge this responsibility, it is necessary that the Inspector thoroughly understand the *Standard Specifications*, the special provisions of the contract, and the instructions set forth herein. The Inspector must also have a good working knowledge of methods and equipment involved in the construction.

The Street Inspector should adopt an attitude of cooperation with the Contractor. The Inspector must conduct inspection duties so that no unnecessary delays to the paving operation result. A smoothly organized, continuous paving operation will produce the best results, both in quality and economy.

The remarks contained in Chapter 5-4.2G of this manual concerning the attitude of the Inspector toward the Contractor apply to the Street Inspector as well as the Plant Inspector.

A means of communication between the Street Inspector and the Plant Inspector must be established, and the Street Inspector shall keep the Plant Inspector informed of any difficulties encountered in the laying of the mixture or of any faulty mixture received at the paving site.

5-4.3B Duties Before Paving Begins

Immediately following assignment to the project, the Street Inspector should contact the Project Engineer, the Plant Inspector, and the Contractor's representative for a discussion of a plan of paving operations with each of these persons. An understanding should be reached as to the point of beginning of work, hours of operations, the direction in which paving is to proceed, methods of performing any unusual features of work peculiar to the project, proposed traffic control methods, etc. Once a plan of operation is agreed upon, it should be followed faithfully whenever possible.

Traffic Control

The Contractor shall conform to the requirements of Section 1-07.23 of the *Standard Specifications*. The Project Engineer and the responsible inspector must work closely with the Regional Traffic Engineer and the Contractor to

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Issued by
Bituminous Equipment Manufacturers Bureau

	2000	3000	4000	2000	3000	4000	2000	3000	4000	2000	3000	4000	Wheel Load
7:50 x 15	50	50	50	60	60	60	70	70	70	90	90	90	TIP
10 ply	46	53	57	56	65	68	60	67	73	67	75	82	GCP
7:50 x 15	50	50	50	70	70	70	90	90	90	110	110	110	TIP
12 ply	53	60	66	60	69	75	69	77	84	75	83	89	GCP
7:50 x 15	50	50	50	70	70	70	90	90	90	110	110	110	TIP
14 ply	59	66	71	65	73	79	72	80	86	78	87	94	GCP

	2000	4000	6000	2000	4000	6000	2000	4000	6000	2000	4000	6000	Wheel Load
9:00 x 20	35	35	35	50	50	50	75	75	75	90	90	90	TIP
10 ply	48	55	58	53	62	66	64	75	81	68	82	88	GCP
9:00 x 20	35	35	35	50	50	50	75	75	75	90	90	90	TIP
12 ply	47	55	57	53	61	66	64	75	81	68	82	88	GCP
9:00 x 20	35	35	35	75	75	75	90	90	90	105	105	105	TIP
14 ply	42	49	55	57	68	74	62	74	81	67	81	89	GCP
9:00 x 20	35	35	35	75	75	75	90	90	90	105	105	105	TIP
16 ply	40	50	57	57	68	75	64	75	82	69	81	89	GCP
10:00 x 20	35	35	35	70	70	70	85	85	85	100	100	100	TIP
14 ply	40	48	53	51	60	66	56	66	71	61	72	77	GCP
10:00 x 20	35	35	35	70	70	70	100	100	100	125	125	125	TIP
18 ply	40	48	54	51	60	66	61	72	78	67	80	87	GCP
11:00 x 20	35	35	35	50	50	50	70	70	70	90	90	90	TIP
14 ply	42	47	51	45	51	58	54	63	70	68	75	82	GCP
11:00 x 20	35	35	35	70	70	70	90	90	90	105	105	105	TIP
16 ply	42	47	51	54	63	70	68	75	82	69	83	88	GCP
11:00 x 20	35	35	35	70	70	70	90	90	90	105	105	105	TIP
18 ply	42	47	51	54	63	70	68	75	82	69	83	88	GCP

	4000	6000	8000	4000	6000	8000	4000	6000	8000	4000	6000	8000	Wheel Load
13:00 x 24	35	35	35	60	60	60	80	80	80	100	100	100	TIP
18 ply	50	54	57	63	66	69	71	75	79	80	85	88	GCP
13:00 x 24	35	35	35	60	60	60	80	80	80	100	100	100	TIP
22 ply	50	54	57	66	69	72	77	81	84	87	91	95	GCP
13:00 x 24	35	35	35	60	60	60	80	80	80	100	100	100	TIP
26 ply	54	59	62	69	73	76	81	85	89	91	96	100	GCP

GCP Ground Contact Pressure

TIP Tire Inflation Pressure

Note: Interpolation is necessary between either/or Loads and Pressures. Each axle of pneumatic roller should be weighed separately and ballasting done accordingly to provide uniform tire load and contact pressure.

Figure 5-1

ensure that the proper signs are placed in the best possible manner. All applicable signs shall be installed on the job before paving begins. Chapter 1-2.3 of this manual includes additional sign installation details.

Inspection Tools

Before paving work begins, the Street Inspector must secure all tools and equipment necessary for the inspection work, such as thermometers, tapes, tire pressure gauge, 3-meter (10-foot) straightedge, notebooks, diary, report forms, etc.

Inspection of Paving Equipment

It is the duty of the Street Inspector to make a personal inspection of the Contractor's paving equipment, checking the condition and adjustment of the component parts of the paving machines and rollers. In order that the best possible surface finish will be obtained, it is essential that all machines be in good condition and all parts be in proper adjustment. All equipment including trucks should be checked for hydraulic and fuel leaks when systems are under pressure. By making this inspection prior to the beginning of paving operations, obvious deficiencies in the condition of the equipment may be discovered and corrected, thus avoiding delays once the work is under way. The Contractor must not be allowed to begin work until the Inspector is satisfied that the equipment is in good operating condition.

Listed below are some of the most important details the Inspector should check during the inspection of paving equipment:

(a) Paving machines.

Several types and makes of pavers are in use in this State, all of which are capable of producing satisfactory surface finishes. The differences between types of paving machines are primarily in the methods used in striking off, compacting and smoothing the mixture. The Inspector must be familiar with the mechanical features of the type of paver to be used on each job, so that an intelligent appraisal of the condition and adjustment of the machine can be made. Handbooks of operating instructions are available from each manufacturer, in which the various adjustments and operating details are shown. The Inspector should obtain copies of these instructions from the Contractor or the manufacturer.

Paving machines using a vibratory screed to strike off, compact and smooth the mixture must be checked to see that all vibrators are set to deliver vibrations of equal amplitude rate. The screed plate should be checked for signs of excessive wear, and engine speed determined to ensure correct adjustment of the governor.

Any extensions that are added to the paving machine should be checked to make sure they have the same equipment as the rest of the paver. Most newer paving machines will be equipped with automatic screed extensions. Regardless of whether the screed extensions are automatic or bolted on, sufficient auger must be added to properly distribute the mix without segregation.

On all track paving machines, correct adjustment of the track linkage is essential for smooth operation. A poorly adjusted track, or a badly worn one, can produce an uneven, lurching movement in the travel of the machine which will be reflected in an uneven, "choppy" pavement surface. Observation of the machine in motion will usually show up any defects in the track or drive mechanisms.

Some pavers are suspended on rubber-tired wheels. With these machines, all tires must be inflated to the correct pressure, and the drive system must be examined to see that it is without slack.

(b) Rollers

Steel-wheeled rollers must be inspected to determine that the wheels are capable of rolling a true plane and are in good condition. The Inspector should be especially watchful for flat spots on the wheels. The steering and driving mechanisms must be free of excessive play or backlash. Observation of the roller in motion and reversing direction will disclose any deficiencies in the drive and clutch mechanisms. The maximum rate of travel shall be limited to 1.75 meters per second (4 mph).

Vibratory rollers must have at least two amplitude settings and the minimum capability of 2,000 vibrations per minute at any speed. The maximum rate of travel shall be limited to 1.3 meters per second (3 mph).

Pneumatic-tired rollers, to function properly, must have tires of equal size and in good condition. All tires must be equally inflated, so that all exert equal unit pressure on the pavement. Tire pressures may be varied to suit conditions on the job, but, in general, should be such that ground contact pressures range between 40 and 80 psi. The Inspector should observe the roller in motion to see that all wheels are rolling true, without wobble or creep. See Figure 5-1. The maximum rate of travel shall be limited to 2.2 meters per second (5 mph). Pneumatic tired rollers shall have full skirts as the tires must be warm to prevent "picking."

(c) Miscellaneous tools

A check must be made to see that the Contractor has available on the job an adequate supply of rakes, lutes, shovels, brooms and other small tools. The Inspector should be satisfied that the Contractor is properly equipped

with portable barricades, cones, or other means of protecting the freshly laid pavement from damage by traffic.

Upon completion of the check of the paving equipment, the Street Inspector should call any deficiencies or maladjustments of equipment to the attention of the Contractor, so that correction can be made before the work begins.

Preleveling

The Engineer must give careful consideration to the use of a preleveling course over areas of unusual roughness, wheel ruts, or sags in the profile of the pavement base. The Contractor should be given as much advance notice as is possible of the intent to place a preleveling course.

The standard operation for preleveling normally will be with a motor patrol grader. A paving machine may be used when the Engineer has determined that better results can be obtained by this method and particularly where long undulations occur. When conditions warrant, a reference line may be erected for preleveling and a long multi-footed ski-type reference should be used for placement of subsequent pavement courses. Ruts can be economically preleveled by dragging a paver screed. Because of the possible detrimental effect on the equipment, it should only be done with the consent of the Contractor or if required by the plans. In order to outline areas and amount of preleveling, the Contractor should be encouraged to erect a single reference line along the crown point for the first pass. The practice of directly marking depths and limits of preleveling required on the pavement surface is considered beneficial.

The nominal compacted depth of any layer of any course including preleveling lifts shall not exceed the depths outlined in the *Standard Specifications* for the class of mix being used. The purpose of this requirement is to reduce the differential compaction which takes place and to ensure adequate compaction of thick lifts between two humps. Compaction should be accomplished with a pneumatic roller.

To produce a satisfactory riding surface, preleveling should continue regardless of quantities until a uniform lift of asphalt concrete can be placed by paving machines with the multi-footed ski-type reference. The Engineer must take care to clearly distinguish between preleveling operations and paving operations, especially leveling courses.

Preparation of Untreated Roadway

Section 5-04.3(5)B of the *Standard Specifications* covers the work of preparing the untreated roadway quite thoroughly. When the roadway is carrying traffic, public or construction, it is usually necessary to construct the prime coat treatment to maintain the roadway to the desired line, grade and cross-section until the first course of pavement is constructed. If there is no traffic problem, it may be desirable to eliminate the construction of the prime coat treatment.

Weather conditions must be satisfactory for construction of the prime coat treatment and the prime coat must be allowed to cure for a minimum of 5 days before proceeding with paving. When the weather limitations cannot be met or the minimum curing period would present a hardship and it is desirable to pave the roadway, elimination of the prime coat should be considered.

5-4.3C Duties During Paving Operations

Prior to beginning of paving work each day, the paving equipment shall be checked for adjustment and condition. The Inspector shall see that guidelines are set for the day's work, that the base is properly prepared, and that the tack coat has been applied through the area to be paved during the day. It is not a good practice to apply the tack coat over more area than can be paved in a day or an hour or two if the weather appears to be questionable.

The specifications require an application of tack coat from 0.1 to 0.35 liters (0.02 to 0.08 gallons) of retained asphalt per square meter. For pavement of normal thickness, less than 0.23 liters (0.05 gallons) per square meter (yard) should be adequate. Thin lifts of pavement and open graded mixes such as Class D require heavier applications of tack coat to prevent ravelling and spalling.

Joints

The *Standard Specifications* provide that butt joints be constructed. The use of heavy paper is recommended to form the butt joint at the end of the day's work, with a temporary ramp laid on the paper beyond the joint to assist traffic over the change in elevation. Paper protruding above the pavement shall be carefully trimmed flush with the pavement so that there will not be an illusion of a hazard at night. When the ramp and paper are removed prior to beginning the succeeding day's paving, a well-constructed joint will require a minimum of cutting back to form the required butt joint. When hand raking is performed on a joint, all segregated coarse aggregate shall be removed, to avoid a coarse, porous surface at the joint.

If the roadway is open to traffic, the transverse joint must be feathered to provide a smooth transition for the traveling public and joints between successive lifts in each lane should not be less than 30 meters (100 feet) apart. The higher the speed on the roadway, the longer the taper on the joint must be to provide an acceptable transition.

The recommended minimum slope ratios for various vehicular speeds are:

110 kph (70 mph)	1 vertical to 50 horizontal
80 kph (50 mph)	1 vertical to 30 horizontal
55 kph (35 mph)	1 vertical to 10 horizontal

This schedule will usually require use of more than one width of paper. Sufficient material must be temporarily placed in front of the paver to prevent a deformation from occurring in the permanent ACP behind the joint. Care should be taken to construct a straight line taper without humping. As the thickness of the course increases, the longer the taper should be increased over the minimum length for a satisfactory transition.

The open longitudinal joint resulting from any day's operation should be abutted by paving the adjacent lane on the next day.

At the beginning of the day's work, special care must be exercised in the construction of the transverse joint joining the freshly laid mixture with the previous day's work. The paver should be allowed to proceed at a low rate of speed (creep) ahead of the joint, until hand finishing of the joint is completed. The Inspector should check this work closely, using the 3-meter straightedge to see that the requirement for surface smoothness is met.

Spreading and Finishing

In the construction of asphalt concrete pavements, it is extremely important that the paving machine be in good adjustment and that the machine and screed operators be experienced and capable. The Inspector should be quick to note operational practices which have an adverse effect on the work, and request the Contractor to make immediate corrections.

Before beginning paving work for the day, or before resumption of paving following a lengthy shutdown, the Inspector must see that the machine is cleaned of all congealed pieces of mix and that the screeds are heated to the operating temperature. If a delay occurs during the day which will allow the mix to cool below the temperature required for proper compaction, the Contractor must construct a transverse butt joint before the mix cools below the temperature required for proper compaction.

Compaction procedures will be as specified in Section 5-04.3(10) of the *Standard Specifications* and Chapter 5-4.3D of this manual.

During the paving operation, constant inspection must be maintained to see that the machine is producing a smooth pavement having the required characteristics of texture and uniformity. The Inspector must require immediate action be taken to correct any trouble that may develop and should attempt to assist the Contractor in locating the source of the trouble.

Listed below are some common difficulties encountered on asphalt paving work, together with the most common causes of the difficulty:

1. *Wavy surface (short, choppy waves):* Worn or poorly adjusted tracks or drive train; truck driver setting brakes too tightly; excessive paving machine speed.

2. *Wavy surface (long waves):* Excessive variation in amount of mix carried in auger box ahead of screed; over-controlling screed; roller operating too fast.

3. *Excessively open surface texture:* Improper adjustment of strike off; screed plate rough or galled; excessive paving machine speed.

4. *Varying surface texture:* Insufficient mixing; trucks being loaded improperly at the plant; segregation of mix in trucks; poor gradation control at mixer; screed not uniform across paving machine.

5. *Streaked surface texture:* Insufficient mixing; segregation of mix in trucks; worn or damaged screed plate.

6. *Bleeding patches on surface:* Asphalt not uniformly mixed; excessive moisture in mix.

7. *Irregular rough spots on pavement:* Roller standing on fresh surface; abrupt reversing of roller; trucks backing into paver; poor workmanship at transverse joints.

8. *Cyclic open texture, that usually matches up with the distance that each truck load of material covers:* This is primarily caused by the machine operator allowing the head of material to fall below the top of the augers or by dumping the wings of the paver when the hopper is low on material. Hopper wings should be operated only occasionally and then with some load in the hopper.

9. *Crooked or irregular longitudinal joint lines:* Careless machine operation or no guide string placed for the machine operator to follow.

Some paving machine operators have a tendency to operate the paver at speeds in excess of that required to handle the quantity being produced at the plant, resulting in a jerky, stop and go operation. *This must not be allowed.* Generally, the slower the paver is operated, consistent with plant production and roller capacity, the smoother the finished surface will be. The ideal speed of the paver will be that which will result in a smooth, nearly continuous process with a minimum of stops required in waiting for trucks and/or the compaction equipment. If the production rate of the mixing plant is very high, requiring excessive speed of the paver, the Contractor will be required to correct the situation by slowing his production or using additional paving machines and generally, additional compactive

equipment. Delivery must be adjusted to match production and uniform laydown.

To assist the Inspector in exercising some measure of control over paver speeds, the following formula can be used to calculate speeds required to handle various production rates at varying depths. Section 5-04.3(3) of the *Standard Specifications* provides for direct control of paver speeds, by the Engineer, to hold the paver speed at the lowest rate which will allow a smooth, *continuous* paving operation.

Metric

$$[(T \div 2.432) \div (W \times D)] \div 60 = S$$

where: T = Tonnes per hour
W = Width in meters
D = Depth in meters
S = Paver speed in meters per minute

Based on 2.432 tonnes per m^3

English

$$[(T \div 0.076) \div (W \times D)] \div 60 = S$$

where: T = Tons per hour
W = Width in feet
D = Depth in feet
S = Paver speed in feet per minute

Based on 2.052 tons per c.y. =
0.076 tons per c.f.

The Inspector should periodically check for difficulties while dumping truck loads of mixture into the hopper of the paving machine. Trucks must not be allowed to back into the paver in such a manner that they bump the paver, nor shall trucks which bear against any part of the machine other than the pushing rollers be permitted to dump into the paver. Any mix spilled onto the pavement in front of the paving machine must be shovelled into the hopper of the machine or back into the truck before paving is resumed. The Inspector should be especially watchful to see that mix spilled in the paths of the tracks or wheels of the machine is removed.

Checks should be made of the crown adjustment of the screed, to ensure that the finished surface will conform to the required section.

Particular attention must be given to the construction of the longitudinal joint when paving adjacent to a previously laid lane. The Inspector must insist that hand raking be held to a minimum, by adjusting the screed so that the freshly laid pavement is of the proper depth, allowing for compaction, to meet the grade of the previously laid lane. The uncompacted mixture immediately adjacent to the joint should be left slightly high so that the roller can compact the mixture thoroughly at this point. The rakers must not be permitted to cast excess mixture over the uncompacted, freshly spread lane. The Inspector must insist that segregated coarse particles of mix remaining after making the joint be removed and wasted, to avoid construction of a coarse, porous joint.

Surface Smoothness

During construction of the leveling course, an attempt must be made to remove all depressions and sags in the grade line by adjusting the depth of the course. The Inspector should work closely with the screed operator to accomplish this result by pointing out irregularities in the base far enough ahead of the machine to allow proper adjustment of the screed to eliminate the irregularity. The objective to be attained during construction of the leveling course is the complete elimination of all irregularities, so that the placing of the wearing course can be accomplished with a minimum of screed adjustments. If the base is excessively rough, pre-leveling should be done prior to construction of the leveling course.

Section 5-04.3(3) of the *Standard Specifications* require the use of automatic screed controls on the paver. It must be remembered that as the equipment becomes more sophisticated, it also becomes more necessary that it be properly adjusted and operated or satisfactory results will not be achieved. With proper operation, this equipment will give excellent performance.

When reference lines are required, or the Contractor elects to use reference lines, the instructions in Chapter 1-5.7C of this manual should be followed. When reference lines are used, particular attention must be given to see that the line is properly set and tensioned. If the line is offset too far from the paving machine, vibrations of the machine may affect the operation of the automatic controls which in turn affect the smoothness of the pavement. The reference line for asphalt paving machines normally will not be used when the roadway is under traffic.

The specifications provide that if the course that the pavement is to be placed on is superior to established smoothness requirements, the paver may operate from a multi-footed ski-like arrangement instead of the wire. The Inspector must ascertain that smoothness of the pavement continues to be superior to the requirements of the specifications.

Normally, when the surface for paving is properly constructed using a reference line, or the first course of pavement is constructed using a reference line, subsequent courses of pavement may be constructed using skis with continued improvement in the surface smoothness.

Manual operation of the screed controls will be permitted in the construction of irregular shaped and minor areas, such as gore areas, road approaches, left turn channelizations, and tapers.

Surface smoothness and good riding qualities of a pavement are secured only by hard work and strict attention to small details. The Inspector should continually study the conditions peculiar to the job, and strive to obtain the smoothest surface possible. A smooth riding pavement costs no more than an unsightly, poor surface, but it does require constant, careful inspection of all details of construction to obtain the desired results.

Refer to Section 5-04.3(13) of the *Standard Specifications*.

5-4.3D Compaction

5-4.3D(1) General

Adequate field compaction is very important in the construction of durable asphalt concrete pavement. When good compaction is coupled with the proper mix design, extended service life of the pavement can reasonably be expected.

The importance of thorough, early compaction of asphalt concrete cannot be overstressed. Two major factors are simultaneously reacting in a well-designed mixture to oppose good compaction. These can be stated simply as (A) the stability of the mix in-place increases with each pass of the roller, and (B) the viscosity of the asphalt increases as the temperature drops. Although densities occasionally may be increased at temperatures below 80°C (175 F), vibratory rollers may damage the mat internally in ways that cannot be seen at the time of compaction. To counteract these factors, the Inspector should insist that compaction be accomplished at a temperature above the minimum specification of 80°C (175 F). When paving in air temperatures over 30°C (90 F), some or all of the compactive effort may have to be delayed, but in no case should it be delayed below 80°C (175 F) mat temperature.

The desirable end point of a properly compacted asphalt concrete is a dense and nearly impermeable mat. Acceptable densities can be obtained if the mix proportions are proper. If not, no reasonable amount of compaction can produce acceptable density. Without proper density, the asphalt concrete will be subject to early distress and failure. Having available the 0.45 power plot of the design and production mixes will help the Inspector know what to expect in terms of compaction difficulty.

The asphalt content in an ideal mix should be sufficient to allow the mix to compact to specification density. The mix design asphalt content is a good starting point; however, the asphalt content is subject to adjustment as indicated by field tests on compacted mix. Increasing the asphalt content on high traffic volume routes carries more long term performance risk than on low volume roads.

The use of thicker lifts of pavement permits more time for compacting and will increase the effectiveness of the equipment. With careful organization and planning, the production of over 360 tonnes (400 tons) per hour may be compacted by as few as three rollers on deeper lifts. It is also apparent that high production rates with thin lifts might require twice as many rollers or more.

Usually the Contractor has a companion group of rollers, pavers, and production equipment that is used together on ordinary paving projects and have proven to be compatible. By consulting with the Region Staff, it may be determined if the full complement is present or just what past experience has been. Before production begins, the Regional Materials Engineer should be notified to provide equipment, guidance, advice, and arrange for the coring of the pavement to correlate nuclear densities to core densities for calculation of a gauge correlation factor.

In general, compacting shall begin on the outer edge of the course and progress toward the center of the pavement except on superelevated sections where the initial effort shall be on the lower side with the progressive compaction to the higher side.

The type of rollers and their relative position in the compaction sequence shall generally be at the Contractor's option provided specification densities are attained and it's not specified otherwise in the contract provisions. An exception shall be that the pneumatic tired roller shall be used between October 1 and April 1 for breakdown compaction. On wearing course, coverages with the vibratory or steel roller may precede pneumatic tired rolling. The maximum speed of rollers shall not exceed 1.3 meters per second (3 mph) for vibratory, 1.5 meters per second (4 mph) for steel-wheeled, and 2.2 meters per second (5 mph) for pneumatic tired. Better performance is generally obtained in the 0.7 to 0.9 meter per second ($1^1/_2$ to 2 mph) range with vibratory rollers. The speed of the roller must be slowed and the vibrators turned off momentarily while reversing direction.

The vibratory roller is generally used for the primary compaction on ACP mixes and sometimes for finish rolling in a static mode. Two terms frequently used with vibratory rollers are frequence and amplitude. Frequency is how often the impacts are applied and is normally stated in cycles per second. Amplitude is the greatest vertical movement, up or down, of the drum during a cycle. The current specifications for vibrating rollers are:

1. A variable amplitude with at least two settings.
2. A variable frequency with a 2000 RPM minimum.

3. The maximum rate of travel shall be limited to 1.3 meters per second (3 mph).

4. Pneumatic propulsion on surface courses shall be limited to smooth tires that will not leave visible tracks.

Vibratory rollers achieve their compaction effect from the kinetic energy produced by the vibrating components of the roller. Vibratory rollers usually work best when operated with high frequency and low amplitude on dense graded leveling and wearing courses. On hills it usually works best to operate the vibrators only while traveling uphill. Overvibrating can cause decompaction. Operated in the static mode, despite their apparent bulk, they are less effective than even intermediate size conventional steel wheel rollers due to their lower mass.

With pneumatic roller breakdown it will be necessary to hold in about 150 millimeters (6 inches) from unsupported edges to avoid lateral displacement. Keep the tires dry and the roller within 60 meters (200 feet) of the paver and in constant motion. A narrow overlap of successive trips is desirable. During the initial compaction, the rollers direction should be such that the powered wheel passes over the uncompacted mix first. Breakdown tiller wheels will be turned the least possible amount in the uncompacted area and thereby avoid pushing and shoving the hot mat in a local area. Avoid stopping the roller in the same place. Continue pneumatic breakdown rolling until deep tire tracks are ironed out as much as possible and the roller walks out to the top of the mat, and then move ahead. The most desirable arrangement is to have two similar pneumatic rollers about 1.8 meters (6 feet) wide with the "air-on-the-run" feature and positraction type differential followed by a tandem steel wheel roller. The steel wheel roller should follow closely behind the pneumatic roller to compact the center line joint and the edge of the pavement as well as iron out the pneumatic tire marks. The steel wheel roller will exert extra pressure on the uncompacted edge and should have no difficulty in properly compacting this edge if the roller is close behind the pneumatic rollers. Cold rubber tires usually "pick" the mat. Every effort should be made to warm the tires before compacting the mat.

The ground contact pressure of pneumatic rollers is a combination of load and tire pressure as outlined on Figure 5-1 and shall be such that it will produce the desired densities without shoving or rutting the mixture.

Individual dual axles shall be weighted by the use of iron pigs, chain, rivets or other concentrated loading in addition to the usual water and aggregate tank loading to control the total roller mass (weight). Ground contact pressure is determined by the tire inflation pressure. Provided the mixture is close to the Mix Design recommended by the Materials Laboratory, a ground contact pressure of 480 kilopascals (70 psi) will be a reasonable pressure to start with. Variation in the mixture and tire pressures will soon determine the most desirable combination of mixture, temperature, contact pressures and number of applications.

Steel wheel rolling is generally used for finish rolling; however, it is sometimes used for break-down and primary compaction. It is important that vibratory roller operation on pavement with temperatures below 80°C (175 F) not be permitted. Over-rolling by the steel wheel roller may damage the pavement more than under-rolling.

Preferably, rolling equipment should be wide enough so that a uniform application of compactive effort can be distributed over the entire course without creating hard streaks or leaving narrow porous strips. Breakdown and intermediate rolling should be completed while the mixture is above 85°C (185 F) with the finish rolling completed above 65°C (150 F). With lower temperature mixes and thin lift applications it becomes obvious that the rollers must be kept up close to the paver.

5-4.3D(2) Test Sections

Test sections should be recommended to the Contractor and will be the Contractor's option on any dense graded mix such as Classes A, B, E, F, and G where paving is in the traffic lanes and compacted course thickness is greater than 30 millimeters. For these applications the function of the test section is to establish the compactibility of the Mix Design, not to establish the most efficient rolling pattern for the Contractor. It is current practice to allow the Contractor to receive a 1.00 QA compaction pay factor, when the Contractor requests a test section, until mix compatibility is proven. Test sections are financially important to both WSDOT and the Contractor. Therefore, it is very important that this issue be thoroughly discussed with the Contractor before the start of paving. Assuming that the Contractor does not want a test section, being silent is not sufficient. Ask, do not assume! If the Contractor chooses not to perform the test section, this fact must be documented in the Inspector's diary.

When the compacted course thickness is 30 millimeters (0.10 foot) or less for any dense graded mix in the traffic lanes, or when paving shoulders and other nontraffic lane areas, regardless of course thickness, the Contractor shall construct a test section to establish a rolling pattern. The test section shall be constructed in accordance with the following instructions (Steps 1 through 6) except that the proposed rolling pattern and equipment shall be used. The number and timing of passes with an approved compaction train that will yield the maximum density in the test section shall be used on all successive paving.

When paving with open graded mixes such as Class D, or when paving with prelevel, test sections will not be required. Usually a specified minimum number of passes with a specific type or size of roller will be specified in the contract for compaction of open graded mixes.

The test sections provide for varying compactive efforts. If the compaction equipment and compaction conditions are right, values should increase with increasing number of roller coverages. Ideally the values should rise until a maximum compacted mat has been reached and then flatten out as compactive effort increases. An exception to this can occur when the vibratory roller is used as it can pull the mat apart and lower the density if operated after the temperature is below 80°C (175 F). If the mat does not react to the compactive procedures described, then the Inspector should review the directions for test procedures to ascertain what corrective action to take.

The procedures for a test section are as follows:

1. Select a test section on a reasonably level portion of the project providing a consistent paving depth and uniform underlying conditions.

2. Compaction equipment used in the test section should be the most effective units. Pneumatic tired rollers and/or vibratory equipment in the vibrating mode are normally the most effective units.

3. Pave a section approximately 60 meters (200 feet) long of course thickness depth.

4. Select a test spot within the section near the center of the traveled lane and near the middle of a truck load discharged to the paver. Avoid longitudinal ruts or nonrepresentative locations (severely alligatored, patched pothole).

5. After each roller pass, a density reading is taken with the nuclear gauge at the test spot.

6. When the density readings increase by less than 8 kilograms per cubic meter (1/2 pcf) on any two consecutive passes, the rolling is discontinued. Densities are then to be determined at an additional location 5 to 8 meters (15 to 25 feet) each side of the test spot and in line longitudinal with the direction of paving. Evaluation of the compactibility of the mix shall be made on the average of the three densities.

7. If the average test spot density is greater than 92 percent, but less than 96 percent of Rice density for wearing courses or less than 98 percent of Rice density for base and leveling courses, a satisfactory test section has been completed. If the test section values are beyond these limits the mix design should be changed. The Olympia Service Center Materials Laboratory can provide assistance as needed.

The test section should be repeated when:

1. The results of previous tests are not considered by the Engineer to be reliable.

2. The Engineer directs a change in mix composition. Note that slight adjustments in bin masses are not considered a change in mix composition.

The Contractor may request a test section when:

1. There is a change in compaction equipment.

2. Routine control tests indicate changes from results found in previous qualifying test sections. (In this instance, the Inspector should check the contractor's rolling pattern for changes and check plant test results for mix changes. Any changes should be noted on the compaction report.)

5-4.3D(3) Compaction Control

Compaction is controlled by testing with the nuclear density gauge for Classes A, B, E, F, and G where the paving is in the traffic lanes and compacted course thickness is greater than 30 millimeters (0.10 foot). The nuclear gauge testing shall be conducted in accordance with Test Method WSDOT 715. The specification requirements shall be a quality level of 1.00 or greater referenced to a minimum density of 91 percent of the maximum density as determined by Test Method WSDOT 705.

Cores of the finished pavement may be substituted for nuclear gauge readings to determine densities, provided they are requested by the Contractor by noon of the next day after paving. If this alternate is done at the request of the Contractor, WSDOT shall be reimbursed for the coring expenses at the rate of $75 per core. If the cores show the materials to be within specification limits then there will be no charge for the cores. Under the current specification, the cores replace the gauge readings.

Control lots not meeting the prescribed minimum density standard of 0.75 CPF shall be removed and replaced with satisfactory material. At the Engineer's option, control lots with a CPF between 0.75 and 1.00 may be accepted at a reduced price in accordance with current policies.

For Class D and prelevelling mix the compaction control shall be to the satisfaction of the Engineer.

For all other conditions, the Contractor shall construct a test section in accordance with instructions from the Engineer. The number and timing of passes with an approved compaction train that will yield maximum density with the nuclear gauge in the test section shall be used on all succeeding paving. The Inspector should make

sure the Contractor is making the required number of passes and reconstruct a test section if conditions change as noted in Chapter 5-4.3D(2) of this manual.

5-4.3E Computing Yield

During the paving operation, a careful record shall be kept, showing truck loads, the mass (weight) of each truck and other pertinent data. Periodically, the Inspector shall compute the quantity of mix placed per square meter (yard), and shall compare the yield against the proposed quantities. Overruns or underruns in quantities may be avoided by making a constant check of quantities placed.

Asphalt concrete pavements are designed on a mass (weight)-volume relationship of 74 kilograms (13.7 pounds) for one square meter (yard) of pavement of a compacted depth of 30 millimeters (0.10 foot). It is the intention in the construction of the pavement to spread the mixture according to an average yield in kilograms (pounds) per square meter (yard).

It must be borne in mind that the minimum compacted depth of pavement must also be met. If the aggregates are heavier than anticipated when the quantities were computed or if the surface that the pavement is being constructed on is not true, the average yield can be attained without meeting the minimum thickness requirement.

Weigh tickets shall be collected and a daily total mass (weight) of mixture received shall be obtained and entered on the daily report for submission to the Project Engineer. To eliminate possible errors, totals as recorded by the Plant Inspector shall be compared against the total obtained by the Street Inspector. Careful attention given to those details may save argument with the Contractor concerning pay quantities.

5-4.3F Miscellaneous Duties of the Street Inspector

When constructing plant-mixed pavement adjoining gutters, curbs, cold pavement joints, manhole castings, etc., the Inspector shall see that all contact surfaces are painted with an approved asphalt material before placing the adjoining pavement.

A detailed Inspector's Daily Report (Forms 422-002, 422-002A, and 422-002B) shall be kept by the Inspector, noting all unusual occurrences, orders received from the Project Engineer, orders issued to the Contractor, and other pertinent information.

5-4.3G Reports

The Asphalt Concrete Pavement Compaction Report, Form 350-092, shall be prepared by the Density Inspector and distributed as shown on the form.

5-4.3H Street Inspector's Check List

Some of the most important details of inspection on asphalt paving are listed below:

1. Check condition and adjustment of paving machines and rollers.

2. Has width of spread in successive layers been determined?

3. See that traffic control is organized and functioning properly; make sure required signs are in place and document same.

4. Check application of tack coat; do not allow tacking of more base than will be paved each day. Be sure that the pavement is swept and clean ahead of the tack application.

5. Examine pavement base, see that required patching and/or pre-leveling is done. Do not be afraid to get the front of your shirt dirty; do a lot of "belly-grading." Make a check of surfacing depths before paving begins.

6. See that paver guidelines are set and adhered to.

7. Check transverse joint for smoothness and appearance.

8. Watch trucks dumping into paver hopper for adverse effect on paver operation. Pay particular attention to constant uniform paver speed and minimum operation of the hopper wings.

9. Check temperature of mix occasionally and watch for evidence of incomplete mixing.

10. Maintain constant inspection of mat behind paver for signs of roughness or non-uniformity of mixture.

11. See that longitudinal joint is raked and compacted properly.

12. Make frequent checks of yield and depth.

13. Watch rolling operation; see that the established rolling pattern is used; watch for variation in speed of rollers and correct. See that nuclear density readings are maintained. Check internal temperature of mix to verify rolling is completed prior to mix cooling to 85°C (185 F).

14. Keep record of truckloads used each day; check with Plant Inspector concerning masses.

15. Make sure the job is in good shape before you leave at the end of the day and see that any excess paper is trimmed from the transverse night joint.

5-4.4 Weed Control Under Asphalt Pavement

Weeds cause considerable damage to thin asphalt pavements such as sidewalks, shoulder overlays, and asphalt lined ditches. It is recommended that chemical

weed control be used under all asphalt pavements less than 105 millimeters (0.35 foot) in depth unless a full depth base preparation was included in the construction.

There are several Soil Residual Herbicides which are presently registered for use under asphalt by the State Department of Agriculture. The Contractor is required to obtain approval of the material and rate of application before use. The request for approval of the material shall include the name of the material, State registration number, manufacturer, and the proposed rate of application.

The specifications require the herbicide to be applied by an experienced applicator licensed by the State of Washington. The Contractor must use extreme care to ensure confinement of the chemicals within the areas designated. Manufacturer's brochures should be obtained from the Contractor and reviewed. WSDOT Form 540-509 must be completed and the appropriate distribution made.

Most herbicides require paving within 24 hours after application. If the herbicide is rained on before paving, there is danger that the herbicide will be carried to adjacent areas and the areas damaged. The manufacturer's time limits for paving following application must be met. Any area that has not been paved within the time limits specified by the manufacturer or that has been rained on, must be treated again at the Contractor's expense.

Soil Residual Herbicides shall be measured and paid in accordance with the contract specifications.

5-5 Cement Concrete Pavement

5-5.1 General Instructions

Modern concrete paving is a highly complex, mechanized operation involving tens of thousands of dollars worth of pavement in a single day's production. Proper organization and planning of the work are essential on the part of both Contractors and Engineers. Cement concrete pavement has a relatively high initial cost and WSDOT expects many years of satisfactory service from this type of pavement. It is imperative that the Project Engineer and Inspectors are thoroughly familiar with the specifications and techniques applying to the work, if this objective is to be attained.

Before construction begins, the Project Engineer should review all phases of the work, and see that all members of the crew are familiar with the duties to which they are to be assigned. Advance planning and organization of the engineering and inspection teams will do much to eliminate the confusion and improper construction sometimes found during the first day's work. All inspection equipment and testing tools should be on hand in advance of beginning of paving, and demonstrations should be made to acquaint Inspectors with their proper use.

The Project Engineer should make certain that all Inspectors are instructed in the proper methods of keeping notes, records and diaries. Accurate records of construction progress and test results are absolutely essential in evaluating pavement performance through the years.

5-5.2 Duties Prior to Paving

5-5.2A Preparation of Subgrade

The subgrade should be shaped and thoroughly compacted. Special attention should be directed to see that all parts of the subgrade are firm and unyielding. Soft spots should be removed and backfilled with suitable material. The subgrade should be prepared to a width that will accommodate the paving equipment without visible distortion. Throughout the area to be trimmed, the compacted grade should be left slightly high, to be trimmed to the proper grade by the trimming machine.

5-5.2B Setting Control Stakes

If control stakes have not been set for previous operations, they shall be set as outlined in Chapter 1-5.7C of this manual. If the control stakes have previously been set, the installation of the wire shall be checked to verify that it is set to the proper line and grade. This is especially important if the wire is offset from its original position.

5-5.2C Fine Grading

The subgrade must be trimmed to the proper subgrade elevation and shape. After trimming, the subgrade shall be thoroughly wetted and compacted to achieve a dense unyielding surface. The subgrade must be kept in this condition until the concrete is placed.

The elevation of the subgrade should be checked by stretching a stringline between the control wires and measuring down to the surface. Extra checks should be made through crown and super transitions to be sure proper adjustments were made in the machine through this area and that no high spots exist.

The subgrade should be thoroughly wet at the time of placement without puddles or pools of water standing on the grade. Care must be taken to see that too much water is not placed on the surfacing that will cause distress in the underlying material.

5-5.2D Inspection of Paving Equipment

Before paving operations begin, the Inspector shall check to see that all the required paving equipment is on the project, it meets the requirements of the specifications, is in good working order, and is properly adjusted.

Inspection of Proportioning and Batching Equipment

Refer to Chapter 6-2.2 of this manual for instructions concerning inspection of the batch plant.

Inspection of Mixer

The following instructions apply primarily to portable mixing plants set up specifically for the project. Refer to Chapter 6-2.2 for inspection of permanent ready mix plants.

In order that an intelligent appraisal of the mixer condition can be made, the Inspector should obtain a copy of the manufacturer's catalog, showing specifications and operational instructions. The model number and rated capacity of the mixer are shown on the mixer name plate.

An inspection should be made of the mixing drum, to see that the mixing blades are not excessively worn. A worn blade will show wear at the center of the blade, while the ends receive very little wear. Since new mixing blades are generally straight, the amount of wear can be determined by use of a stringline or straightedge. Blades worn more than 19 millimeters ($^3/_4$ inch) must be removed and new ones installed. Make sure the interior of the drum and the blades are clean, and that accumulations of hardened mortar are all removed.

The batch counter, or timer, should be checked to see that a batch receives the full specified period of mixing before the first part of the batch emerges from the discharge gate.

The water measuring equipment should be inspected to see that all requirements of the specifications are met. The meter should be checked for calibration to ensure that the indicated quantity of water is delivered into the mixing drum. By diverting the discharge water into a suitable container and weighing the quantity delivered, the accuracy of the meter can be checked. This check of the calibration should be made at a minimum of three different settings of the meter control, covering a somewhat wider range than that expected to be used on the job. If the quantity of water delivered does not check with the setting on the gauge, a curve should be plotted, showing actual quantity delivered for a given gauge setting.

The Inspector must make sure that no water valves or lines are leaking, resulting in loss of control of water content of the mix and should make sure that no other means are available for the mixer operator to add unauthorized water.

A careful inspection of the mixer prior to beginning of work will pay dividends in better control of the mix once the job is underway.

Inspection of Batch Trucks

Nonagitating trucks are permitted to haul plant mixed concrete provided the concrete is delivered and discharged within 45 minutes after the introduction of mixing water to cement and aggregates, and the concrete is in a workable condition when placed. The trucks shall be inspected for tightness and ability to dump or empty. If square cornered truck beds are used, corners should be baffled to prevent bridging and hanging-up of concrete.

Inspection of Paver

The slip form paving equipment must be self-propelled and be capable of placing, spreading, consolidating, screeding, and finishing the freshly placed concrete to the proper pavement elevation and cross-section within the specified tolerances. Sliding forms on the paver must be rigid to prevent spreading of the forms. The paving equipment must finish the surface in a manner which will minimize hand finishing. Slip form pavers contain various combinations of all or some of the following components: auger spreader, spud vibrators, oscillating screeds, clary screed, tamping bars, and pan floats. The equipment should be checked for calibration and satisfactory operation in accordance with the manufacturer's manual before paving is allowed to proceed. Critical features include checking all screeds with a stringline to ensure a true plane or crown, checking the height of the finished pavement elevation, checking vibrating frequency of the vibrators and screeds, checking the feelers or sensors for sensitivity, and the related stringline for tightness to ensure adequate control of line and grade. The paver should be checked to see that it can accomplish the desired crown break section and any transition adjustments required from this section to a one plane section. If it is necessary to stop the forward movement of the paver, the vibratory and tamping elements should also be immediately stopped. No tractive force should be applied to the machine except that which is controlled from the machine.

Inspection of Miscellaneous Tools and Equipment

The power saws shall be checked to see that they are in proper running order and adjustment to the crown of the roadway and the required depth. Extra blades shall be on hand and sufficient lighting to operate at night.

The curing compound applicator shall be checked to see that it is capable of applying the curing compound as specified at a uniform rate.

5-5.3 Inspection of Mixing Operations

5-5.3A Batching

Refer to Chapter 6-2.2 of this manual for instructions concerning inspection of the batching operations.

5-5.3B Mixing

It is essential that careful, diligent inspection of the mixing of the concrete be maintained. A great many features of the work require constant attention in order that properly mixed concrete of uniform consistency will be placed on the subgrade. The concrete must be properly mixed in order that the pavement will have the desired characteristics of strength and durability. So that concrete may be finished uniformly and result in a smooth profile, it is essential that the mix be of uniform consistency.

Several items of work that the Inspector must watch are listed below:

(1) The addition of water during the mixing period is of utmost importance. Every effort should be made to see that the total water content of the mix remains uniform. Variations in water content result in variations in the strength and shrinkage characteristics of the separate batches. Overwatered batches will cause difficulties in finishing, edge slump, and also will result in random cracks due to excessive shrinkage. If variations occur in slump, look for (1) variation in the moisture content of the aggregates, (2) leakage of water from the discharge valve into the drum, (3) variations in batch sizes due to errors in weighing or spillage, or (4) nonuniformity in grading in each size of aggregate.

(2) If an air-entraining agent is added at the mixer, checks must be made of the quantity added to each batch by the automatic dispenser. Tests for air content of the mix should be made with the air meter. The automatic dispensers have been known to malfunction, resulting in an excess of air entrained in the mixture, or no air entrained at all. For this reason, occasional checks should be made to see that the dispenser is functioning properly, by comparing the amount of air-entraining agent used against the number of batches mixed.

(3) Speed of the mixing drum in RPM's should be checked when the mixer is in operation. Specifications require that the drum shall revolve at the speed shown on the manufacturer's name plate.

(4) Occasional checks should be made of the mixing time. Once the mixing timer is set and locked, it must not be changed except on order of the Engineer.

(5) Check to see that the concrete is well mixed with no segregation when emptied from the mixer.

(6) The Inspector should make daily inspections of the mixer for wear of mixing blades, and to see that hardened concrete is not allowed to accumulate on the blades or sides of the drum. Proper mixing is dependent upon a clean drum with full-sized, clean mixing blades.

5-5.3C Transporting

The trucks transporting the concrete shall conform to the load limits specified in Section 1-07.7 of the *Standard Specifications*. If the trucks travel on or off the edge of existing pavement, see that the edge of the pavement is protected from damage by the trucks.

See that there is no segregation in the concrete when it is discharged from the truck and that the complete batch is discharged. See that the trucks are properly cleaned at the end of each day's operation.

5-5.4 Paving Spread Inspection

5-5.4A Placing and Compacting

Ahead of the paving operation, the subgrade must be properly prepared with some type of "fixed" control template to accommodate the width of the paver. The subgrade must be properly dampened so as to have no water demand from the mix, but, also, the concrete must not be placed on subgrade on which pools of water have formed. If concrete is delivered by trucks on the grade, subgrade disturbance should be kept at a minimum.

As paving progresses, the Inspector should be alert to the wire position just ahead of the machine, since the most precisely set control can be disturbed by workers or equipment hitting it. Here again, however, the Contractor has the basic responsibility of protecting the paving operations.

A very important factor in obtaining a superior product with slip form paving is uniformity of operation. The Engineer should ensure that the plant, mixing facilities and hauling units are in quality and quantity balance to supply the paver with an adequate quantity of concrete for continuous operation at the recommended speed, without sacrificing uniform slump. Considerable pavement roughness can be attributed to spasmodic operation and this should be held to a minimum.

It is very important that uniform consistency of the concrete be maintained. The *Standard Specifications* no longer require the slump be maintained between 19 mm and 32 mm ($^3/_4$ inch and $1^1/_4$ inch) unless otherwise modified by the Engineer. The current requirements for water/cement ratio and edge slump are intended to control consistency.

The unconsolidated concrete in front of the paver should be kept well distributed by spreading or by dumping. As the truck or mixer discharges the mix onto the grade in front of the paver, the forces delivered to the machine should be held to a minimum, with all systems functioning as designed. If the paver is not moving, the vibration should be off. When vibration is in progress, it is important that

the concrete becomes uniformly plastic for the full slab width as it passes through the vibration area. A lack of consolidation at one position on the machine could cause a potential fracture line parallel to the direction of movement and also a rough and uneven finished surface. The machine should always operate with a full head of material in front of it to prevent an abrupt reduction in slab thickness.

The Contractor should be encouraged to be a "good housekeeper" on the paver with loose tools, steel and oil under control. The paving equipment should be operating correctly. The vibrator should operate at the proper frequency as indicated on the tachometer or the hydraulic pressure gauge on the machine console. The sensing devices for the automatically controlled machine should be engaged with the wire and console where each unit has an indicator which lights when the sensing element contacts the wire. In correct operation the light flashes on and off, which means the unit has contacted the wire when beginning to drift out of line, and the hydraulic ram has corrected the position. A continual "off" light could mean lack of power or some other problem, and a steady "on" light could mean the ram was defective, the circuit not being made, etc.

If water is added to the surface from a spray bar at the rear of the machine it should be in the form of a fine fog spray to avoid washing of the surface and extreme care must be exercised to see that the amount of water added is held to a bare minimum. Addition of excessive amounts of water during finishing will weaken the surface of the concrete and may result in hair checking or scaling of the pavement surface at an early date. If a considerable amount of water is continually required to finish the concrete, it may be better to add more water to the concrete mix to reduce the need for spraying water on the surface.

It is possible that experimentation may be necessary at the beginning of paving. To start, no trailing forms should be used on the machine and all finishing equipment should be engaged. This could then be modified if problems occur. One of the prime contributors to edge slump is high slump concrete. This should not be tolerated. Another is tie bar insertion for abutting lanes which should be installed ahead of the final finishing.

Edge slump of the unsupported sides behind the paver is one of the major problems to be combatted on slip form paving. The surface should be immediately straight edged by the Contractor and methods corrected to deliver a consistently true edge. Trailing forms can be used to give support beyond the length of the paver, but this may not be the answer. It is possible that more damage than good is done by trailing forms in some cases, by drag resistance pulling down the edge, or by mechanical vibration transmitted through the paver linkage to the form. This comment is also applicable to a trailing finisher. Remember that the concrete is between the moving forms only a few minutes and does not take its initial set until long after the forms leave it.

Rain on a green unformed slab can cause disastrous edge slump and erosion. The Contractor should be encouraged to halt operations previous to this circumstance, and should be prepared to protect the pavement at all times.

Although the paver template was established true "dry," soon after paving starts, and periodically thereafter, the slab template should be checked by stretching a line over the wires (transverse) and measuring down to see that the machine has not changed due to the concrete support. This check should also be made through curves and transitions to ensure that the proper section adjustments are being made.

Behind the paver, a grout rod (usually 100-mm to 150-mm (4-inch to 6-inch) aluminum pipe) is dragged parallel to and at a skew with the pavement to heal minor faults in the surface. This may be replaced with other methods at the Contractor's discretion.

The slip form paver behaves similarly to an asphalt paver with the front probe approximately 5 mm ($^3/_{16}$-inch) higher than the rear. This will probably vary with the machine, due to mass distribution, etc.

Slope of less than this produces an unstable characteristic and an undulating profile; slopes in excess of the correct one cause the machine to repeatedly build up and then slump down. If the symptoms occur, this is one place to check. The machine also has about 19-mm ($^3/_4$-inch) convergence in the sides, to encourage stability. Hand finishing, water adding and other surface manipulation should be kept at a minimum.

Installing Tie Bars

Tie bars must be installed where specified in the Standard Plan. Tie bars are not required when constructing the pavement on a treated base, unless older existing pavement is being widened. Tie bars must be placed so that equal lengths of the bars project into the two lanes of adjoining pavement. When paving two or more lanes at a time, the tie bars are placed at the juncture of the lanes by mechanical means. The Inspector must be alert to see that the bars are set at the proper spacing and depth and are properly centered between the two lanes.

When placing tie bars in the edge of a slab, the ends of the bars projecting from the forms should be protected against disturbance which might destroy the bond between the concrete and steel. The bars already in place shall be bent to lie close to the slab to permit preparation of the subgrade of the adjoining lane, and carefully straightened to their proper position before placement of concrete.

5-5.4B Tests and Records

Tests of the concrete as required in Chapter 9 of this manual shall be made. A complete record shall be kept, showing quantity of pavement constructed each day, number of batches mixed, results of air meter tests, cement factor tests, density tests, general weather conditions, minimum and maximum air temperatures, and any unusual condition encountered during the day.

Test Beams

Test Beams are to be made on all paving projects as a means of determining the strength of the concrete under field conditions. They are to be made at intervals of one beam for approximately 2000 square meters (2,500 square yards) of pavement but not less than one per day. Beams will be made for shorter sections of particular importance when the concrete is designed for early opening. Two beams per day will be made from the last few days of work on a section that is intended for opening immediately after the curing period. The extra beams are to be reserved for tests at later ages in case the strength of the concrete is found to be below design requirements at the designed age. Air, density, and cement factor tests shall be made at the same time the beam is made and the results included on the Report of Beam Test.

Density of Hardened Concrete

The vibration and consolidation of the concrete will be checked by referee testing of cores taken from the hardened concrete after a minimum of 24 hours of curing and when, in the opinion of the Engineer, conditions will permit. The density of the core shall be compared to the mass (weight) per cubic meter (foot) measurement made on fresh concrete. The core should be taken as closely as practical to the same station at which the density test was made. For this comparison the mass (weight) per cubic meter (foot) of fresh concrete shall be determined in accordance with the Supplemental instructions in WSDOT Test Method 806 for vibrating the concrete in the "mass-per-cubic-meter" ("weight-per-cubic-foot") bucket. The density of the concrete in the pavement shall be considered to have met the requirements of the specifications if the mass per cubic meter of the core is not less than 98 percent of the mass (weight) per cubic meter (foot) of the fresh concrete. (See Chapter 9-3 of this manual.)

5-5.4C Finishing and Surface Smoothness

After the concrete has been given the preliminary finish by the paving machine, the Contractor shall check the surface with a straightedge device not less than 3 meters (10 feet) in length. High and low areas indicated by the straightedge shall be corrected. The requirements of checking the surface with the straightedge may be waived if it is demonstrated that other means will consistently produce a surface that meets the requirements for surface smoothness.

Before the concrete has taken its initial set, the edges of the pavement on each side of transverse construction joints shall be edged with a 3-millimeter ($^1/_8$-inch) edger.

The pavement shall be given a final finish by texturing with a comb perpendicular to the center line of the pavement. The comb shall produce striations approximately 3 millimeters (0.01 foot) minimum in depth in the fresh concrete with spacings of the striations at approximately 13 millimeters ($^1/_2$ inch). If the striation equipment has not been previously approved, a test section shall be constructed prior to approval of the equipment. It is important that the comb be used when the concrete is at the proper consistency. If the concrete is too soft, it will not retain the proper texture obtained by the comb and if the concrete is too hard, the proper texture will not be achieved. The comb should be set up and ready to use well in advance of the time it will be required.

In general, the paving contractor is responsible only for the pavement placed by them. This includes the smoothness of the pavement on both sides of any and all joints constructed. On the other hand, the Contractor would not be responsible for pavement placed by another contractor or if the work abuts a bridge or approach slab constructed on a separate contract. When leaving or approaching such joints, the center of the profilograph will be started or stopped on the pavement to be profiled at a point approximately 5 meters (15 feet) from the joint. The remaining areas that are unprofiled would be checked for smoothness with the 3-meter (10-foot) straightedge in accordance with current practices used on bridge decks.

Since the primary goal is to obtain a smooth pavement, it would be advisable to run the profilograph over the joints at the beginning and end of the project as well as any intermediate joints as described above and exclude these readings from the profile index. Should these areas meet straightedge tolerances but not that for the profilograph, the consideration should be given to grinding which would be performed at WSDOT's expense.

Section 5-05.3(12) of the *Standard Specifications* requires that the pavement smoothness be checked by not later than 5 p.m. of the day following the placing of the concrete by the Contractor in the Engineer's presence using the computerized recording profilograph to determine whether the equipment and methods used by the contractor are producing a pavement meeting the smoothness required by the specifications. For the purposes of determining the "daily profile index" two or more profiles may be averaged together (see example in WSDOT Test Method 807). The "daily profile index" may also be used to identify those areas having high points in excess of 7 millimeters

(0.3 inches) which must be reduced by abrasive means until reruns indicate the area does not exceed the allowable deviation. The longitudinal "profile index" of the pavement is based on the elevation of any point on the pavement relative to the elevation of points 3.8 meters (12.5 feet) ahead of and behind the point. This is measured by a 12-wheeled vehicle having a 7.62-meter (25-foot) wheel base and a reference wheel, free to move in a vertical direction, suspended midway between the outer wheels. The vehicle is calibrated to record longitudinal travel and vertical variations in elevation on a continuous strip chart as it traverses a section of pavement. The "profile index," which is determined from the recorded chart of each 0.1 kilometers (0.1 mile) section, is defined as the cumulative total of recorded elevation extremes above or below a standard variation of ±10 millimeters (±0.1 inch).

For example, if the chart for a 0.1-kilometer (0.1 mile) section showed all elevation extremes to be within the +1.5 mm (0.1 inch) standard except for 2 points which measured +3 mm (+0.2 inch) and +4.5 mm (+0.3 inch) respectively, the "profile index" would be 4.5 mm per 0.1 kilometer (0.3 inch per 0.1 mile), or 45 mm per kilometer (3 inches per mile).

The "daily profile index" may be used for acceptance purposes should the various individual indexes used to determine the "daily profile index" not exceed 10 mm (0.7 inches) per any 0.1-kilometer (0.1 mile) section or 100 mm (7 inches) per kilometer (mile).

Grinding depths should be limited to 9 mm ($^3/_8$ inch). If the specifications cannot be met with this, the section should be removed. Low areas which grinding cannot feasibly remedy shall be sandblasted, filled with epoxy bonded mortar and texturized by grinding. Areas which exhibit improperly finished surfaces and would require extensive patching should be removed at the Engineer's discretion.

5-5.5 Curing

Immediately following final finishing of the concrete, or after free water leaves the surfaces, the curing compound should be applied. The purpose of curing, whatever method is used, is to prevent the loss of moisture required to hydrate the cement so that the concrete will gain its proper strength and durability. It is essential that a complete coverage of curing compound be applied to seal the exposed surface of the pavement.

On most paving work, specifications will call for machine application of the curing compound. It should be seen that the spray nozzle is adequately protected from the wind by shielding so that the compound is not blown off the pavement surface. The Inspector shall check to see that the specified rate of coverage is obtained.

The efficiency of the curing compound in preventing escape of moisture from the concrete is dependent upon the thickness of the membrane. For this reason, it is essential that the compound be evenly applied over the exposed surface at a rate of application not less than that specified.

The curing membrane must be protected from damage by foot traffic or equipment. There is a certain amount of foot traffic required in sawing joints, operating the profilograph and other operations. This traffic should be held to a minimum and if damage from undue scuffing or other causes does occur, the area shall be resprayed with the required amount of curing compound. Care must be exercised so that curing compound is not sprayed into saw cuts, as the joint sealing compound will not adhere to the concrete in the joints if the curing compound is present.

Special Precautions for Cold Weather Curing

When pavement is being constructed in early spring or late fall, the Engineer must be alert to predictions of freezing weather, and to see that the Contractor is prepared to protect the fresh concrete from freezing, as required in Section 5-05.3(14) of the *Standard Specifications*. Daily inquiries at the local office of the Weather Bureau should be made in such cases, to obtain information concerning future weather conditions.

When special protection against freezing is required, the protective earth or straw covering must be placed against the sides of steel forms, if used, as well as on the surface of the pavement, since steel offers poor insulation to the change in temperature.

5-5.6 Joints

5-5.6A Contraction Joints

As concrete cures and hardens, a change in volume occurs due to loss of moisture and cooling. This shrinkage results in tensile stresses being set up in the pavement, causing cracks to develop. History has shown that transverse cracks will develop at about 4.5-meter (15-foot) intervals along the length of a slab, and that a slab wider than 4.5 meters (15 feet) may crack longitudinally. Random spacing is specified to break up the harmonics occurring from the wheels rhythmically crossing joints (see the Standard Plans).

The purpose of contraction joints is to control the cracking of the concrete, thereby preventing ragged random cracks which spall and require expensive maintenance. Good construction of these joints is of the utmost importance, and inspection of this work is one of the most important phases of the Engineer's duties.

Contraction joints are weakened planes which collect the cracking into a controlled joint. These joints are made by sawing and pouring a hot or cold filler into the joint. The

purpose is to create a maintainable joint in the slab and cause the crack to form along the plane of the joint.

Sawed Contraction Joints

This type of joint is constructed by sawing a groove in the hardened concrete to create a plane of weakness along which the crack will form. The saw cuts are made with the circular saw blades edged with abrasives or diamonds. On full width construction, a gang sawing machine using several blades simultaneously is generally used to saw the transverse joints. When the gang sawing machine is used, the Inspector must see that the individual blades are properly aligned and set to cut the required depth.

It is necessary to control the time of sawing transverse joints very carefully, so that sawing may be done when concrete has hardened as much as possible without delaying so long as to allow development of random cracks. It is impossible to state a sawing schedule that will be ideal for every job, since curing conditions vary a great deal from job to job. Some generalizations can be made concerning sawing, but the Engineers on each job must determine from experience the most suitable schedule for that job.

It is desirable to delay sawing as long as possible to allow the concrete to gain enough strength to resist raveling adjacent to the saw cut. Sawing green concrete produces excessive wear on the saw blades, and causes washing, raveling, and other structural damages to the concrete near the joint. However, it may be necessary to make some early cuts to control cracking.

In general, a program of sawing control joints should be followed, sawing every fifth joint, not to exceed 19.5 meters (64 feet), as soon as the concrete hardens sufficiently to resist excessive raveling. The time of beginning sawing may vary from about 6 hours on hot dry days to as long as 18 hours when the weather is cool and the humidity high. The Inspector must use good judgment in controlling the sawing sequence. Sawing of the intermediate joints should follow the sawing of the control joints. It will usually be found possible to delay sawing of the final joints until the day following placement of the concrete (see the Standard Plans).

By observing the frequency of cracking and opening of joints the next day, it will be possible to lay out a sawing schedule that will give best results. If only the control joints are cracked, the sawing of the intermediate joints can be delayed further, given fairly constant weather conditions.

Sawing of the longitudinal joints on full width pavement can be delayed as long as 3 days with no danger of random cracking.

The Engineer should mark off the locations of the transverse joints and should check frequently to see that the specified depth of cut is sawed. Since much of the sawing will be done at night, the Inspector should be equipped with a good flashlight to properly examine the condition of saw cuts and to watch for random cracks.

When paving a lane adjacent to a previously paved slab, an early morning examination of joints in the existing lane will show the joints that are open and working. These locations should be marked for sawing control joints in the second lane. Friction at the construction joint and the tie bars will transmit stresses to the new slab and may cause random cracking to occur. For the same reason, uncontrolled cracks in the first lane should be matched with a control joint in the second. In addition, a bond breaker such as a small piece of roofing felt should be over each working joint to prevent uncontrolled migration of the crack into the adjacent slab.

5-5.6B Construction Joints

A construction joint shall be made at the end of each day's paving by placing a header board transversely across the pavement. Uncapped dowel bars should be installed in the joint, seeing that the dowels are parallel with the centerline and profile of the pavement. The ends of the dowels projecting from the header should be protected so that they will not be disturbed or moved from their correct positions.

Upon beginning paving the following day, any broken curing seal on the end of the previous day's work must be resprayed with curing compound. In addition, the exposed dowel bars shall be "greased" to allow for future slab movement.

5-5.7 Inspection of Final Operations

5-5.7A Sealing Sawed Contraction Joints

Prior to opening of the pavement to traffic, sawed joints must be sealed with an approved type of filler material. Before application of the filler material, the joints must be thoroughly clean and dry. In most cases, it will be necessary to clean the saw cut with a carborundum blade saw and remove dirt and dust with a jet of compressed air. It is important that the saw cut be completely filled to within 6 mm ($^1/_4$ inch) of the top with the filler material. The Inspector can check this by probing the joint after sealing with a stiff wire and watching for sagging of the filler below the top of the joint.

5-5.7B Thickness of Concrete Pavement

Section 5-05.5(1) of the *Standard Specifications* outlines procedures for thickness determinations and provides penalties when prescribed tolerances are exceeded. Before

final payment, the thickness tests will have to be made in order to determine the quantities.

5-5.7C Opening to Traffic

During the curing period designated for the concrete mix, the pavement must be properly barricaded to close it to all traffic. If necessary, the Contractor may be required to furnish a person to prevent traffic from using the pavement.

When the pavement has reached its designed age, or has developed the required flexural strength as determined from beam tests, the pavement should be cleaned by brooming before opening to traffic.

Pavement concrete using 335 kilograms (565 pounds) of cement per cubic meter (yard) is designed to have a modulus of rupture of at least 4.5 megapascals (650 psi) as shown by test beams when it is opened to traffic. An exception is in the case of early strength concrete for which the slab thickness has been increased over the plan thickness.

The required modulus of rupture for the thickened section can be computed by formula:

Metric **English**

$$R_1 = 4.5\,\frac{t^2}{T^2} \qquad R_1 = 650\,\frac{t^2}{T^2}$$

in which R_1 = Required modulus of rupture for the thickened pavement.

t = Thickness of pavement as shown on the plans.

T = Thickness actually constructed.

The use of an air-entraining agent lowers the early strength of concrete, particularly during cool weather. The quality of air-entrained concrete is satisfactory if the flexural strength of the concrete is within 90 percent of its design value at 14 days.

If the average of several test beams is below the strengths discussed, consult the Region before permitting travel upon the pavement.

Placement of shoulder material may commence no sooner than 7 days after concrete is placed. Under no circumstances will the Contractor operate rollers adjacent to the concrete, nor any equipment upon the concrete until it reaches the design age or modulus of rupture as shown above.

5-5.8 Unfinished Cement Concrete Pavement

5-5.8A Forms Setting

Metal side forms conforming to the requirements of Section 5-05.3(21) of the *Standard Specifications* shall be used for the construction of unfinished cement concrete pavement unless the Contractor requests to use an approved slip form machine.

It is essential that the base of the steel forms have full, equal bearing upon the subgrade throughout their length and width. They should be set true to alignment and grade and firmly staked with steel pins to avoid movement. Steel forms must never be set on blocks or pedestals. After the forms are firmly staked in place, a final inspection of line and grade should be made by sighting along the tops of the forms. Minor adjustments in grade can be accomplished by tamping additional subgrade material under the form base by an approved mechanical form tamper.

If major changes in alignment or grade are required, the forms should be removed and the subgrade reshaped to the proper elevation and recompacted before resetting the forms.

5-5.8B Joints

Contraction joints will be provided by scoring the surface one mm deep to create a weakened plane. The joints shall match transverse joints on adjacent concrete pavement and be at 4.5-millimeter (15-foot) intervals transversely on other areas.

5-5.9 Testing Equipment, Records, and Reports

Testing Equipment

Specified screens, sieves, and scales

Beam forms, vibrator, and beam breakers

Slump cone

Pycnometer

Air meter

Straightedges and stringlines

Thermometers

Stop watch

Flashlights

Unit mass (weight) bucket, .01 or .02 cubic meter (1 or ½ cubic foot)

Records

The Project Engineer is responsible for the keeping of proper records which must include the following information.

Record of cement received and used

Record of batches weighed and mixed

Record of daily yield

Screen analysis of aggregates (see Chapter 9)

Record of cement factor

Record of density of fresh concrete

Air-entraining agent used, and air meter test results

Rate of application of curing compound

Inspector's diaries

Record of surfacing depth determinations (see Chapter 4-4.4)

Reports Required

Report of beam tests

5-5.10 Inspector's Check List

For the convenience of the Inspector, some of the most important inspection duties on concrete paving work are listed below:

1. See that all testing tools and equipment are on hand and in good condition.

2. Inspect Contractor's paving equipment; see that all deficiencies are corrected before paving is begun.

3. Calibrate water meter and air-entraining agent dispenser on mixer.

4. Check capacity and condition of batch trucks.

5. Check preparation of subgrade; watch for soft spots.

6. See that forms are in good condition and are set securely, true to line and grade. If slip form paver is used, check position of wire.

7. Make sure subgrade is wetted thoroughly in advance of paving.

8. Check mixing time frequently.

9. Watch for variations in consistency of mixed batches.

10. Make tests of air content of mix in accordance with Chapter 9.

11. Check quantity of air-entraining agent used against number of batches mixed.

12. Make cement factor test in accordance with Chapter 9. On projects using slip form pavers, density tests shall be made in accordance with Chapter 9.

13. Make test beams as required by Chapter 9; see that they are cured properly.

14. Make complete, accurate record of test results and computations.

15. See that tie bars and dowel bars are installed properly.

16. Watch for excessive movement of forms under mass (weight) of paving equipment.

17. Check frequently to see that vibrators are operating properly.

18. Watch finishing operations to make sure excessive amount of water is not added to surface; allow fine spray only to be used.

19. Check the combing operation to see that proper, uniformly textured surface is obtained.

20. See that curing compound is placed uniformly, at the required rate and at the proper time.

21. See that concrete is consolidated properly at night headers.

22. Inspect joint sawing operation to see that required depth is cut, and that the best possible saw cuts are obtained.

23. Watch removal of forms; see that damage to pavement does not occur; require curing compound to be applied on edge of slab immediately following form removal.

24. See that additional curing compound is applied over areas scuffed by foot traffic.

25. Make sure pavement is protected from traffic with necessary barricades, lights, etc.

26. See that sawed contraction joints are sealed properly.

27. Check surface smoothness each day in accordance with Section 5-05.3(12) of the *Standard Specifications*.

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6-1 Structures, General Requirements

6-1.1

6-1.1A General Inspection Procedures

Because of the wide variety of types and designs of structures, the Inspector should be thoroughly familiar with all of the contract documents as they provide the specific materials requirements, dimensions, and other details that make each structure unique. The Inspector should examine the contract documents extensively by:

Thoroughly reviewing *all* contract documents, including:

- The plans and special provisions for the project,
- The appropriate *Standard Specifications*, supplemental specifications, and standard drawings that apply, and
- Any contractor-provided documents, such as traffic control plans, falsework and forming plans, shoring plans, and shop drawings for prefabricated items.

Checking and verifying all:

- Plan dimensions,
- Elevations, and
- Materials quantities.

Listing any discrepancies that are discovered and report them to a supervisor (along with any items that may require clarification).

Set up part of the inspection documentation records in advance so that the actual dates, dimensions, quantities, and other values can be more easily filled in as the work progresses.

When inspectors cannot participate directly in the preconstruction conference, they should check with the Project Engineer after the conference to identify any areas of special concern.

6-1.1B Layout and Staking

See Chapter 1-5 for construction surveying and staking.

6-1.2 Foundations

Elevations of bottoms of footings, as shown in the plans are determined from information secured from test holes or borings or other sources. The Project Engineer shall observe the character of the materials removed to confirm the material is similar to that identified in the test borings. If the material is similar they shall note the elevation of such material and approve the footing elevation. If the material differs from the test borings, Olympia Service Center Construction Office shall be consulted for an evaluation. Except in solid rock foundations, it is necessary to carry all footings well below any possible line of scour. Footings in streams are often carried to greater depths in hard material than they would be in the same material where danger of scour does not exist. Footings on solid rock shall be well keyed into the rock to prevent sliding of the structure. Keys should not be less than 300 millimeters (1 foot) deep and the rock surface should be rough so it has more value as a key. Arch abutments may be designed with bottoms on an inclined plane. Care must be taken that the rock or other material is cut as nearly as possible to the plane shown. If this cannot be done, the material should be removed to a satisfactory foundation, cross-sections taken and the Construction Office should be advised and requested to secure a new design of the abutment. Material at the heel, or back of the abutment, shall be carefully removed and all loose material removed. In placing concrete in arch abutments the concrete is placed directly against the undisturbed foundation material at the back of the abutment for the reason that an arch abutment is subject to very high vertical and horizontal loads. Footings in hard material are sometimes sloped or stepped. Steps must be carefully made and if the material is not hard enough to stand vertically the steps shall be inclined or beveled. The slope shall not be steeper than the angle of repose. Backfilling to level up foundations or to fill holes will not be allowed except by permission of the Olympia Service Center Construction Office. Under certain conditions permission will be granted to fill a hole with a lean concrete mix. If the design soil pressure is low, unsuitable material may be replaced by granular material compacted to 95 percent density. If there is no contract unit price for the replacement material, an agreed unit price must be secured. Just prior to placing concrete, all loose material shall be removed and, if in the dry, shall be well sprinkled with water before concrete is placed.

The following are the approximate bearing values of various materials encountered in foundation excavations:

Alluvial Soil	50 to 100 kPa	(1/2 to 1 ton)
Ordinary clay	100 to 190 kPa	(1 to 2 tons)
Dry, stiff clay	240 to 290 kPa	(2 1/2 to 3 tons)
Confined sand	290 to 380 kPa	(3 to 4 tons)
Ordinary sand and gravel	190 to 290 kPa	(2 to 3 tons)
Cemented sand and gravel	480 to 960 kPa	(5 to 10 tons)
Solid rock	480 or more kPa	(5 or more tons)

6-1.3 Clearing the Site

The Contractor shall clear the site of the proposed structure of all trees, brush, stumps and debris for the full width as required and in the manner specified in Section 2-01 of the *Standard Specifications*. Existing bridges, buildings or obstructions shall be removed as provided in the contract or the *Standard Specifications*.

Payment for clearing and grubbing and removing structures and obstructions shall be as provided in the contract. If no specific payment is provided, this work is considered to be incidental to the construction.

The removal or relocation of public or private utilities encountered on the site will be as provided for under the terms of Section 1-07.16 of the *Standard Specifications*.

The Project Engineer shall make a thorough study of the various public utilities involved with respect to the construction of the new work, noting the clearances required for all power and telephone lines and poles, sewer and water lines; tracks, trolley lines, ditches, signals, etc., on railroad grade separations; and possible interference with or inconvenience to adjoining property. The Project Engineer shall ascertain from the Regional Utilities Engineer if notification has been given to utilities for required movement of lines so that the construction is not delayed.

6-1.4 Alignment and Grade of Railings

Bridge traffic barriers, curbs, bridge railings and rail bases shall be carefully aligned to give a pleasing appearance. See Chapter 6-6 of this manual for further instructions.

6-1.5 Working Drawings

The Contractor is required to submit for approval detailed plans for falsework, concrete forms, cofferdams, shoring, and cribbing. These plans must comply with the requirements of the contract plans and specifications and shall be designed under the supervision of or by a Washington State licensed professional engineer and shall bear their seal and signature.

If appropriate, the plans should include:

1. Ground line at time of construction when falsework, shoring, and cribbing are involved.

2. Horizontal clearances to adjacent roadways, existing structures, and railroads when shoring and cribbing are involved.

A change order is required for any deviation from the contract. Deviation from an approved working drawing requires Olympia Service Center's approval. The Project Engineer must receive approval of these plans before the Contractor is permitted to start construction of the structure.

The Contractor is also required to submit an itemized schedule of working drawings, including submittal dates. A copy of this itemized schedule should be sent to the Bridge and Structures Engineer as soon as it is received in the Project Engineer's office. This information will be used by the Bridge and Structures Office to anticipate periods of heavy workload for working drawing review. This will help to ensure a timely review of the Contractor's working drawings.

The Contractor shall submit six complete sets of plans directly to the Bridge and Structures Engineer (or Terminal Design Engineer — Ferries Division) for review and approval, and two complete sets to the Project Engineer for information. If a railroad is involved, four additional sets shall be submitted to the Bridge and Structures Engineer (or Terminal Design Engineer) for each railroad company involved. The plan flow chart for approval is shown in Figure 6-1. The Project Engineer will review the plans to see that they comply with the requirements of the contract and send any comments to the Bridge and Structures Engineer (or Terminal Design Engineer) about any field conditions or contract deficiencies that would affect the checking of the plans.

When preapproved formwork plans are used, the Contractor shall submit two sets of the plans to the Project Engineer. The Project Engineer must then advise the Contractor that construction may proceed unless a field condition needs to be resolved before doing so. If a railroad is involved, four additional sets shall be submitted to the Bridge and Structures Engineer for each railroad involved. The Bridge and Structures Engineer (or Terminal Design Engineer) will return two copies to the Project Engineer with the notations made by the railroad. The Project Engineer will then advise the Contractor that construction may proceed utilizing any notations given by the railroad.

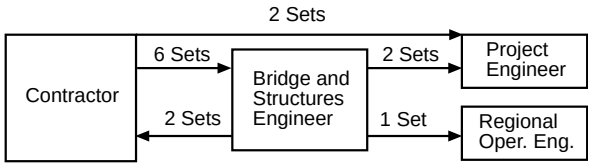


Figure 6-1

The Contractor must allow sufficient time for review and approval of the working drawings. It usually takes 2 to 4 weeks for review and approval and if a railroad is involved, this time is increased to 4 to 8 weeks. The Project Engineer should alert the Contractor to this time requirement and urge them to submit their plans sufficiently in advance of their need. If the plans are incomplete or unsatisfactory, the time required to get final approval is increased. The Project Engineer should also review the required working drawing submittal schedule for validity before sending a copy to the Bridge and Structures Engineer (or Terminal Design Engineer).

Falsework shall be supported on piling unless the Bridge and Structures Engineer (or Terminal Design Engineer) approves the use of mudsills in lieu of piling. When mudsills are proposed and indicated by the Contractor on the falsework plans, the Project Engineer must provide the Bridge and Structures Engineer (or Terminal Design Engineer) with information regarding the soil conditions and allowable soil pressures. Soil condition information and allowable bearing values shall be obtained from the Olympia Service Center Materials Engineer if unavailable in the contract plans.

When mudsills are approved, they shall be placed on undisturbed firm soil or on fill compacted to 95 percent density. The loose upper layer of soil shall be removed and the firm soil below shall be fine-graded to provide firm, even bearing over the entire area of the mudsill. If placed on sand, gravel or other material which can be displaced sideways, the bottom of the mudsill shall be set about 150 millimeters (6 inches) below the normal surface of the surrounding area. Posts should be centered on the mudsills. Mudsills shall be constructed to distribute the load from the post to the soil with very little deflection or settlement.

Falsework piling shall be driven in accordance with the specifications for permanent piles of the same material unless alternate criteria is shown on the Contractor's falsework plans. The falsework piling shall be driven to develop a bearing value as shown on the approved falsework plans. Allowance for settlement must be made for all spans, as the amount varies, depending on the character of foundations and the number of joints of timber. Piles and timbers should be carefully cut to fit, thereby reducing settlement of the falsework.

Forms for concrete deck on steel or prestressed concrete girder spans shall be fully supported on the girders. They shall in no case extend to the ground unless the steel girders are also supported on piles or posts.

The Project Engineer shall see that the falsework and forms are constructed in accordance with the approved plans. If it becomes necessary or the Contractor desires to deviate from the approved plans, a revised plan for approval shall be submitted and the Contractor shall not start construction in accordance with the revised plan until receiving approval of the revision. All revisions to the approved plan shall be reviewed by the Bridge and Structures Engineer (or Terminal Design Engineer) to ensure the structural integrity of the falsework and formwork.

6-1.6 Approval of Material Sources

The Project Engineer shall notify the Contractor that approval of the sources of all materials used in permanent structures is required. Contractors frequently list only the local suppliers and not the origin of the material. This should be discussed with the Contractor at a preconstruction meeting. Particular care should be used to see that this requirement is met in regard to minor parts and materials such as drains, bearings, expansion dams, bolts, pins, and paints. It should also be impressed on the Contractor that inspection of all materials is required before they are used and that the best time for inspection is generally before the materials are shipped. Contact the Olympia Service Center Materials Lab for inspection services.

Prefabricated materials such as structural steel and cast steel are fabricated in accordance with approved shop plans submitted by the Contractor and approved by the Bridge and Structures Engineer. Erection of unapproved prefabricated materials shall not be allowed.

6-1.7 Safety Nets and Staging

Fall arrest and protection shall be provided. See Section 1-2.2I(4) of this manual.

Section 1-05.6 of the *Standard Specifications* requires the Contractor to furnish sufficient, safe and proper facilities such as walkways, railings, ladders, and platforms for inspection of the work. The Project Engineer should insist that the Contractor provide safe facilities and should not permit WSDOT personnel on the project when it is not safe for them.

6-1.8 Working in Water

When working in water, the Project Engineer shall see that the Contractor complies with the requirements of the specifications and the various agencies for pollution control and navigation. If the contract requires the Contractor to obtain special permits, the permits shall be obtained before the work covered by them is begun. In the event of a fuel or oil spill, the Contractor is required to notify the Coast Guard immediately, regardless of the amount of the spill or the efforts for containment.

See Chapter 1-1.8C of this manual for instructions on submitting Coast Guard Bridge Construction Progress Reports.

6-1.9 Final Cleanup

When the structure is completed, the Contractor shall clean up the site and remove all materials and debris. The decks of the structures shall be swept and washed clean. The Contractor shall level off and fine grade all excavated material not used for backfill, and fine grade around all piers, bents, abutments, and on slopes so that the entire site and structure is left in a clean and presentable condition.

Upon completion of the work, all falsework piling, cofferdams, shoring, curbs, and test piles shall be removed to a minimum of 0.6 meter (2 feet) below the finished ground line. Removal limits within a stream or channel are described in Section 2-09.3(3)D of the *Standard Specifications*.

6-1.10 Concrete Placement Checklist

The Concrete Placement Checklist was developed as an inspection aid. See Figure 6-2. The use of this checklist is encouraged.

6-1.11 Inventory Inspection

After a permanent or temporary bridge or a bridge modification is complete and preferably before opened to traffic, the Bridge and Structures Office's Bridge Condition Unit needs to perform an inventory inspection. The purpose of this inspection is to field verify certain contract plan details, to provide a base-line condition assessment of the bridge, and to identify any potential problem features.

When the bridge is nearing completion, two to four weeks before completion, the Project Engineer should notify the Bridge Condition Engineer of the anticipated completion date. The Bridge Condition Engineer will make arrangements with the Project Engineer for an inventory inspection.

When load or width restrictions are in force on a temporary structure, immediate notification should be provided when service is discontinued on the temporary structure and traffic is rerouted to the permanent structure.

6-1.12 Falsework

Falsework construction is a critical part of the bridge construction process. Generally, the factor of safety used for design of falsework is less than that of permanent construction. Therefore, it is extremely important that the falsework is constructed in accordance with the approved falsework drawings. Any changes to the approved falsework drawings must be approved by the Bridge and Structures Office.

6-2 Concrete Structures

6-2.1 Proportioning and Mixing Concrete

The proportions for WSDOT Provided Mixes given in the *Standard Specifications* are in the nature of basic mixes which will need adjustment for the factors listed below as applicable to the job conditions. Adjustments for cement content and workability cannot be applied until after batches have been mixed. The adjustment factors listed below are in the order in which they are to be applied.

In addition to the mixes whose proportions are designated in the *Standard Specifications* (WSDOT Provided Mixes), the Contractor may propose their own mix design including mixes that incorporate fly ash.

Any adjustment made to the WSDOT provided concrete mix design shall be approved and documented by the Engineer.

6-2.1A Adjusting WSDOT Provided Mix Proportions

Adjustments to the proportions of the WSDOT Provided Mixes shown in the *Standard Specifications* are to be made in the following order:

1. Bulk specific gravity
2. Crushed rock used as coarse aggregate
3. Substandard gradings
4. Free water in aggregates
5. Cement content**
6. Workability**

**The adjustments for either cement content or workability can only be made after testing has been completed from concrete batched with adjustments made for items 1 through 4.

Example:

Assume the following conditions for Class 20 (Class 3000) Concrete without Air:

Coarse aggregate is crushed rock.

Bulk specific gravity, coarse aggregate is 2.76

Bulk specific gravity, sand is 2.62

Grading of coarse aggregate OK.

Grading of fine aggregate — finer than fine limits of specification by 25 percentage points. (Under Section 9-03 of the *Standard Specifications*, aggregate

Concrete Placement Checklist

Location _____
(span, pier, station)

Contract No. _____

Structure _____

Part of structure being cast _____
(seal, footing, deck, etc.)

Inspector _____

Date _____

Concrete scheduled for _____ (a.m.) (p.m.) on _____
(time) (day of week and date)

Weather forecast is _____

1. Foundation:

A. Spread Footing:
- ___ cross-sections recorded prior to excavation
- ___ excavated to plan elevation
- ___ foundation approved by the Project Engineer (if foundation material differs from the test borings, consult Olympia Service Center Construction Office)

B. Pile Supported Footing:
- ___ excavated to plan elevation
- ___ pile order length given to contractor (if required)
- ___ pile driving completed and accepted
- ___ pile cutoff elevations checked
- ___ pile cutoff treated (timber)

2. Falsework:
- ___ constructed per approved F/W drawings
- ___ tattletails set and checked after first placement
- ___ foundations (mudsills or piling) constructed per specifications and falsework drawings

3. Forms:

A. Approved Form Drawings:
- ___ dimensions verified
- ___ elevations checked
- ___ longitudinal and transverse form alignment checked
- ___ studs and walers in accordance with approved drawing
- ___ plumb and/or batter checked
- ___ form material of proper thickness, grade and grain orientation, facing, and in satisfactory condition
- ___ form liner approved
- ___ kickers and braces in accordance with approved drawing
- ___ ties, bolts, nails, etc., in accordance with approved drawing
- ___ forms coated with a release agent

Concrete Placement Rate: _____ m/hr. at _____ °C

B. Construction Joints:
- ___ location checked
- ___ construction joint properly formed, braced, and aligned
- ___ shear keys fabricated to proper size and correctly placed
- ___ construction joint elevation checked
- ___ existing concrete at the construction joint is cleaned, roughened, and wetted
- ___ open or dummy joints formed and located in accordance to the plans
- ___ premolded joint filler secured

4. Reinforcing Steel:
- ___ cut sheets reviewed
- ___ mill certificates received
- ___ bar sizes, number, and spacing checked
- ___ bottom and top concrete cover and side clearances checked
- ___ bar ties and supports in accordance with contract
- ___ splice locations and lengths checked (welded or mechanical splice approved)
- ___ alignment and length of bars extending into future work checked

5. Post-Tensioning:
- ___ approved shop drawing received
- ___ trumpet, distribution plate, and reinforcement correctly located and secured
- ___ duct sizes, material, and wall thickness checked
- ___ ducts installed per approved profile and alignment
- ___ ducts securely tied
- ___ ducts free of holes and dents
- ___ duct joints sealed
- ___ ducts clear and unobstructed
- ___ inlets, outlets, vents, and drains properly installed
- ___ contractor prepared to clear all ducts immediately after concrete placement

6. Method of Concrete Placement:
- ___ pump
- ___ pump backup system available
- ___ bucket
- ___ chute
- ___ tremie
- ___ other list: _____

7. Concrete:
- ___ Concrete Class _____
- ___ 28 day strength _____ MPa (psi)
- ___ specified slump _____ mm (in.) max.
- ___ specified air entrainment _____%
- ___ flyash
- ___ air-entraining admixture, Brand _____
- ___ water-reducing admixture, Brand _____
- ___ retardant admixture, Brand _____

Estimated Concrete Quantity: _____ cubic meters (yards)

Inspector: _____

Date: _____

Figure 6-2

finer than the specifications may be used provided the cement content is increased.)

Concrete is non-air entrained

6-2.1B Proportioning for Bulk Specific Gravity

The masses of aggregates given in the *Standard Specifications* are for a bulk gravity of 2.67. These values must be corrected for the actual bulk specific gravity (G) of the materials used. The adjusted batch mass to be used is:

$$\text{Adjusted Batch mass} = \text{Batch mass} \times \frac{G}{2.67}$$

Metric

Example:

The mix proportions for Class 20 concrete are as follows in kg/m^3.

Current batch masses:

Cement	320 kg
Fine Aggregate	775 kg
No. 2 Coarse Aggregates	1155 kg
Water	160 kg
	2410 kg

W/C (160/320) = 0.50

Batch masses corrected for bulk specific gravity:
(Aggregate masses rounded to nearest 5 kg.)

Cement		320 kg
Fine Aggregate	775 × (2.62/2.67) =	760 kg
No. 2 Coarse Aggregates	1155 × (2.76/2.67) =	1195 kg
Water		160 kg
		2435 kg

W/C (160/320) = 0.50

English

Example:

The mix proportions for Class 3000 concrete are as follows in pounds per cubic yard.

Current batch weights:

Cement	540 lbs.
Fine Aggregate	1,315 lbs.
No. 2 Coarse Aggregates	1,950 lbs.
Water	270 lbs.
	4,075 lbs.

W/C (270/540) = 0.50

Batch weights corrected for bulk specific gravity:
(Aggregate weights rounded to nearest 10 lbs.)

Cement		540 lbs.
Fine Aggregate	1,315 × (2.62/2.67) =	1,290 lbs.
No. 2 Coarse Aggregates	1,950 × (2.76/2.67) =	2,020 lbs.
Water		270 lbs.
		4,120 lbs.

W/C (270/540) = 0.50

6-2.1C Proportioning for Crushed Rock

Crushed rock is angular in shape and contains more voids than gravel. Unless a greater proportion of mortar is provided to fill the excess voids, the concrete will be harsh as compared to that made with gravel.

Example:

As a starting mix, the mass (weight) of crushed rock should be reduced by 8 percent of the mass (weight) of the coarse aggregate shown, corrected for bulk specific gravity. At the same time the mass (weight) of fine aggregate should be increased the same number of kilograms (pounds) that coarse aggregate was decreased.

In general, no additional changes in the starting mix will be needed because of the presence of crushed oversize gravel in coarse aggregate. In the absence of contrary instructions from the Olympia Service Center Materials Lab, no changes in cement per cubic meter (yard) will be necessary on account of the use of crushed rock in place of gravel as coarse aggregate. Decrease gravel 0.08 × 1155 kg = 93 kg (0.08 × 2020 = 162); add same amount to fine aggregate.

Metric

Batch masses corrected for crushed rock: *(Aggregate masses rounded to nearest 5 kg.)*

Cement		320 kg
Fine Aggregate	(760 + 92) =	850 kg
No. 2 Coarse Aggregate	(1195 – 92) =	1105 kg
Water		160 kg
		2435 kg

W/C (160/320) = 0.50

English

Batch weights corrected for crushed rock: *(Aggregate weights rounded to nearest 10 lbs.)*

Cement		540 lbs.
Fine Aggregate	(1,290 + 162) =	1,450 lbs.
No. 2 Coarse Aggregate	(2,020 – 162) =	1,860 lbs.
Water		270 lbs.
		4,120 lbs.

W/C (270/540) = 0.50

6-2.1D Proportioning for Substandard Gradings

The *Standard Specifications* permit the use, within certain limits, of aggregate graded finer than the fine limits as specified, provided cement is added. A reduction of 1 percent in mass of aggregate per cubic meter (yard) of concrete will result in an increase of approximately 1 percent in cement content.

The use of finer gravel with extra cement ordinarily will not cause changes in workability sufficient to warrant revising relative proportions of sand and coarse aggregate in the starting mix.

When finer sand (fine aggregate) is used with extra cement, however, the mix is almost certain to be oversanded, dependent on the amount of excess fineness of the fine aggregate. The starting mix should, therefore, be revised in accordance with the following rule:

> After reducing masses (weights) of both fine aggregate and coarse aggregate proportionally to result in the required change in cement content, further reduce the mass (weight) of fine aggregate at the rate of 0.67 kg per 100 kg (⅔ pound per 100 pounds) of cement for each 1 percent the fine aggregate passing each sieve is in excess of the maximums. Increase the coarse aggregate by the same number of kilograms (pounds) that the fine aggregate has been reduced to control over-sanding.

Metric

Example:

Consider a fine aggregate having a gradation as follows:

Percent Passing Screen Size mm	Gradations Sample	Allowable* Specifications	Excess Maximum	Fineness
4.75	100	95-100		
3.35	97	82-98		
2.36	93	68-86	95	7
1.18	75	47-65	80	10
0.60	50	27-42	60	8
0.30	19	9.0-20.0	20	
0.15	6	0.0-7.0		
0.075	2.0	0.0-2.5	2.5	___
				25%

*As designated in the *Standard Specifications*.

The 25 percent of excess fineness of fine aggregate requires an increase of 8 percent cement, calculated on the basis of ⅓ percent for each percent of excess fineness (25 × ⅓ = 8). The desired cement content will be (320 × 1.08) = 346 kg per cubic meter.

The fine aggregate should next be decreased by (⅔ × .25 × 346) = 57.7 kg to avoid over sanding. The coarse aggregate should be increased a like amount.

Batch masses corrected for substandard gradings:
(Aggregate masses rounded to nearest 5 kg.)

Cement		346 kg
Fine Aggregate	(850 – 58) =	790 kg
No. 2 Coarse Aggregate	(1105 + 58) =	1165 kg
Water		160 kg
		2461 kg

W/C (160/346) = 0.46

English

Example:

Consider a fine aggregate having a gradation as follows:

Percent Passing Screen Size	Gradations Sample	Allowable* Specifications	Excess Maximum	Fineness
4	100	95-100		
6	97	82-98		
8	93	68-86	95	7
16	75	47-65	80	10
30	50	27-42	60	8
50	19	9.0-20.0	20	
100	6	0.0-7.0		
200	2.0	0.0-2.5	2.5	___
				25%

*As designated in the *Standard Specifications*.

The 25 percent of excess fineness of fine aggregate requires an increase of 8 percent cement, calculated on the basis of ⅓ percent for each percent of excess fineness (25 × ⅓ = 8). The desired cement content will be (540 × 1.08) = 583 pounds per cubic yard.

The fine aggregate should next be decreased by (⅔ × .25 × 583) = 97 pounds to avoid over sanding. The coarse aggregate should be increased a like amount.

Batch weights corrected for substandard gradings:
(Aggregate weights rounded to nearest 10 lbs.)

Cement		583 lbs.
Fine Aggregate	(1,450 – 97) =	1,350 lbs.
No. 2 Coarse Aggregate	(1,860 + 97) =	1,960 lbs.
Water		270 lbs.
		4,163 lbs.

W/C (270/583) = 0.46

6-2.1E Proportioning for Free Water in Aggregates

Free water is the water available in the aggregates that will combine with the cement during the mixing process in addition to the mix water added and if not accounted for

will reduce the strength of the concrete. The planed mixing water is reduced by an amount of free water present in the aggregates in order to ensure the maximum water/cement ratio is not exceed or water/cementitious ratio where fly ash is used.

The free water is defined as the amount of water present in the aggregates above the amount of absorbed water. Absorbed water will not be released by the aggregates during mixing of the concrete. The absorbed water is reported on the Pit Report and is expressed as a percentage of the mass (weight) of the aggregates.

The Moisture content of the aggregates is the total water in the aggregates expressed as a percentage of the dry mass (weight) of the aggregates. The free water can be determined by subtracting the amount absorbed water (absorbed content × dry mass (weight) of the aggregates) from the total water in the aggregates (moisture content × dry mass (weight) of the aggregates).

Metric

Example:

The total amount of water permitted in the mix includes both the free water in the aggregates and the total mixing water (added at the plant and any water added in route to or on the project). For example, consider a Class 20 mix which has been determined to have a maximum water content of 160 kg per cubic meter.

Batch masses corrected for substandard gradings:
(Aggregate masses rounded to nearest 5 kg.)

Cement	346 kg
Fine Aggregate	790 kg
Coarse Aggregates	1165 kg
Water	160 kg
	2461 kg

W/C (160 kg of water/346 kg of cement) = 0.46

Current tests of the aggregate stockpiles shows the moisture content as follows:

Fine Aggregates	4.0 percent
Coarse Aggregates	1.2 percent

The Pit Report from Olympia Service Center Materials Laboratory shows the amount of absorption as follows:

Fine Aggregates	1.5 percent
Coarse Aggregates	1.0 percent

Total Water in Aggregates:

Fine Aggregates	790 kg × 0.04 = 32 kg
Coarse Aggregates	1165 kg × 0.012 = 14 kg

Absorbed Water in Aggregates:

Fine Aggregates	790 kg × 0.015 = 12 kg
Coarse Aggregates	1165 kg × 0.010 = 12 kg

Free Water in Aggregates:

Fine Aggregates – 32 kg of total water – 12 kg of absorbed water – 20 kg of free water

Coarse Aggregates – 14 kg of total water – 12 kg of absorbed water – 2 kg of free water

Total Free Water in Aggregates: 20 kg from Fine Aggregates + 2 kg from Coarse Aggregates = 22 kg

Deducting free water gives 138 kg of allowable mixing water.

(160 kg – 22 kg) = 138 kg of allowable mixing water

The aggregate masses should be increased to reflect the free water and the amount of water added should be decreased to maintain the maximum water/cement ratio.

Batch masses corrected for free water in aggregates:
(Aggregate masses rounded to nearest 5 kg.)

Cement		346 kg
Fine Aggregates	790 + 32 kg =	820 kg
No. 2 Coarse Aggregates	1165 kg + 14 kg =	1180 kg
Water		139 kg
		2485 kg

W/C (160 kg of water/346 kg of cement) = 0.46

English

Example:

The total amount of water permitted in the mix includes both the free water in the aggregates and the total mixing water (added at the plant and any water added in route to or on the project). For example, consider a Class 3000 mix which has been determined to have a maximum water content of 270 pounds per cubic yard. This is calculated to be 270 lbs./8.34 lbs./gallon = 32.4 gallons.

Batch weights corrected for substandard gradings:
(Aggregate weights rounded to nearest 10 lbs.)

Cement	583 lbs.
Fine Aggregate	1,350 lbs.
Coarse Aggregates	1,960 lbs.
Water	270 lbs.
	4,163 lbs.

W/C (270 lbs. of water/583 lbs. of cement) = 0.46

Current tests of the aggregate stockpiles shows the moisture content as follows:

Fine Aggregates	4.0 percent
Coarse Aggregates	1.2 percent

The Pit Report from Olympia Service Center Materials Laboratory shows the amount of absorption as follows:

Fine Aggregates	1.5 percent
Coarse Aggregates	1.0 percent

Total Water in Aggregates:

Fine Aggregates	1,350 lbs. × 0.04 = 54 lbs.
Coarse Aggregates	1,960 lbs. × 0.012 = 24 lbs.

Absorbed Water in Aggregates:

Fine Aggregates	1,350 lbs. × 0.015 = 20 lbs.
Coarse Aggregates	1,960 lbs. × 0.010 = 20 lbs.

Free Water in Aggregates:

Fine Aggregates – 54 lbs. of total water – 20 lbs. of absorbed water = 34 lbs. of free water

Coarse Aggregates – 24 lbs. of total water – 20 lbs. of absorbed water = 4 lbs. of free water

Total Free Water in Aggregates: 34 lbs. from Fine Aggregates + 4 lbs. from Coarse Aggregates = 38 lbs.

Deducting free water gives 232 lbs. of allowable mixing water.

(270 lbs. – 38 lbs.) = 232 lbs. of allowable mixing water

The aggregate weights should be increased to reflect the free water and the amount of water added should be decreased to maintain the maximum water/cement ratio.

Batch weights corrected for free water in aggregates: *(Aggregate weights rounded to nearest 10 lbs.)*

Cement		583 lbs.
Fine Aggregates	1,350 lbs. + 54 lbs. =	1,400 lbs.
No. 2 Coarse Aggregates	1,960 lbs. + 24 lbs. =	1,980 lbs.
Water		232 lbs.
		4,195 lbs.

W/C (270 lbs.of water/583 lbs. of cement) = 0.46

6-2.1F Correction for Cement Content

Determine the unit mass (weight) of the concrete, using ASSHTO Test Method T 121, of the first two trucks that meet all applicable acceptance test requirements. Using the unit mass (weight), calculate the yield and cement content, adjusting the calculations for a design air content of 6 percent if the mix is entrained. Average the two cement contents and compare the averaged cement content to the minimum cement content specified.

If the averaged calculated cement content is 5 kg per cubic meter (10 pounds per cubic yard) less than the minimum cement content specified, an adjustment is required. If a mix proportion adjustment is necessary, the adjustment shall be accomplished by adjusting the aggregate only. The fine to coarse aggregate ratio shall be maintained when the concrete mix is adjusted. The yield and cement content calculations should be provided to the contractor.

Metric

Example:

The cement content is determined to be 340 kg per cubic meter whereas the minimum cement content of 346 kg per cubic meter was specified. This amount is 6 kg per cubic meter less, so an adjustment is required. The aggregate masses should be decreased. The batch masses should be corrected as follows:

Fine Aggregates	820 kg × 340/346 = 805 rounded to nearest 5 kg 15 kg decrease
Coarse Aggregates	1180 kg × 340/346 = 1160 kg rounded to nearest 5 kg 20 kg decrease

Batch masses corrected for cement content: *(Aggregate masses rounded to nearest 5 kg.)*

Cement	346 kg.
Fine Aggregates	805 kg
Coarse Aggregates	1160 kg
Water	139 kg
	2450 kg

W/C (160 kg of water/346 kg of cement) = 0.46

English

Example:

The cement content is determined to be 568 pounds per cubic yard whereas the minimum cement content of 583 pounds was specified. This amount is 15 pounds per cubic yard less, so an adjustment is required. The aggregate weights should be increased. The batch weight should be corrected as follows:

Fine Aggregates	1,400 lbs. × 568/583 = 1,360 lbs. rounded to nearest 10 lbs. 40 lb. decrease
Coarse Aggregates	1,980 lbs. × 568/583 = 1,930 lbs. rounded to nearest 10 lbs. 50 lb. decrease

Batch weights corrected for cement factor: *(Aggregate weights rounded to nearest 10 lbs.)*

Cement	583 lbs.
Fine Aggregates	1,360 lbs.
Coarse Aggregates	1,930 lbs.
Water	232 lbs.
	4,105 lbs.

W/C (270 lbs. of water/583 lbs. of cement) = 0.46

6-2.1G Revision for Workability (Example)

During the placing of the first truck, some difficulty was found in the region of a group of closely spaced reinforcing bars. The same situation will exist on the next pour. It is decided to increase the fine aggregate content somewhat and the entire 35-kg (90-pound) decrease (as calculated previously) for cement content is deducted from the coarse aggregate. The new batch masses are as follows:

Metric

Batch masses corrected for workability: *(Aggregate masses rounded to nearest 3 kg.)*

Cement		346 kg
Fine Aggregate		820 kg
No. 2 Coarse Aggregate	(1180 – 35)	1145 kg
Water		139 kg
		2450 kg

W/C (160/346) = 0.46

English

Cement		583 lbs.
Fine Aggregate		1,400 lbs.
No. 2 Coarse Aggregate	(1,980 – 90)	1,890 lbs.
Water		232 lbs.
		4,105 lbs.

W/C (270/583) = 0.46

The goal should be to use the lowest percentage of fine aggregate that is consistent with job conditions and will permit placing the concrete without voids and finishing it to a satisfactory surface. If the mix is undersanded, however, the tendency will be to make up for a lack of inherent workability by using an excessive amount of mixing water. Such concrete tends to segregate in handling and placing and is to be avoided. The sand content of the mix, however, should not be increased merely to relieve the Contractor of the work of vibrating that is required to be performed under the specifications.

A grossly oversanded mix will be recognized by the apparent shortage of coarse aggregate and by its “sticky” character. Those particles of coarse aggregate that are readily visible will appear to be floating independently in a matrix of mortar. In a badly undersanded mix, the coarse aggregate will be very conspicuous, the concrete will be hard to handle with a shovel regardless of its wetness and there will be a marked tendency for separation of the mortar from the coarse aggregate. Between these extreme limits, the best mix must be determined by experience and careful study of the results obtained during placing of the concrete and upon removal of the forms.

If the fine aggregate is graded near the coarse limits of the specifications and the coarse aggregate is near the fine limit, the concrete is apt to be harsh. Increasing the fine aggregate content in such cases probably will not result in much improvement. The grading of the fine aggregate and the coarse aggregate should be improved. The *Standard Specifications* require rejection or alteration of the aggregates when the resulting concrete is too harsh.

Generally speaking, a reduction or increase of 20 kg (20 pounds) of fine aggregate per 100 kg (100 pounds) of cement will make a pronounced change in the appearance and workability of the concrete. The Project Engineer should work within these limits (after revising proportions of the starting mix as outlined in Chapter 6-2 of this manual) to secure the best results possible. Changes should be made only after consultation with the Olympia Service Center Materials Lab.

6-2.1H Contractor Provided Mix Designs

The Project Engineer should review all Contractor proposed mix designs for conformance to the contract. The mix design should be submitted on Form 350-040 Proposed Mix Design.

6-2.2 Inspection of Concrete Production Facilities

6-2.2A Prequalification Inspection

All concrete production facilities will be prequalified. The prequalification inspection and approval shall be accomplished either through the National Ready Mix Concrete Association (NRMCA) or by the Regional Materials Engineer.

The prequalification inspection by the Region Staff shall use a check list similar to that used by the NRMCA. The inspection includes a review of the following:

1. Storage and handling of cement and other cementitious material such as fly ash and aggregates.

2. That the admixtures are protected from freezing.

3. The weigh batchers are protected from the effects of wind to ensure accuracy.

4. The accuracy of the weighing equipment. That the batch scales have recently been serviced and certified as to accuracy by a commercial scale company within the past six months.

5. For transit-mix plants and central mix plants, the delivery fleet is to be inspected as it is an essential part of the mixing operation. The inspection shall be in accordance with the *Standard Specifications*.

6. A producer-signed agreement stating that the batch scales will be reinspected and certified at intervals not exceeding six months.

The completed inspection form shall be signed by the Regional Materials Engineer and submitted to the Olympia Service Center Materials Laboratory. The Materials Laboratory will publish a listing of all prequalified concrete production facilities. The listing is titled *Approved Concrete Batch Plants*, and identifies the concrete batch plant (company name and plant location), the date the scales expire, the date the next inspection is due, the plant type, and the status (current or expired).

The Contractor is required to submit Form 350-071, Request for Approval of Materials Source, listing the name and location of the plant which will supply the concrete and also the source of the cement, aggregates, and admixtures that will be used in the concrete. Concrete from the plant shall not be used until the plant has been approved. The Project Engineer shall take approval action based on the Approved Concrete Batch Plant listing provided by the Olympia Service Center Materials Lab and the Approved Source of Material Listing. If the Approved Concrete Batch Plants list indicates that the scales have expired, the Project Engineer shall confirm that the scales have been recertified or the source will not be approved.

6-2.2B On-Site Inspection of Trucks

Whenever ready mix concrete is used on the project, the Inspector shall be alert to the condition of the trucks being used for delivery. All trucks shall have operational counters and a device to measure the amount of water added at the site. All trucks are required to be operated within the rated capacity stated on the manufacturer's data plate. When necessary, the Inspector will inspect the drums of the delivery trucks for the condition of the fins and build-up of hardened concrete.

6-2.2C Verification Inspection

When necessary, the Regional Material Engineer and the Region independent assurance inspector shall make an inspection of the batch plant to confirm: the accuracy of the batching process; that the scales have current certifications; the accuracy of the water metering devices; and to sample the coarse aggregate. The fine aggregate should also be sampled by the Project Engineer at this time.

6-2.3 Concreting

6-2.3A General

Type III portland cement shall not be allowed in any concrete structure unless called for in the plans or specifically approved by the Olympia Service Center Construction Office. The use of Type III cement in structures is not desired because it is believed to reduce the resistance of the finished surface to weathering, particularly to freezing and thawing cycles and is more subject to plastic and shrinkage cracking. If it is necessary or desirable to place structural concrete in service prior to the time stated in the *Standard Specifications*, authority must be obtained from the Olympia Service Center Construction Office. In such cases, test cylinders from each pour are taken and tested by the Contractor to determine the early break strength.

All sawdust, nails, dirt, and other foreign material, including ponded water, must be removed from within the forms and the forms shall be inspected and approved before placing any concrete.

The bottom of footings and forms must be thoroughly soaked with water prior to placing the concrete so they do not absorb water from the concrete mix. Care must be taken to be sure there is no ponded water when placing the concrete.

Vibrators are usually specified to be used when placing concrete. Their use is important for the purpose of consolidating the concrete in the forms, thus producing a dense uniform concrete.

Adequate vibration is necessary for placing concrete in difficult places such as under and around closely spaced reinforcement. When steel forms are used for curbs, traffic barriers, or rail bases, external vibration may be required to eliminate voids at the surface caused by entrapped air. It is desirable to have the Contractor designate one person to operate the vibrator. This person could then be instructed in its use and an effort could be made to have that person kept on the same work whenever it is required.

The quantity of mixing water to be used shall be the minimum amount possible to produce the required workability. Vibrators shall be used only in freshly placed concrete. As soon as the concrete is dumped it should be spread out and vibrated by inserting the vibrator torpedo directly into the fresh concrete. However, it should be kept in one place only long enough to make the concrete uniformly plastic. Dependence should not be placed on the vibrator to work the concrete into corners and along the faces of the forms. Metal or wooden spades should be used to whatever extent is necessary in places where the vibrator cannot be satisfactorily employed, however, spades should be used only to accomplish complete filling of the forms and not for the purpose of puddling the concrete.

In regard to the desired consistency of concrete and the use of vibrators, the *Standard Specifications* should be carefully studied and followed. Every effort should be made to see that the specifications are followed.

Air-entrained concrete is required in all concrete pavement and in all structural concrete above ground. The use of air entrained concrete below the finished ground line is optional with the Contractor.

The specifications require that construction joints shall be located and constructed as shown in the plans or approval for changes must be obtained from the Olympia Service Center Construction Office. Section 6-02.3(12) of the *Standard Specifications* requires that shear keys shall be provided at all construction joints unless a roughened surface is shown in the plans, and where the size of keys is not shown in the plans, they shall be approximately one-third of the area of the joint and approximately 40 millimeters ($1^1/_2$ inches) deep.

Construction joints are to be either vertical or horizontal. Wire mesh, wire lath, and other similar items can be used for a roughened surface construction joint but shall be removed and the joint cleaned before making the adjacent pour. Construction joints in roadway slabs must be formed vertical and in true alignment. An edger shall not be used on the joint but lips and edgings must be removed before making the adjacent pour. If the joint is properly formed, a good straight edge will be obtained with a minimum amount of lips and edgings to be removed.

Shear keys in construction joints shall be formed with 40-millimeter ($1^1/_2$-inch) thick lumber and shall be constructed the full size shown in the plans. For box girder webs, these shear keys are normally shown in the plans to be full width between stirrups. The specifications require shear key forms to be left in place at least 12 hours after the concrete has been placed. The plans will indicate certain joints to have a roughened surface. These joints shall be finished and prepared for the next pour in accordance with the instructions given in the specifications or as shown in the plans.

Expansion dams or the expansion dam blockout shall be carefully placed before concreting the roadway decks. They shall also be carefully aligned for crown and grade.

Blockouts for expansion joint seals must be carefully formed to the dimensions shown in the plans for proper placement and operation. Be sure to check that the rebar in the blockout does not conflict with the expansion joint anchors. The joint seal must be placed using a lubricant adhesive.

Concrete shall be placed in accordance with the requirements of Section 6-02.3(6) of the *Standard Specifications*. The Inspector should be alert to see that any method of placing concrete that causes segregation of the concrete mix be discontinued. Some of the conveyor belt systems tend to cause segregation of the mix after several exchanges from one belt to another. The Inspector shall see that the length of conveyor belt is limited so segregation does not occur. Aluminum pipe or sheeting shall not be used in contact with fresh concrete.

In heavily reinforced sections, except the bridge deck slabs and flat slab bridge superstructures, the maximum concrete slump may be increased 25 millimeters (1 inch) with the use of a normal range water reducer if approved by the Olympia Service Center Construction Office. If the Contractor elects to pursue this increase of concrete slump, the request for the change shall be in writing, accompanied by a description of the specific section, and reasons why the slump increase is necessary. The Contractor will bear any added cost that may result from this change.

If the increased concrete slump is approved, a no cost change order is required to modify the contract. It is anticipated that possible candidates for this increase of concrete slump may be columns, cross-beams, and post-tensioned box girder web walls.

6-2.3A1 Weather and Temperature Limits

Concrete may **not** be placed when rain is hard enough to:

- Cause a muddy foundation.
- Wash or flow the concrete.

The temperature of the concrete must be within 16°C (60 F) and 32°C (90 F) during placement.

The air temperature must be at least 2°C (35 F) during and for seven days after placement (unless approved by cold weather plan).

The temperature measuring device shall be capable of measuring the temperature of freshly mixed concrete to ±1°C (±1 F) with a range of -18°C to 54°C (0 F to 130 F).

Hot Weather Placement (Air Temperature Above 32°C (90 F))

- Cool the component materials of the mix, transport and placement equipment, and the contact surfaces at the site.
- Methods shall be preapproved by the Engineer.

Cold Weather Placement

- Concrete shall not be placed against any frozen or ice-coated foundation, forms, or reinforcement.
- A preapproved plan for cold weather placement and curing is required, if temperatures are below 2°C (35 F) or anticipated to be below 2°C (35 F) in the next seven days.
- Heat aggregate and/or water to maintain mix temperatures above 16°C (60 F).
- Control temperature and humidity after placement by:
    - Enclosing concrete.

- Heating to 10°C to 32°C (50 F to 90 F) for seven days.
- Add moisture for six days (discontinue 24 hours before heat is stopped).

- An accurate recording thermometer is required.
- Corners and edges require special attention to prevent freezing.

When heating water and aggregates, the approximate resulting temperature for a batch of concrete can be estimated from the following formula:

$$X = \frac{Wt + 0.22W't'}{W + 0.22W'}$$

Where

X = temperature of the batch
W = mass (weight) of the water
W′ = mass (weight) of the aggregates and cement
t = temperature of the water in degrees C (F)
t′ = temperature of the aggregates and cement

6-2.3A2 Acceptance of Concrete

The Contractor is required to provide a certificate of compliance for each load of concrete delivered to the job. Based on who is supplying the mix, the format of the certification may vary. All certifications must contain the information required by the *Standard Specifications*. If a Contractor Certification sheet is not provided by the Contractor, the form provided by WSDOT may be used.

Example forms are available as follows:

1. Manufacturer's Certificate of Compliance (MCC)
2. Mix Design Batching Tolerance
3. Batching Process Verification
4. Contractor Acceptance of Slump and Air Price Adjustment
5. Contractors Mix Design Data Sheet

Prior to Placement

It is the responsibility of the Inspector to compare the actual batch masses (weights) to the approved mix design masses (weights). Aggregate masses (weights) shall conform within ±2 percent, total cementations material masses shall be within ±1 percent. Water mass (weight) shall not exceed mix design masses (weights) by 1.5 percent or the maximum water cement ratio, whichever is less. Additives shall not exceed the recommended dosage by ±3 percent. These batching tolerances apply to both WSDOT and Contractor mixes.

A copy of the applicable cement mill certificate shall be provided daily with the first load of concrete.

Acceptance testing will be performed by WSDOT in accordance with WSDOT standard test methods 801 through 809. Acceptance for state-provided mix designs shall be slump, air content (if required), temperature, and mix proportions. The additional acceptance requirement for contractors and commercial mix designs is strength.

The Inspector must be familiar with the type of concrete mix and who is responsible for the mix. The Contractor mix design is their mix and they are responsible for 28-day strength. The Contractor is responsible for any State-provided mix designs until the mix passes acceptance testing (slump and air).

The Inspector must be prepared to test materials for conformance. The Inspector must also be prepared to deal with nonconformance.

Preparation as a concrete testing inspector requires knowledge of concrete properties and construction procedures. Knowledge of how to use testing equipment and understanding the reliability of testing is also important. A continual evaluation of the testing equipment is needed to be sure it is operating and performing as required. Care and caution are recommended when transporting testing equipment and handling test materials, i.e., cylinders, molds, fresh concrete cylinders, and other samples).

Slump Acceptance

The maximum slump for vibrated and nonvibrated concrete is listed in the *Standard Specifications*.

When a high range water reducer (super plasticizer) is used, the maximum slump limit may be increased an additional 50 millimeters (2 inches) while the concrete is affected by the admixture.

Concrete can be accepted with a price adjustment if the slump is up to 25 millimeters (1 inch) beyond the specified maximum.

Air Content Acceptance

All cast-in-place concrete above the finished ground line shall be air entrained. The air content shall be a minimum of 4.5 percent and a maximum of 7.0 percent, unless otherwise specified.

The Contractor may elect to use air entrained concrete below finished ground line. If so, the 28-day compressive strength shall meet the requirements for the class of concrete specified.

Price Adjustment

Price adjustment for concrete that deviates from the specified slump and/or air content is calculated as indicated in the *Standard Specifications*.

If the Contractor is using a WSDOT provided mix design and the slump or air content is being placed under a price adjustment the Contractor then also becomes responsible for the specified strength requirements. It would be beneficial to have the price adjustment for particular concrete placement calculated ahead of time for ease of use in the field. This is calculated by using the appropriate unit price of concrete (see Section 6-02.3(5) of the *Standard Specifications*) and plugging it into the Price Adjustment equation. The volume of concrete in the truck being tested is then multiplied by the price adjustment per cubic meter (yard) to get the total price adjustment for that load.

Placement Time

It is the Inspector's job to ensure that:

- The concrete is placed in the forms as soon as possible after mixing, but no later than 1½ hours after cement is added to the mix.
- The concrete is always plastic and workable while being placed.
- The concrete is placed continuously with interruptions no longer than 30 minutes.
- Each layer of concrete is placed and consolidated before the preceding layer takes initial set. Initial set has begun if the vibrator will not penetrate the preceding layer under its own mass while being operated.

The discharge time may be extended to 1¾ hours if the temperature of the concrete being placed is less than 24°C (75 F). With the approval of the Project Engineer, this may be extended to 2 hours, if the temperature of the concrete being placed is less than 24°C (75 F). If it is apparent that the 30-minute time limit will be exceeded for a continuous pour, a construction joint should be established. The Olympia Service Center Construction Office shall be contacted when this occurs. A vibrator can be used to determine if initial set has taken place when evaluating the need for a construction joint as described previously.

Point of Acceptance

Acceptance tests for specification compliance are to be determined from samples taken at or close to the point of final placement, i.e., from the mixer discharge to the placement bucket or from the discharge end of a conveyor or pumpline.

If concrete is placed using a pump, the air content and slump may vary substantially. It is the Contractor's responsibility to request a change in the location of the acceptance test different than the point of placement and establish an acceptable correlation between the point of acceptance and the point of placement. In case of questions concerning the supplied adjustment values, a test confirming the accuracy of these values shall be performed. If the Contractor requests that cylinders be made at other than the point of placement, they become responsible for 28-day strength.

If a pump is used as a placement system, the initial acceptance test must be delayed until the pump has been cleared of all initial priming slurry. The Contractor shall advise the Engineer when the initial priming slurry has been cleared.

The Inspector should arrive in advance of the concrete placement and prepare the testing location. Above all, the equipment must be in good working condition with records of the last calibrations for airmeter and scales. The Inspector should have all the information, including the mix design, and all the forms needed for documentation of the placement operation.

Retesting Concrete

Once the Contractor has turned over the concrete for acceptance testing, no more mix adjustment will be allowed. The concrete will be accepted, rejected, or placed with a pay adjustment based on the acceptance testing.

Multiple Placements from One Concrete Truck

Only one set of acceptance tests are required per concrete truck.

6-2.3B Bridge Deck Construction

Bridge deck construction is critical because this part of the structure receives the most abuse from traffic and the environment. Construction of maintenance-free bridge decks requires close attention to details. One or two weeks before placing the concrete in the deck, a placement conference should be held to go over the procedures to be used and to emphasize the critical areas of construction. As a minimum, this should include a discussion of the rate of placement, personnel and equipment and backup equipment to be used, type of finish, and curing details. The rate of placement should normally provide for at least 6 meters (20 feet) of finished deck per hour.

The position of the reinforcing steel is very important because of the thin concrete section. Adequate blocking and ties are necessary to hold the steel in place. If foot traffic on the reinforcing steel causes it to deflect, the spacing of the chair supports is not adequate. A precheck of the screed setting for proper elevations and clearances to the reinforcing steel is essential prior to any concrete

placement. The finishing machine should be run the full length of the placement after the screed is adjusted to check deck thickness and cover of the reinforcing steel. During the placement, frequent checks should be made of the actual cover obtained directly behind the finishing machine and recorded in the Inspector's Daily Report.

Quality concrete is required, particularly in the bridge deck. Uniform consistency of the concrete should be maintained throughout the placement. The water-cement ratio is very important. It should be the minimum possible to produce the required workability and not exceed the specification limit. To keep the water-cement ratio as low as possible the specifications require the use of a water reducing additive for all bridge deck concrete. Frequent checks of the free water contained in the aggregates is necessary to determine the amount of water actually contained in the concrete mix.

6-2.3B1 Placing Concrete in Hot Weather

When the concrete is being placed in the bridge deck during hot weather, additional precautions must be taken in order to prevent surface evaporation. See 6-02.3(6)A for estimated evaporation rates.

The temperature of the concrete at the time it is placed in the forms must be kept under 32°C (90 F). Concrete with high temperature looses slump rapidly and is difficult to place and finish. This temperature can be controlled by shading the concrete trucks while loading and unloading and shading the conveyors or pump lines used in placing the concrete. The forms and reinforcing steel should be cooled prior to placing the concrete. This can be done by covering them with damp burlap and then spraying them with cool water immediately prior to placing the concrete. Care must be taken to see there is no standing water in the forms when the concrete is placed.

Water reducing retarder admixture should be used in the concrete so the water-cement ratio and slump of the concrete can be maintained within the specification limits. The mixing time of the concrete should be held to the minimum. The concrete must be placed and finished as soon as possible. If there is a delay in applying the curing compound after the concrete has been finished, a fog spray should be applied to reduce the moisture loss due to evaporation. If plastic cracks form and the concrete is still in a plastic state, they can be eliminated by revibrating the concrete and refinishing. Care must be taken to not revibrate the concrete after initial set has been obtained.

The requirements for curing the concrete shall be enforced. As soon as the visible bleed water has evaporated from the finished deck, the curing compound should be applied. The curing compound should be applied in two applications to ensure full coverage of the concrete. The second coat should be applied in a direction perpendicular to that of the first application. The amount of curing compound applied in the two applications should meet the minimum amount specified. Immediately after application of the curing compound and initial set, the concrete deck should be covered in accordance with Section 6-02.3(11) of the *Standard Specifications*.

In summary, the difficulties arising from hot weather concreting may usually be minimized by:

1. Using cool mixing water.
2. Keeping the aggregate temperature as low as is economically feasible.
3. Reducing the length of mixing time.
4. Placing the concrete as soon as possible after mixing and with a minimum of handling.
5. Keeping the surfaces shaded during placing.
6. Placing curing compound as soon as possible.

6-2.3B2 Placing Concrete in Cold Weather

Several precautions must be taken when placing concrete in cold weather. If temperatures below 2°C (35 F) are anticipated within seven days following placing the concrete, the Contractor will normally be required to enclose the structure and provide heat and moisture so the concrete will obtain its initial strength without freezing. The addition of moisture should be discontinued 24 hours before discontinuing the heat so there will not be an excess of moisture on the surface of the concrete to form ice in case of cold weather following the seven-day protection. If the temperature is below 2°C (35 F) when placing the concrete, the concrete must be heated to at least 16°C (60 F) by heating the aggregate and/or water in accordance with the *Standard Specifications*. The temperature of the concrete as well as the slump must be consistent from batch to batch.

When heating water and aggregates, the resulting temperature for a batch of concrete can be computed from the formula in Chapter 6-2.3A1 of this manual.

6-2.3C Use of Epoxy Resins

Quite frequently the use of epoxy resin systems on our projects is considered; either at the design stage or during the progress of a contract. Generally this use is in connection with repair of distressed concrete or in setting rebar.

Epoxy resins are quite versatile materials and are capable of providing the answer to numerous bonding or grouting problems. However, like a number of products, there is a tendency to treat them as a universal cure-all and they

occasionally are applied without proper consideration of inherent limitations.

Epoxy systems are capable of providing many different properties through the formulation of their various components. To a certain extent, the systems can be tailored to fit the particular need and conditions of time, temperature, humidity, etc., that will prevail. Use of a material under conditions beyond those for which it was formulated, can result in considerable trouble rather than benefit. Probably the greatest potential for trouble exists in the use of epoxies at temperatures below which a normal reaction can occur. Generally speaking, unless a specially formulated epoxy is being used, trouble can occur when application is attempted below 10°C (50 F).

The Olympia Service Center Materials Engineer is available as a technical resource on the use of such systems, in the resolution of pertinent problems should they occur during preliminary design considerations, or as a result of problems during construction. It is strongly recommended that any contemplated use of epoxy resin systems at application temperatures below 10°C (50 F) be checked with the Materials Division to forestall potential difficulties.

If epoxy resin is used, the following elements need to be carefully checked by the Inspector:

- Proper mixing and curing of the epoxy resin.
- Temperature and/or moisture limitations of the epoxy being used.
- That the areas are clean and prepared in accordance with the manufacturers recommendations.
- That the epoxy covers the entire repair area.
- That the epoxy fills the entire space between bar and the hole (if bars are being set with epoxy resin).
- That the epoxy is still tacky (not set) when it is being used to bond two structural elements together (just before elements are put together).

For setting rebar or anchors, it is best to determine the volume required to be filled by the epoxy and measure the epoxy being used. A method of measurement should be agreed to with the Contractor for inspection purposes. Also, occasional samples should be taken of the epoxy resin being placed to be sure it is setting up properly. If there is any question of filling the void or adequacy of the epoxy resin, the Inspector shall advise the Contractor, document the discussion, and report it to the Project Engineer.

6-2.3D Finishing Structures

6-2.3D1 General

As soon as possible after the forms are stripped, the concrete surfaces shall be examined and all lips or edgings where form boards have met, shall be removed with a stone or sharp tool. Bolt holes and rock pockets shall be filled with cement mortar and floated to a smooth finish. The mortar patch shall be the same color as the adjoining concrete surfaces. Finishing of concrete surfaces shall be done in accordance with the provisions of the *Standard Specifications* and Special Provisions.

The amount of work necessary to complete the finishing satisfactorily, depends entirely on the quality of the original concrete work. If the forms have been poorly constructed and the concrete surfaces are rough and uneven, it will be necessary for the Contractor to do sufficient rubbing and finishing after the forms are removed to secure a satisfactory job. Grinding leaves a surface that is off color and should be kept to a minimum.

6-2.3D2 Formed Surfaces

The primary purposes of finishing formed surfaces are:

- To seal the surface from water and other elements that can rust or corrode metal ties and reinforcement within the concrete.
- To provide a uniform, pleasing appearance for surfaces that will remain visible to the public.

There are three different classes of finish. They are:

Class 1

- All rail bases, curbs, traffic barriers, pedestrian barriers, and ornamental concrete members.
- Same as class 2 plus finishing steps outlined in Section 6-02.3(11)A.

Class 2

- Required for all surfaces on bridge superstructures at highway grade separations and railroad undercrossings.
- Required for all above finished ground surfaces of bridge piers, columns, abutments, retaining walls, and culvert head walls within 45 meters (150 feet) of walkway or roadway.
- Required for all outside surfaces, vertical or sloping, or each superstructure.
- Required for all surfaces of open spandrel arch rings, spandrel columns, and abutment towers.

Class 3

- Required for all above ground surfaces not receiving a class 1 or 2 finish.
- Required for all surfaces that will be underground or covered with fill.

See the *Standard Specifications* for additional requirements.

6-2.3D3 Roadway Slabs

Finishing of roadway slab surfaces shall be as outlined in Section 6-02.3(10) of the *Standard Specifications*. The principal objectives to be attained are a good wearing surface and a smooth riding roadway. The Engineer should ensure that adequate preparation has been made to do a good job in accordance with the specifications.

The Engineer should insist that a float be available. When a good strikeoff and finish has been obtained by a finishing machine, floating may be, and should be, kept to a minimum because excess floating can be detrimental. A light aluminum float carefully and sparingly used will not harm a well finished deck but will expose poor adjustment and misuse of a good machine. It will also smooth out mortar ridges left by the finishing machine and seal the surface. The Contractor is required to check the deck with a 3-meter (10-foot) straightedge immediately after it is floated.

Low and high spots can possibly be corrected by operating the finishing machine over the area (if the concrete is still plastic).

The Engineer should be cautioned that hard floating of the concrete surface with aluminum floats may cause a chemical reaction between the aluminum and the fresh concrete which could decrease the strength of the concrete at the surface of the concrete. Excessive wear or pitting of the aluminum float could be an indication that chemical reaction is taking place between the float and the concrete.

It is important that the texturing comb be used when the concrete is at the proper consistency. If the concrete is too soft, it will not retain the proper texture obtained by the comb and, if the concrete is too hard, the proper texture will not be achieved. The comb should be set up and ready to use well in advance of the time it will be required. Surface texturing is normally done with a comb except when an overlay is required.

The finished and cured deck slabs must be checked with a 3-meter (10-foot) straightedge and corrected by cutting down the high spots and building up low spots until the entire surface comes within the specified tolerance.

Sidewalks shall be finished smooth with a wood float and then brushed with a fine bristle brush. Use edger tool at all joints and edges. Block lines on sidewalk surfaces are not desired on structures.

6-2.3E Vacant

6-2.3F Curing Concrete

Proper curing of concrete is important to securing strong, good wearing concrete and in reducing cracking. Curing periods and methods specified should be strictly observed.

The last step in ensuring a good concrete job is to provide proper curing. Concrete begins to cure from the time cement and water are added in the mixing chamber and continues for many years after. Concrete is very susceptible to damage during initial curing, if proper steps are not taken. Three of the most important factors are:

1. Surface drying (evaporation).

2. Rapid temperature changes between segments of the concrete as it is curing.

3. Stresses or loads applied before the concrete has reached adequate strength.

All of the specifications regarding curing, form removal, hot and cold weather concreting, etc., are designed to provide protection for the concrete during this critical stage. For example: If the surface begins to dry, the surface will begin to shrink and cracking can occur. To prevent this, the Inspector should be aware that fog misting, curing compounds, wet blankets, plastic sheeting, etc., are designed to be applied **before** surface drying begins to prevent loss of surface moisture. Some concrete mixes such as microsilica and latex are very susceptible to surface drying and require closer attention due to the effects of thin lift application.

Note: Curing compounds are not chemicals that cure concrete. They prevent water loss by forming a waterproof membrane.

Like most materials, concrete expands when heated and contracts when cooled. Therefore, the concrete should not be subjected to extreme temperature changes as hardening takes place.

Hardening of concrete is also slowed down by cooler weather. Concrete must not be exposed to freezing conditions to avoid permanent damage.

Concrete (as it hardens) contains a high percentage of moisture and could crack if the water in the mix freezes and expands. Air entrainment will not protect the concrete from damage during the initial curing period.

Summary

1. Prevent surface moisture loss.
2. Maintain constant temperature (no freezing).
3. Prevent stress loads.

6-2.3G Test Cylinders

Concrete test cylinders shall be molded in forms conforming to the requirements for single use molds as detailed in ASTM C470, or in steel or plastic molds meeting the requirements of reusable vertical molds as detailed in ASTM C31. Cardboard test cylinder molds shall not be used.

See Chapter 9 of this manual for instructions for making, curing, and shipping concrete test cylinders and for the number of test cylinders to be made.

Extra cylinders that are tested for early removal of forms and falsework shall be the responsibility of the Contractor. Early cylinders are cylinders tested in advance of the design age of 28 days. Their purpose is to determine the in place strength of concrete in a structure prior to applying loads or stresses. The Contractor shall retain an independent testing laboratory to perform this work. This lab shall be approved by the Engineer.

The cylinders shall be cured in accordance with WSDOT Test Method 809, Method 2. Special cure boxes to enhance cylinder strength will not be allowed. The number of early cylinder breaks shall be in accordance with the Contractors need and as approved by the Engineer.

Prior to the removal of any forms, the Contractor is required to furnish the Engineer with all test results. Forms shall not be removed without approval of the Engineer.

If set retarders are used in a mix, the Olympia Service Center Materials Lab should be consulted for curing, handling, and storage instructions prior to use.

6-2.4 Concrete Seals and Cofferdams

When constructing foundations in streams and other locations below water, it is usually necessary to place a concrete seal in the cofferdam so that the cofferdams may be dewatered. The mass of the concrete seal resists the buoyant force on the cofferdam when it is dewatered. Seal concrete is placed underwater by means of a tremie. Concrete pumps may be used.

Handling of the tremie requires the use of a crane to raise and lower it into place. Hand winches are sometimes used in small seals but they must be equipped with a brake and drum for quick release and stop.

The tremie pipe shall be at least 250 millimeters (10 inches) in diameter, made of heavy steel pipe, with flange or sleeve connections. Sleeve connections are preferable for seals placed in pile foundations. Flanges sometimes hang up on tops of piles and the concrete charge is lost. The tremie pipe must be absolutely water tight, at the joints as well as at the connections to the hopper. The hopper should be of at least, one-half cubic meter (yard) capacity.

Before any concrete is placed, the bottom of the tremie pipe shall be sealed with a plug. A satisfactory plug can be made with a 50-millimeter (2-inch) board slightly larger in diameter than the tremie pipe; on top of this board fasten a 19-millimeter ($^3/_4$-inch) round piece cut to the neat size of the inside of the pipe. Place a piece of cloth or burlap over the end of the pipe and drive the plug in place. Lower the tremie until the plug rests on the bottom, then fill the tremie pipe with concrete. When the tremie is raised the mass (weight) of the concrete will push out the plug. The plug can be salvaged by fastening a piece of wire to it before it is lowered into the water.

Further details for handling a tremie are found in Section 6-02.3(6)B of the *Standard Specifications*.

The thickness of seals without piling are generally not less than 0.43 times the height of high water above the bottom of seal. Seals in footing with piling require special design. The thickness of the seal is computed for the water elevation shown in the plans. The cofferdams must be designed and vented for this elevation. The design and vent elevations are noted in the plans. If concrete is placed in the seal during a period of high water, the dewatering of the cofferdam will have to be delayed until the water level drops to the vented elevation. No change in the vent elevation shown in the plans shall be allowed without approval from the Olympia Service Center Construction Office. Such approval should be obtained before the cofferdam is designed. All cofferdams must be vented at the elevation used for computing the seal thickness in order to prevent an unsafe hydrostatic pressure on the seal. Cofferdams shall not be dewatered before the concrete has been placed and cured.

The vertical sheathing of the cofferdam or shoring shall extend below the bottom of the excavation in accordance with the approved working drawings. Sheet piles in cofferdams shall be placed tightly together so that there will be no flow of water through the cofferdams while seal concrete is being placed.

The tops of seals should slope slightly toward one end. At that end, provision shall be made for a sump for the pump intake. Cofferdams should be tightly constructed so that a minimum of pumping is required after the cofferdam has

been dewatered. Space for water courses shall be provided on top of the seal and around the footing block, between the footing block and the walls of the cofferdam.

Before starting to place seal concrete, all equipment should be checked to see that it is in good working order. It is necessary that concrete in a seal be placed continuously until completion, with the end of the tremie always extending into the fresh concrete.

It is not desirable to leave cofferdam struts and waling in the seal concrete but it is sometimes necessary to do so, especially in soft foundation material, when a set of struts and waling is required near the bottom of the cofferdam. The concrete displaced by such struts and waling is not deducted from the Contractor's pay items.

After the cofferdam is dewatered, a film of scum or laitance will usually be found on top of the seal. This must be cleaned off before the footing concrete is placed. If the seal is designed as a footing, the laitance will have to be removed only from the areas that will support pier shafts, columns, or walls.

6-2.5 Pier, Column, and Wall Concrete

Concrete in all reinforced footings shall be placed in the dry. All reinforcing, including vertical wall or shaft bars and dowels, shall be securely fastened in place before placing of concrete begins. Driving of dowel bars into concrete must not be permitted, except in seal concrete when the seal is also the footing block, but they must be placed immediately after the concrete is placed. The placing and spacing of footing reinforcing steel is as important as in any other part of the structure.

Care must be exercised in placing reinforcing steel in the columns where it splices with the dowel bars into the footings. In many instances, if the dowel bars and column bars are not carefully placed, there is not enough space between the steel bars for proper placement of concrete. Considerable care must be taken in placing and vibrating the concrete in the columns so that no rock pockets are formed. Column details must be strictly adhered to since they are critical to the earthquake resistance of the bridge.

Port holes shall be constructed in the forms on the rear face of retaining walls and in columns with sloping faces which are over 3.7 meters (12 feet) in height, to provide access for vibrating of the concrete and inspection during the pouring of concrete in the walls or columns. Care must be taken in placing and vibrating the concrete of sloping walls or columns to get proper consolidation and to avoid rock pockets.

Concrete shall be placed in one continuous operation from top of footing to bottom of coping unless construction joints are shown in the plans or preapproved by the Olympia Service Center Construction Office. Concrete shall be placed at the rate for which the formwork is designed. This rate, in meters of height per hour along with the concrete temperature, should be stated on the approved falsework plans or be specified by the Bridge and Structures Engineer. Spacing of studs, wales and form ties shall be as shown on the approved falsework plans. Copings on piers and columns shall not be placed sooner than twenty-four hours after the shafts are placed. Copings on retaining walls shall not be placed until all backfilling is completed. Anchor bolts shall be correctly placed in copings before concrete is placed. Vibrators shall be used at all times when placing concrete, unless otherwise specified.

6-2.6 Concrete Structures

6-2.6A Forms and Falsework

The forms for the structure shall be constructed in accordance with the approved falsework and form plans and the requirements of Section 6-02.3(17) of the *Standard Specifications*. In general, the forms used for all concrete surfaces which will be exposed, shall be faced with plywood. All plywood used shall be exterior type except where CDX is allowed by the specifications. All forms have to be strong enough to hold the plastic concrete in place until it has hardened. Forms should be designed to permit easy removal without damage to the concrete. Forms are a critical part of the concrete bridge construction process. Generally, the factor of safety used for design of forms is less than that of permanent construction. Therefore, it is extremely important that the forms are constructed in accordance with the approved form drawings. Any changes to the approved form drawings shall be reviewed and approved by the Bridge and Structures Office.

The Contractor is responsible for designing and constructing the forms and falsework for fixed-form concrete work, but they must meet certain requirements.

The Contractor must submit detailed plans (refer to Chapter 6-1.5 of this manual):

- For departmental approval,
- Except for footings and retaining walls less than 1.2 meters (4 feet) in height.

Prior to placing concrete, the Inspector should verify that all forms:

- Provide forming faces that are:
    - Smooth and firm,

  - Clean of dirt, laitance, oil, or any other material that would contaminate or discolor the concrete,
  - Treated with an approved form-release agent;
- Are mortar tight to avoid any leakage (including tape or caulking if needed for surfaces that will require Class 2 finish);
- Are constructed in accordance with the approved forming plans;
- Are adequately rigid and well supported to hold and retain the concrete without distortion or displacement;
- Are set at the locations, dimensions, lines, and grades as specified in the plans.

If wood forms are used, see that plywood is used for the form faces with:

- The joints and grain generally in line with the line of the structure,
- The face grain of the plywood running perpendicular to the supports,
- No offsets or projections that would leave an impression in the concrete surface,
- New plywood (one use only) being used.

Also verify that:

- Uniform chamfer strips are set at the correct line and grade as required for filleted edges.
- Adequate tie rods, snap-ties, hairpins, studs, walers, and braces are securely placed as needed support.

If metal or fiberglass forms are used, the same basic requirements apply, but particularly check for:

- Any dents or other defects that would harm the uniformity of the concrete surface.
- Any rust or other foreign material that would discolor the concrete surface.
- Countersunk bolts and rivet heads.
- Adequate support clamps, rods, and pins.

Prior to placing any reinforcing or concrete loads on the falsework, verify that:

- The bottom of the falsework is set on a solid foundation, with mudsills, minimum pile diameter, etc., all constructed per approved plans.
- The upper portion provides firm, uniform support.
- Devices such as screws-jacks and wedges are used to hold the forms at the correct elevation, and that they are free from defects, and undamaged or not bent.
- When wedges are used, they are placed in pairs to provide uniform bearing.
- The falsework construction is in accordance with the approved falsework plans and the *Standard Specifications*.

Major failures with loss of life have occurred as a result of poor falsework and formwork construction. It is critical that the Inspector check these temporary structural elements very carefully. Any deficiencies must be corrected before construction loads are applied. If there is a question, the Bridge Construction Plans Office or the Olympia Service Center Construction Office should be contacted.

Suggested acceptance tolerances are as follows:

1. Bridges and similar structures:

   a. Variation from the plumb or the specified batter in the lines and surfaces of columns, piers, walls and in arrises

Exposed, in 3 m (10 ft.)	13 mm (1/2 in.)
Backfilled, in 3 m (10 ft.)	25 mm (1 in.)

   b. Variation from the level or from the grades indicated on the drawings in slabs, beams, horizontal grooves, and railing offsets

Exposed, in 3 m (10 ft.)	13 mm (1/2 in.)
Backfilled, in 3 m (10 ft.)	25 mm (1 in.)

   c. Variation in cross-sectional dimensions of columns, piers, slabs, walls, beams, and similar parts

Minus	6 mm (1/4 in.)
Plus	13 mm (1/2 in.)

   d. Variation in thickness of bridge slabs

Minus	3 mm (1/8 in.)
Plus	6 mm (1/4 in.)

   e. Footings: Variation in dimensions in plan

Minus	13 mm (1/2 in.)
Plus	50 mm (2 in.)

   f. Misplacement or eccentricity

2 percent of the footing width in the direction of misplacement but not more than	50 mm (2 in.)

   g. Reduction in thickness

Minus	5 percent of specified thickness

   h. Variation in the sizes and locations of slab and wall openings 13 mm (1/2 in.)

Forms for concrete surfaces which will be exposed shall be treated with a parting compound consisting of a chemical release agent. Form oil or other oils shall not be used. The

parting compound shall be applied before the reinforcing steel is placed. The forms shall be thoroughly wetted on both sides in advance of placing the concrete.

The basic requirements for the removal of any forms and falsework are that:

- The curing temperature was above 10°C (50 F) during the cure period and that strength is adequate.
- No forms or falsework may be removed until authorized by the Engineer.
- All forms and falsework must be removed unless there is no access for removal (i.e., inside a box girder bridge).
- All forms and falsework must be removed in a manner that will not damage the structure.

Timing is a key consideration in the removal of forms and falsework. In terms of curing, the concrete, forms, and falsework must remain until the concrete has sufficient strength to support itself. For finishing purposes, it is generally better to remove the forms as early as possible to finish the surface while it is still green. Therefore, the timing of falsework and form removal depends largely on the type of structure as well as how it is cured and finished.

For example:

- Side forms — not load bearing — at least 24 hours for:
    - Footings, if curing compound applied to complete cure,
    - Steel or dense plywood if: (1) water reducer in mix; (2) low-slump mix, (3) 9650 kPa (1,400 psi) compressive strength, and (4) wet cure for balance of three days,
    - Otherwise three days minimum.
- Release of falsework — supporting mass (weight) of concrete (see *Standard Specifications*).

6-2.6B Traffic Barrier, Pedestrian Barrier, and Rail Bases

On some projects, the Contractor has the option of using slipform techniques in addition to the usual fixed forms as specified in Sections 6-02.3(6), 6-02.3(11)A, 6-02.3(24)C, 6-10.3(2), and 9-03.1(2)B of the *Standard Specifications*.

In either method, barriers and rail bases should be carefully aligned both horizontally and vertically to give a pleasing appearance; refer to Section 6-01.4 of the *Standard Specifications*. The vertical adjustment for the pleasing appearance is intended for localized camber and deck profile variables. This **adjustment is not intended to eliminate grade breaks, such as vertical curves and superelevation transitions**. In reinforced cast-in-place concrete box girder, flat slab, and Tee girder bridges, approximately one-half the residual dead load camber should be built into the barriers and rail bases. None is required for prestressed girder bridges; I-girders, Bulb-T, etc. In other types of bridges, a recommendation should be obtained from the Olympia Service Center Bridge and Structures Engineer on the appropriate camber adjustment.

The Project Engineer should plot to a large scale the profiles of the roadway grades at the curb lines. From these profiles, the grades for the tops of traffic barriers, pedestrian barriers, and rail bases can be properly determined. A slight hump in the barriers or rail base over the whole bridge is not usually objectionable.

On the safety-shape traffic barriers, some of the height variation may be accommodated in the vertical face at the base. Any height variation shall maintain the 815-millimeter (2-foot 8-inch) total height. The vertical toe face at the base is usually 75 millimeters (3 inches) unless the structure is receiving an immediate overlay. To accommodate the overlay, the vertical face at the base is increased to 75 millimeters (3 inches) plus overlay thickness. The front face geometry of the safety-shape traffic barrier is critical and should not be varied except as noted herein. Ideally, all height adjustment required to provide a pleasing appearance should be accomplished by modifying the total height of the traffic barrier by varying the vertical toe face at the base, i.e., 50-millimeter (2-inch) minimum. The front and back faces of the traffic barrier are parallel on the upper part to accommodate all height adjustment necessary. The 175-millimeter (7-inch) height of the intermediate sloping face shall be maintained. To ensure proper alignment, carefully check the top of forms or the Contractor's control wire prior to placing concrete.

On slipformed traffic barriers and pedestrian barriers, the same cross-section as shown for fixed-form construction shall be used, except the top chamfer may be shaped to a 20-millimeter ($^3/_4$-inch) radius. Although slipforming may be allowed in the contract, the reinforcing steel bars may not be sufficient to resist the forces during the concrete placement operations. The contractor should evaluate the stiffness of the reinforcing and, if necessary, provide additional reinforcing steel crossbracing, both longitudinally and transversely. Slipformed concrete is usually placed with a slump of 30 millimeters ($1^1/_4$ inches) plus or minus 6 millimeters ($^1/_4$ inch). This slump is critical and should be carefully controlled by the Contractor. It is not unusual to encounter conditions which produce sections of unsatisfactory barrier or rail base due to slump, finish, alignment or other problems. When this occurs, do not hesitate to have the unsatisfactory sections removed. Occasional removal is inherent in slipform construction.

Placement of the reinforcing steel bar cage to ensure adequate concrete cover and proper reinforcing bar location is very important and difficult to check for

slipformed traffic barrier, pedestrian barrier, and rail bases. When fixed forms are used, final adjustment of the reinforcing steel bar cage can be accomplished after the forms are set prior to concrete placement. The slipform method does not present this opportunity. For that reason, Section 6-02.3(24)C of the *Standard Specifications* requires that the Contractor check reinforcing steel bar clearances and placement prior to slipform concrete placement. This check can be accomplished by either the use of an approved template or by operating the slipform machine over the entire length of the barrier. The final grade control must be set prior to the check. All reinforcing steel deficiencies must be corrected by the Contractor. Once the deficiencies are corrected, the Contractor may begin slipform concrete placement after he has the Project Engineer's approval.

6-2.6C Reinforcing Steel

For most concrete structures, some type of reinforcement is required to resist high tension stresses. Reinforcing materials include:

- Uncoated deformed steel bars, which are most commonly used,
- Other types, such as welded wire mesh, epoxy-coated bars, wire, prestressing cable, and

(**Note:** Epoxy-coated bars require special handling to prevent damage to the coating.)

- Wire ties and other devices to securely hold the reinforcement in place.

The Contractor is responsible for determining and ordering quantities from the plans.

As reinforcing steel is delivered and stored at the project site, the Inspector should verify that:

- All positioning, spacing, sizes, lengths, shapes, and splice locations conform with the plans.
- Any field bending is done as specified and any cracked or split bars are rejected. If in doubt, reject the bar in question.

The Inspector should verify that the reinforcing placed is:

- Tied at all intersections if bar spacing is 300 millimeters (1 foot) or more.
- Tied at alternate intersections if spacing is less than 300 millimeters (1 foot).
- Supported in accordance with the *Standard Specifications*.
- **Tack welding is not allowed. It can severely damage the reinforcing steel.**
- Check that clearances between the forms and the reinforcement are within 6 millimeters ($^1/_4$ inch) of those specified in the plans.
- Check that splices are located and constructed only as shown in the plans using either:
  - Lap splicing:
    - Not permitted for No. 14 or No. 18 bars.
  - Welded splices:
    - Special inspection is required (steel fabrication inspector),
    - Advance approval of welding methods,
    - By certified welded (test welds).
  - Mechanical splicing (if allowed in the plans):
    - This type of splice must be approved by the Olympia Service Center Materials Lab before use.
- Check that reinforcement is securely supported and held in place as follows:
  - By preapproved metal chairs, hangers, support wires, or mortar blocks that are at least as strong as the structure,
  - With such supports having the correct dimensions to provide the required clearances.
- Check that all damaged epoxy-coated rebar is repaired in accordance with the *Standard Specifications*.

See the *Bar Identification Guide* (Figure 6-4) for proper identification of rebar at the job site.

The ASTM specifications for billet-steel, rail-steel, axle-steel, and low-alloy steel reinforcing bars (A 615M, A 616M, A 617M, and A 706M respectively) require identification marks to be rolled into the surface of one side of the bar to denote the producer's mill designation, bar size, type of steel and minimum yield designation. See Figure 6-4. Grade 400 bars show these marks in the following order:

1st — Producing Mill (usually a letter)

2nd — Bar Size Number (#3 through #18)

3rd — Type Steel:

S for Billet meeting Supplemental Requirements S1 (A 615M)

N for New Billet (A 615M)

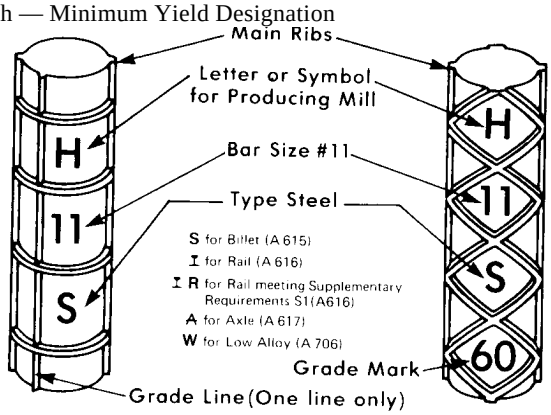
R for Rail meeting ASTM A 617M, Grade 60 bend test requirement (A 616M) [per ACI 318-83]

I for Rail (A 616M)

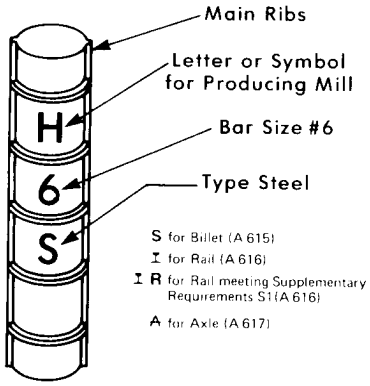
A for Axle (A 617M)

Wfor Low-Alloy (A 706M)

4th — Minimum Yield Designation



GRADE 400 (60)



GRADE 300 (40) AND 350 (50)

Figure 6-4

Minimum yield designation is used for Grade 400 (60) bars only and can either be one (1) single longitudinal line (grade line) or the number 60 (grade mark).

A grade line is smaller and between the two main ribs which are on opposite sides of all U.S. made bars. A grade line must be continued at least 5 deformation spaces. A grade mark is the 4th mark on a bar.

Grade 300 (40) and 350 (50) bars are required to have only the first three identification marks (no minimum yield designation).

Bar identification marks may be oriented as illustrated or rotated 90 degrees. Grade mark numbers may be placed within separate consecutive deformation spaces. Grade line may be placed on the side opposite the bar marks.

Reinforcing steel shall be placed in position as shown on the plans and held securely during the placement of the concrete. The strength of a reinforced concrete structure depends not only upon the amount of steel placed but also on its proper location. Improper location of the steel can impair the strength of the structure.

In instances where reinforcing steel is shown in detail in specific relationship to other material and details such as inserts, openings, etc., the Inspector should make sure that this relationship exists when inspecting the placement of the reinforcing steel. If the shown relationship is impossible to maintain or results in a conflict with other details, the Olympia Service Center Construction Office shall be consulted to obtain clarification of the details.

The reinforcing steel shall be securely blocked from the forms by means of small mortar blocks, with a groove or tie wire embedded, not more than 50 millimeters (2 inches) square, or by other approved devices. If metal chair supports are used as supports for steel reinforcing bars, all surfaces of the chair supports not covered by at least 13 millimeters (1/2 inch) of concrete shall be treated in accordance with the requirements of Section 6-02.3(24)C of the *Standard Specifications*.

Runways for wheelbarrows or concrete buggies used in placing concrete shall not be supported on the steel reinforcing bars.

Steel delivered to the job far in advance of its use should be stored under cover to prevent rust. Mill scale is sometimes present on the reinforcing steel to such an extent that it must be removed. This is especially true with the larger bars. Removal can usually be accomplished by the use of wire brushes or by tapping the bars with hammers. Hardened concrete mortar must be removed from the reinforcing steel before placing the concrete. All reinforcing steel shall be in its proper place before concrete is placed. Driving of dowels, rail bars, etc., into concrete (wet setting) shall not be permitted. See the *Standard Specifications* for further details.

Before concrete is placed, the reinforcing steel shall be inspected to see that it conforms to the plans and that the steel is properly fastened in position. The amount of cover of concrete over the reinforcing steel in bridge roadway slabs is critical. The Inspector must verify compliance with

plan dimensions in the slabs by an adequate number of measurements of the steel reinforcing bar locations in the forms before and immediately after placing concrete. These measurements can be taken at the same time checks on the depth of the concrete in the slabs are taken. These measurements shall be recorded as to depth and location and made a part of the project construction documents.

When steel reinforcing bars protruding from columns or walls are exposed to weather for several months, they rust and exposed surfaces below become stained with rust. To prevent this, the bars should be protected to prevent rust. Coatings used for this purpose may prevent adequate bonding of concrete to the steel bars and should be removed from the bars before concrete is placed, except as allowed by the *Standard Specifications*.

6-2.6D Welding Reinforcing Steel

Reinforcing bars shall not be welded unless welding is indicated in the plans or special provisions. If welding is specified, the WSDOT welding inspector must be contacted for purposes of certifying welders and procedures. Reinforcing bars which are to be welded must be furnished of steel which is suitable for welding as specified.

Only operators qualified as specified in Section 6-02.3(24)E of the *Standard Specifications* shall be allowed to weld reinforcing steel.

AWS specifications require that Low Hydrogen type electrode (welding rod) be used for welding reinforcing steel. Generally, grade E7018 electrodes shall be used for grade 300 (40) reinforcing bars and grade E8018 electrodes shall be used for grade 400 (60) reinforcing bars. If semi-automatic welders are used equivalent grade electrodes shall be used. It is important that moisture be eliminated from the electrode and the steel reinforcing bars. The electrode must be prepared as called for in Section 6-03.3(25) of the *Standard Specifications*. To do this, a drying oven is essential and must be available and used at the site where welding is done.

The recommended procedure for welding steel reinforcing bars is given in Section 6-02.3(24)E of the *Standard Specifications*. The Contractor shall submit a welding procedure to the Engineer for approval. The Project Engineer shall transmit the Contractor's welding procedure to the Olympia Service Center Bridge and Structures Engineer for review.

6-2.7 Prestressed Concrete Products

Shop inspection of the manufacturing process of prestressed concrete products will be done by an inspector working under the direction of the Olympia Service Center Materials Engineer. The Materials Laboratory has instituted a procedure of inspecting each prestressed concrete plant in the State on an annual basis. During this inspection, the Materials Laboratory obtains a list of the sources of the component parts to be used in manufacture of the prestressed concrete members. When the Contractor submits a request for approval of source of prestressed products, the complete member and the prestress plant which will manufacture it need only be listed.

The Inspector prepares a weekly Fabrication Progress Report and Inspectors Daily Report, and submits them to the Project Engineer for information and records. When the pre-stressed unit is completed, including finishing, the Inspector will attach an Approved for Shipment tag, and the girder will be stamped with an "approved for shipment" and a lab I.D. number. The Approved for Shipment tag properly signed and dated will be the Project Engineer's basis for accepting the product at the job site. The Project Engineer will be required to inspect the item only for any damage which may occur during shipment or after the item arrives at the job site.

Finishing of concrete surfaces of prestressed units shall be in accordance with Sections 6-02.3(14) and 6-02.3(25)F of the *Standard Specifications* unless specifically changed by the special provisions. The Shop Inspector shall require that the finishing done in the shop is in accordance with the specifications.

Prestressed concrete girders shall be maintained in a plumb, upright position at all times and shall be lifted by means of the lifting strands provided at the ends of the girders. All prestressed girders have been designed for a vertical pickup at the ends as indicated in the contract plans, and any other method will induce stresses which could cause failure of the girder during pickup. Some deviation from the vertical is safe for some girders. If the Contractor wishes to deviate from the vertical pickup, they shall have the proposed method analyzed by their engineers and shall submit the method, with supporting calculations, for review. The Project Engineer submits the calculations to the Olympia Service Center Construction Office for review. If the girders are broken or damaged during handling or erection, they will have to be replaced at the Contractor's expense and an extension of time will not be granted for lost time from this cause.

The girders shall not be placed on the finished piers or abutments until the concrete in the piers or abutments has obtained at least 80 percent of its design strength. If grout pads are required, they shall be constructed and cured as required by the plans and specifications before placing the girders. If elastomeric bearing pads are required, the lower contact surface of the pads must be bonded to the structure with an approved rubber cement to hold them in the position shown in the plans.

The girders must meet the dimensional tolerances listed in Section 6-02.3(25)I of the *Standard Specifications*.

6-2.7A Shop Inspection of Prestressed Concrete Products

The Contractor is required to submit five sets of the shop detail plans to the Project Engineer for approval. The Project Engineer shall check these plans for compliance with the contract plans and specifications. The Project Engineer shall only approve the shop plans for standard series "I" girders and for the concrete piling shown in Standard Plan E-4 or E-4a. No deviations shall be approved without written approval of the Bridge and Structures Engineer (or Terminal Design Engineer for Ferries Division projects). The shop drawings for all other precast piles or prestressed concrete products shall be approved by the Bridge and Structures Engineer (or Terminal Design Engineer for Marine Division projects).

The approved shop detail plans shall be distributed as follows:

A. Project Engineer (or Terminal Design Engineer) Approved:

2 sets retained by the Project Engineer (or Terminal Design Engineer)

1 set to the manufacturer

2 sets, along with the contract plans and special provisions, to the Olympia Service Center Materials Engineer.

B. Bridge and Structures Engineer (or Terminal Design Engineer) Approved:

1 set retained by the Bridge and Structures Engineer (or Terminal Design Engineer)

2 sets to the Project Engineer, who will forward one set to the manufacturer

2 sets to the Olympia Service Center Materials Engineer who will forward the shop drawings and a set of contract plans and special provisions to the Prestressed Plant Inspector.

Manufacture of these members shall not begin until the manufacturer has received approval of the method, materials, and equipment they propose to use in the prestressing operations. Deviations from the approved shop drawings shall not be permitted unless approved in writing in advance of use.

Welding of the reinforcing bars will not be permitted unless shown in the contract plans.

The Olympia Service Center Materials Lab has published a manual entitled "Inspectors Guide for Prestressed Plant Inspection and Quality Control" which contains more detailed instructions for this work.

6-2.8 Post-Tensioned Bridges

The construction of cast-in-place post-tensioned bridges requires considerable attention to details of construction by the Contractor and Inspectors. The Olympia Service Center Construction Office is available to present job-specific training on post-tensioned bridges. They should be contacted after the post-tensioning shop drawings have been approved and before post-tensioning ducts and anchors are to be placed.

In addition to the falsework and form plans for the structure being approved by the Bridge and Structures Engineer, post-tension detail plans shall be submitted for approval as shown on the flow chart in Figure 6-5. Included in these details will be the anchoring details, jacking forces, tendon profile, elongation of the tendons, and the tendon stressing sequence. In many structures, the dead load of the structure is increased at the jacking ends during the jacking operation. In these cases, the falsework at the jacking ends must be designed to carry the additional dead load.

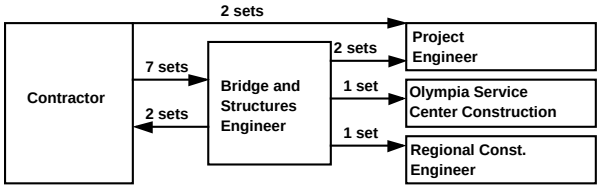


Figure 6-5

The installation of the post-tension system begins with the placing of assemblies consisting of bearing plate, transition cone or trumpet and grout inlet. Duct sections consisting of rigid conduit are assembled with couplers and are tied to the stirrups. Anchorages and bearing plates are securely fastened to the forms to prevent movement and loss of mortar during concreting. Connections between trumpets and ducts, ducts and couplers, and ducts and vent saddles are taped with a durable and waterproof tape to prevent intrusion of mortar.

It is necessary that the ducts be located in the position shown in the approved post-tension details in order for the structure to function as designed. A misaligned duct will cause increased friction and localized stress which can result in failure of the member during the stressing operation. The Inspector must check to see that the ducts are properly located and securely fastened in place to prevent movement during concreting.

Washington State Department of Transportation

CONTRACT NO.	PAGE NO.
SECTION	
STRUCTURE	
PROJECT ENGINEER	INSPECTOR

Post-Tensioning Record

Date	Gir. No.	Tendon No.	Jack No.	Jack Location	Req 'd. Jacking Force Per Tendon (kN)	Strands Per Tendon	20% Jacking Force (MPa)	Req'd. Jacking Force (MPa)	Actual Jacking Force (MPa)	Actual Elong. (mm)	(A) 100% Actual Elong. -20% Actual Elong. (mm)	(B) Req'd. 80% Elong. (mm)	% Elong. Per Tendon	100% Actual Elong. -Seated Elong. = Seating Take-up (mm)	Req'd. Seating Take-up (mm)
1-2-93	A	1	6	Pier 1	1655	12	9.65	48.26	9.65	108					
									48.26	597	489	486			
									9.65	597				10	10
							Dead	End	Slip		(-)3				
											486				
1-2-93	A	1	6	Pier 3	1655	12	9.65	48.26	9.65	0					
									48.26	44	44	50			
									9.65	35				10	10
											530	536	99		
					A		C	B	F	G	H	D	J	I	E

DOT Form 450-005X Metric
Revised 9/95

Distribution: Final Records
Olympia Service Center Construction
Olympia Service Center Bridge

Note: % Elong. = The sum of columns "A" for both ends of the tendon divided by the sum of columns "B" for both ends of the tendon X 100.
% Elong. shall be between 93% minimum and 107% maximum.

Figure 6-6
Metric

Washington State Department of Transportation

POST-TENSIONING RECORD

CONTRACT NO. _____ PAGE NO. _____
SECTION _____
STRUCTURE _____
PROJECT ENGINEER _____ INSPECTOR _____

DATE	GIR. NO	TENDON NO.	JACK NO.	JACK LOCATION	REQ'D. JACKING FORCE PER TENDON (Kips)	STRANDS PER TENDON	20% JACKING FORCE (p.s.i.)	REQD. JACKING FORCE (p.s.i.)	ACTUAL JACKING FORCE (p.s.i.)	ACTUAL ELONG. (in.)	(A) 100% ACTUAL ELONG. -20% ACTUAL ELONG. (in.)	(B) REQ'D. 80% ELONG. (in.)	% ELONG. PER TENDON	100% ACTUAL ELONG. —SEATED ELONG. = SEATING TAKE-UP (in.)	REQ'D. SEATING TAKE-UP (in.)
1-2-93	A	1	6	Pier 1	372	12	1400	7000	1400	4 1/4					
									7000	23 1/2	19 1/4	19 1/8			
									1400	23 1/8				3/8	3/8
							Dead	End	Slip		(-) 1/8				
											19 1/8				
1-2-93	A	1	6	Pier 3	372	12	1400	7000	1400	0					
									7000	1 3/4	1 3/4	2			
									1400	1 3/8				3/8	3/8
											20 7/8	21 1/8	99		
					A		C	B	F	G	H	D	J	I	E

DOT FORM 450-005 REVISED 9/85 -1076-

DISTRIBUTION: FINAL RECORDS
HEADQUARTERS CONSTRUCTION
HEADQUARTERS BRIDGE

NOTE: % Elong. = The sum of columns "A" for both ends of the tendon divided by the sum of columns "B" for both ends of the tendon X 100.
% Elong. shall be between 93% minimum and 107% maximum.

Figure 6-6
English

On continuous structures, vents must be placed at the high and low points of the tendon and grout inlets at the ends of the tendon.

At the completion of the duct installation and prior to placement of concrete in the top slab, a device of slightly smaller diameter than the inside diameter of the duct shall be blown through the ducts to ensure no undetected damage or blockage has occurred.

The prestressing reinforcement strand is delivered to the site in sealed reel-less packs or reels containing desiccant to prevent corrosion. It is necessary that the prestressing reinforcement is free of rust and kept clean while it is assembled, stressed, and grouted. Normally the grouting shall take place within 10 days of the time the strand is removed from the packs to prevent the accumulation of rust. The Inspector should check the reels of strand intended for use and reject those which show damage to the strand or visible rust. See Section 6-02.3(26)D of the *Standard Specifications* for further requirements.

Some projects may be designed for the use of high strength steel rods instead of the strand. These rods come in various sizes to give the required steel area for the tendon in one bar instead of bundling several strands in the tendon.

Jacking operations shall not be started until the concrete in the structure has cured for the specified time or reached the specified strength. Jacking shall be carried out in the sequence shown on the approved post tension details to minimize the amount of eccentric loading on the structure. **During the jacking operations, no person should be directly behind either end of the tendon.** Occasionally a tendon will let go, resulting in a very dangerous situation.

Each jack used to stress tendons shall be equipped with either a pressure gauge or a load cell along with certified calibration charts for determining the jacking force.

Gauging devices should be re-calibrated at intervals of not more than 180 days; however, if during the progress of the work, any gauging system appears to be giving erratic results, or if gauge readings and elongation measurements indicate materially different stresses, the jack and the gauges shall be re-calibrated.

A starting load, usually 20 percent of the jacking load, as shown in the approved post tensioning schedule is applied to the tendon. The purpose of this starting load is to take up the slack in the tendon so that an accurate elongation measurement may be made. This load is applied by hydraulic jacks and measured by the jack gauges. During the stressing operation, the tendons shall be jacked to the specified load and the jacking load and elongation shall be recorded. Also the elongation after seating must be measured and recorded (see Figure 6-6).

In the event of discrepancies between measured elongations and calculated elongations (see Stress Acceptance Criteria), the entire operation should be carefully checked and the source of error determined and corrected before proceeding further. A discrepancy between the elongation and the jacking force usually indicates that the gauge on the jack is not correctly calibrated, there is undue friction between the duct and the tendon, or the tendons are not properly anchored.

Stress Acceptance Criteria

Strand Tendon (lengths 15 meters (50 feet) and less):

1. The tendon may be accepted provided: The measured elongation is equal to or exceeds 93 percent of the approved calculated elongation, and

2. A force verification lift-off is performed: The verification lift-off force is between –5 percent and +5 percent of the approved calculated force.

Strand Tendon (lengths greater than 15 meters (50 feet) and less than 45 meters (150 feet)):

1. If the measured elongation is between –7 percent and +7 percent of the approved calculated elongation, the tendon can be accepted.

2. If the measured elongation exceeds 107 percent of the approved calculated elongation, confirm the jack/gauge calibration, and then perform a force verification lift-off:

   a. If a force verification lift-off is performed on one end of the tendon only and the lift-off force is between –1 percent and +5 percent of the approved calculated force, the tendon can be accepted.

   b. If a force verification lift-off is performed on both ends of the tendon (jacking end and anchor end) and the lift-off forces are between –5 percent and +5 percent of the approved calculated force, the tendon can be accepted.

Strand Tendon (lengths 45 meters (150 feet) and greater):

1. If the measured elongation is between –7 percent and +7 percent of the approved calculated elongation, the tendon can be accepted.

2. If the measured elongation exceeds 107 percent of the approved calculated elongation, confirm the jack/gauge calibration, and then perform a force verification lift-off:

   a. If a force verification lift-off is performed on one end of the tendon only and the lift-off force is not less than 99 percent of the approved calculated force nor more than 0.7 f's As, the tendon can be accepted.

   b. If a force verification lift-off is performed on both ends of the tendon (jacking end and anchor end)

and the lift-off forces are not less than 95 percent of the approved calculated force nor more than 0.7 f's As, the tendon can be accepted.

Singularly Jacked Four-Strand Transverse Deck Tendon:

The tendon may be accepted provided:

1. The measured elongation of an individual strand is between –10 percent and +10 percent of the approved calculated elongations, and

2. The average of all four individual strand percent elongations is between –7 percent and +7 percent of the calculated elongation.

Bar Tendon:

1. The tendon may be accepted provided: The measured elongation is equal to or exceeds 93 percent of the approved calculated elongation, and

2. Perform a force verification lift-off: The verification lift-off force is between –5 percent and +5 percent of the approved calculated force.

If acceptance tolerances are exceeded, notify the Olympia Service Center Construction Office.

f's = specified minimum ultimate tensile strength of prestressing steel (1862 MPa (270 ksi) for strands and 1034 MPa (150 ksi) for bars.)

As = cross-section area of the tendon (99 square millimeters (0.153 square inches) for 13-mm ($^1/_2$-inch) diameter strand, 140 square millimeters (0.217 square inches) for 15-mm (0.6-inch) diameter strand.)

The grout used is fluid and quite different from the mortar we usually associate with the term grout. The component materials of the approved grout mix must be accurately measured. The maximum amount of water specified must not be exceeded. The grout should be screened after it has been mixed and before it is added to the grout equipment to remove lumps which might cause clogging of the ducts.

Immediately prior to grouting, the ducts shall be blown out with oil free compressed air. Grout is applied continuously by pumping under moderate pressure at the lower end of the duct toward an open vent at the upper end until all entrapped air is forced out the open vents. The open vents are closed under pressure of issuing grout after a steady solid stream of grout is discharging. The grouting pressure is gradually increased to a minimum of 690 kPa (100 psi) and 1380 kPa (200 psi) maximum and held at this pressure for a minimum of 10 seconds. The grouting entrance is then closed.

After grouting of the tendons, the recesses for the anchorages are cast solid with concrete.

A complete record must be kept of the stressing operations.

An example of the Post-Tensioning Record (Form 450-005) is shown in Figure 6-6 the following explanation to help in completing the record.

A. Required jacking force for the tendon is obtained from the approved post-tensioning details.

B. Gauge pressure is obtained from the certified calibration chart for the jack to obtain the required jacking force listed in "A" above.

C. Gauge pressure for the initial force to take up the slack in the tendon and is usually 20 percent of the force obtained in "B" above.

D. The designed elongation is obtained from the approved post-tensioning details, however the stress strain curves prepared by the steel manufacturer shall be used to determine the modulus of elasticity for adjusting the designed elongation based on the average value of all strands to be incorporated in the tendon.

E. This required seating take up is obtained from the approved post-tensioning details. This is usually 6 millimeters ($^1/_4$ inch) to 10 millimeters ($^3/_8$ inch).

F. & G. The elongation must be measured at the initial force of 20 percent of the required jacking force, at the specified jacking force, and again at the 20 percent loading.

H. The difference in the elongation measured at full force and the elongation measured at the initial force of 20 percent. This elongation should be reasonably close (see Stress Acceptance Criteria) to the required elongation in "D" above.

I. Seating take-up is the difference in the elongation measured at full force and the elongation measured after the tendon has been seated and the jacking force reduced to the initial force of 20 percent of full force. This seating take-up should be the same as the required take-up in "E" above. It is important that the specified seating take-up be obtained as it has an appreciable effect on the stress in the tendon.

J. Percent elongation per tendon is a comparison of the calculated elongation and the measured elongation. If the elongation obtained at full jacking force is not reasonably close to the required elongation, the following conditions are usually indicated:

1. There is more (or less) friction in the tendon than was anticipated in the calculations of the post-tension details.

2. The gauging devices on the jack are not properly calibrated.

3. The strands of a tendon are not properly anchored.

If tendon stressing is performed at an air temperature below 16°C (60 F), the Contractor shall not be allowed to use jack pressure gauges that utilize oil or glycerin. This will ensure accurate jack pressure readings.

6-2.9 Measurement and Payment

Measurement and payment instructions are covered in Sections 6-02.4 and 6-02.5 of the *Standard Specifications*.

6-3 Steel Structures

6-3.1 General

The Contractor shall submit shop plans of all steel fabrication for approval. Fabrication of the steel shall not be started until the shop plans have been approved by the Bridge and Structures Engineer (or Terminal Design Engineer for the Ferries Division projects) and the materials source and fabricator have been given approval by the Olympia Service Center Materials Engineer. The Olympia Service Center Materials Engineer shall advise the Bridge and Structures Engineer (or Terminal Design Engineer) when the materials source or fabricator has been approved. The plans will not be returned to either the Contractor or the fabricator by the Bridge and Structures Engineer until the approval of source has been given by the Olympia Service Center Materials Engineer. WSDOT approves the shop plans for sufficiency of the materials and connections and not for the correctness of dimensions. Some details of the design drawings may, with the approval of the Bridge and Structures Engineer (or Terminal Design Engineer), be changed to suit the erection methods the Contractor desires to use. These revisions may require a change order.

The Contractor shall submit eight sets of all shop detail plans required for fabrication of the steel directly to the Bridge and Structures Engineer and two sets to the Project Engineer. For the Ferries Division projects, all ten sets shall be submitted to the Terminal Design Engineer. If a railroad is involved, four additional sets are required for each railroad involved. The plan flow chart for approval is shown in Figure 6-7. When the fabricator submits shop detail plans directly to the Bridge and Structures Engineer, as specified in Section 6-03.3(8) of the *Standard Specifications*, Figure 6-8 will apply. The Project Engineer should advise the Bridge and Structures Engineer of any conditions that would affect the checking and approval of the drawings. These comments should be shown with a green color marker on the Project Engineer's copy.

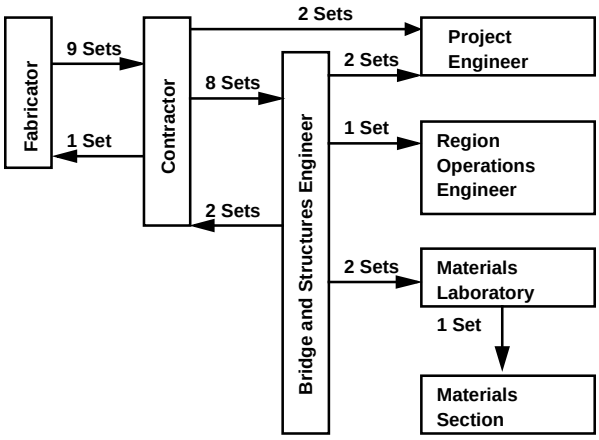


Figure 6-7

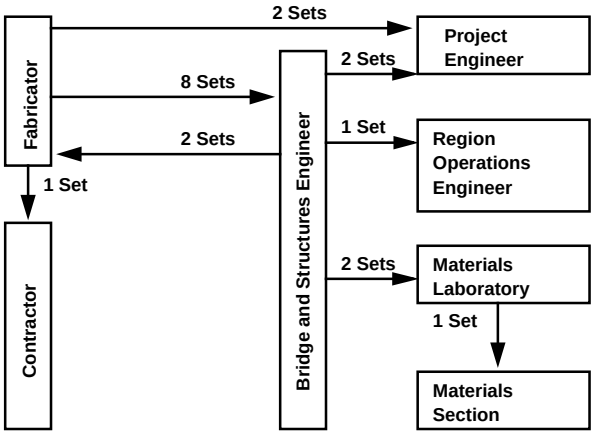


Figure 6-8

Shop inspection is performed either by inspectors or representatives of the Olympia Service Center Materials Laboratory. Material Acceptance Reports are obtained by these inspectors and provided to the Project Engineer upon completion of the shop fabrication. Erection plan sheets generally accompany the shop plans.

Falsework and erection plans for structural steel structures shall be submitted for approval in the same manner as for concrete structures.

Camber diagrams are normally shown in the contract plans. It is the Fabricator's responsibility to fabricate the members to the prescribed camber shown in the plans. The

Fabrication Inspector should verify that the members are fabricated in accordance with the approved shop drawings.

The use of heavy equipment for erection purposes requires the approval of the Bridge and Structures Engineer. See *Standard Specifications* Section 6-01.5.

Prior to completion of the project, the Contractor is required to furnish shop drawings on mylar or equivalent, which will be sent to the Bridge and Structures Office for their permanent file. These drawings must be suitable for reproducing by microfilming.

6-3.2 Layout

Laying out work for structural steel spans requires greater accuracy than for other structures. Use precise instruments, standardized tapes, scales and thermometer when making layout. Spacing of piers, bents, and anchor bolts shall be as shown in the plans, providing the span after fabrication in the shop is the correct length.

The fabrication shop is required to furnish a sketch showing the length of span and amounts of camber measured in the shop at the time the spans are assembled. The Project Engineer should have a copy of this sketch before erection is begun. The lengths as measured in the shop seldom vary more than 6 mm (1/4 inch) to 10 mm (3/8 inch) from the design drawings, and there is sufficient play in the anchor bolt sleeves for this tolerance.

Allowance will be made on the design drawings for stretch of the span due to loss of camber. The Project Engineer shall compute camber elevations from the shop camber measurements taken by the shop. Elevations shall be set above the falsework at each panel point for the camber blocking. Most erectors set the camber blocks high to allow for settlement of the falsework. The amount of allowance for settlement should be decided by the erector. The Project Engineer shall give the exact elevations for the finished camber. Elevations shall be given and carefully checked as an error means that an unnecessary amount of jacking and adjusting may be required.

The adjustment of spans is often a source of argument between erectors and engineers. Accurate work on the part of the Engineer will do much to avoid such arguments. Elevations set on the falsework before the load is applied may not be correct after the load is applied. It is the responsibility of the Contractor to determine the allowance that may be necessary to compensate for settlement in the falsework. It is easier to lower the span than to raise it.

6-3.3 Handling and Storing Material

Structural steel members shall be handled carefully to prevent twisting, bending, or scraping the member. The material shall be supported on suitable skids or platforms to keep it off the ground or out of water and it shall be protected from deterioration by rust.

Structural steel members should not be unloaded and stored on adjoining concrete approach spans. If the Contractor proposes to use the concrete approach spans to support the structural steel members, the proposal must be submitted in writing to the Bridge and Structures Office for review and approval. This proposal shall include drawings describing the support locations, loads, and supporting stress calculations. The structural steel members shall be placed on timber blocking, spaced so that the mass (weight) will be carried on the girders (load carrying members) and not on the comparatively thin concrete deck slab. Bridge decks are designed for carrying traffic and not as storage or dock space. This is especially true for concrete sidewalk slabs. Sidewalk concrete slabs shall not be overloaded by loads such as building material, tool sheds, or paint sheds.

6-3.4 Straightening Bent Material

Methods for straightening of plates, angles, other shapes, and built-up members shall not produce fracture or other injury to the metal, and shall be approved by the Bridge and Structures Office. Distorted members shall be straightened by mechanical means or by the carefully planned and supervised application of a limited amount of localized heat. The temperature of the heated area shall not exceed 593°C (1,100 F) (a dull red) and shall be controlled by temperature indicating crayons, liquids or bimetal thermometers.

Following the straightening of a bend or buckle, the surface of the metal shall be tested for evidence of fracture.

6-3.5 Setting Anchor Bolts and Masonry Plates

Anchor bolts are usually plain round bolts with the head and plate washer on the lower end and the thread and nut at the top end. These bolts are set in the original concrete or in holes drilled after the concrete has set. Pipe sleeves to allow room for adjustment of the span are generally placed around the bolts and cast in the concrete.

Anchor bolt sleeves, when anchor bolts will not be grouted until after freezing weather, must be protected against damage from expanded ice by filling the sleeves with an approved nonevaporating antifreeze solution. Without exception, when piers and superstructures are constructed under separate contracts, the anchor bolt sleeves shall be

filled with an approved nonevaporating antifreeze solution by the substructure Contractor. Before the bolts are grouted, the antifreeze solution shall be removed, the space well cleaned and the holes then filled with grout. The antifreeze solution shall be diluted with water and completely removed from the sleeves or it will have a detrimental effect on the filler grout. See Section 6-02.3(18) of the *Standard Specifications*.

Bearings shall be set level on the pier copings with temporary steel wedges under the bearings during erection. Bearings shall be set so that they are at zero movement at 18°C (64 F) after the total load is applied and the span is released. The amount of offset varies with the length of the span and the temperature at time of erection. Details of the bearings are usually shown in the plans. When details are not shown, the Bridge and Structures Engineer should be requested to supply them.

Anchor bolts and masonry plates shall be grouted in after all structural steel is erected and adjusted for length and camber and at least seven days before the deck concrete is placed. Portland cement shall be used for grouting and the procedure should be as outlined in Section 6-03.3(36) of the *Standard Specifications*.

Do not grout masonry plates with dry mortar unless specifically shown in the plans. The Contractor shall build forms around the masonry plate about 100 millimeters (4 inches) high and pour grout in the form from one side until the whole area is well filled. Use a wire or steel band to keep the grout flowing. After the grout has taken its initial set, remove the form and cut the edges of the grout with a trowel to about a 45 degree bevel from the bottom of the shoe to top of the pier coping. Do not allow the finished grout to extend above the bottom of the masonry plate.

6-3.6 Erection of Steel

6-3.6A Assembling

Before erection of the steel is commenced, the structural steel members shall be inspected for damage during shipping and handling. Any members that have been damaged must be repaired or replaced before being erected.

All members should have been match-marked and shall be assembled in accordance with the erection drawings from the Contractor. As the erection progresses, the Inspector should compare assembled members against the erection plans to see that proper members are in correct positions.

If during assembling, it is discovered that various members do not fit together, do not allow undue force to be applied to make them fit. The application of such a force can introduce stresses in several components of the structure. These stresses can be of a magnitude high enough to cause serious structural problems. The structure has not been designed to take these stresses. In such cases the Olympia Service Center Construction Engineer, Bridges shall be informed.

Structural steel members that are improperly fabricated, or do not fit, shall be rejected and either repaired or replaced with new. If the Contractor elects to repair the structural member, the proposed repair procedure shall be reviewed and approved by the Olympia Service Center Construction Engineer, Bridges, prior to any repair work.

Unless otherwise shown or specified, structural steel connections shall be bolted. Simple truss spans shall be completely erected with all field-bolted connections and/or splices held in place with the minimum number of pins and bolts as specified in Section 6-03.3(32) of the *Standard Specifications*. Once the minimum pins and bolts are installed in all the connections, final adjustments for span length and camber shall be made prior to completion of bolting and release of falsework. The assembly and bolting sequence for all structural steel structures shall strictly follow the approved erection plan. Erection and bolting sequences, especially cantilever and arch spans, are usually detailed in the contract documents.

Field connections shall be pinned and bolted in accordance with the requirements of Section 6-03.3(32) of the *Standard Specifications*. This section applies to connections and splices made in the field. Connections are when one structural steel member is bolted directly to another structural steel member; such as, cross-members and braces. Splices utilize structural steel plates to connect two structural steel members; such as, a plate girder. It also requires all connections and splices be securely drift-pinned and bolted before the mass of the member can be released or the next member is added. The field erection drawings must specify pinning and bolting requirements. Section 6-03.3(32) then specifies the required minimum number of pins and bolts for field connections and splices.

All bolted connections are designed by WSDOT to be friction connections. A friction connection transfers the stress by friction between surfaces in contact and does not depend on shear or bearing between members and bolts. The friction is provided when the connection or splice members are compressed through tension on the bolts (measured by turn-of-nut or direct-tension-indicator method). To develop design contact surface friction, all bolts in a bolted connection must be properly tightened to the minimum specified tension. The *Standard Specifications* recognize that final design loads are not present during erection of the structural steel members. Therefore, during erection, all the bolts are not needed in order to develop the friction necessary in the connection or splice

for erection loads. The *Standard Specifications* recognize this and require a minimum percentage of the holes to be filled during erection; for instance, 50 percent for normal structures and 75 percent for cantilevered structures. These holes are filled with a combination of drift pins and bolts. Drift pins are required to properly align the members since bolts are usually smaller in diameter than the holes. Bolts are required to develop the minimum friction required to transfer erection loading. The minimum friction or load-carrying capacity is not developed until the bolts are tightened to the specified minimum tension.

Once the member is released from its support (support falsework or crane), the *Standard Specifications* specify the procedure required to complete bolting of each connection.

Sometimes fabricators will temporarily bolt-splice plates to the appropriate member. The fabricator will usually use the minimal number of bolts to secure the splice plate during shipping and handling. These temporary bolts shall be removed and replaced with approved high-strength bolts.

6-3.6B High-Strength Bolts

Structural steel field connections are made with high tensile strength bolts conforming to the requirements of section 9-06.5(3) of the *Standard Specifications* and Special Provisions. A special heat treatment gives these bolts a high tensile strength.

WSDOT designed bolted connections generally operate by a transfer of stresses by friction between surfaces in contact and do not depend on shear or bearing between the members and the bolts. Therefore, it is imperative that the contact surfaces of the metal shall be properly cleaned and the required minimum tension be obtained in the bolts.

The required tension in the bolts may be obtained by using either the Turn-of-Nut method or the Direct Tension Indicator (DTI) Method unless the specifications for the project state otherwise. If required because of bolt-entering and wrench-operation, tightening by either procedure may be done by turning the bolt while the nut is prevented from rotating. Section 6-03.3(33) requires a hardened washer under the turned element. Therefore, if the bolt is turned, a hardened washer is required under the bolt head. A hardened washer is also required with the DTI Method.

Bolted parts shall fit solidly together when assembled. Where an outer face of the bolted parts has a slope greater than 1:20 with respect to a plane normal to the bolt axis, a beveled washer shall be used to compensate for the lack of parallelism. See Figure 6-9. Bolts shall be tightened beginning from the center of each connection towards the edges of the connection. All joint surfaces, including those adjacent to the bolt heads, nuts or washers, shall be free of scale, except tight mill scale, and shall also be free of burrs, dirt and other foreign material that would prevent solid seating of the parts.

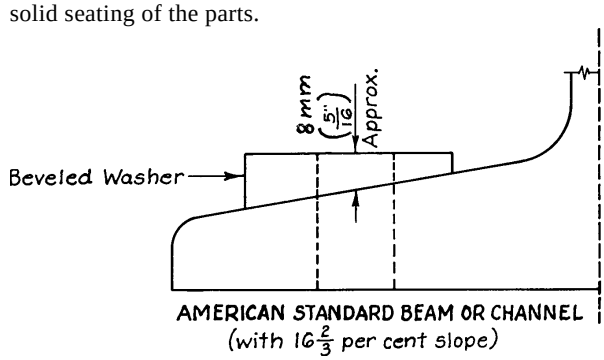


Figure 6-9

AASHTO specifications require that bolts bear specific identification marks. The following identification is marked on the top of the bolt heads:

	A 325M Bolts	A 490M Bolts
Type 1 –	A 325M 8S	A 490M 10S
Type 2 –	A 325M 8S	A 490M 10S
Type 3* –	A 325M 8S3	A 490M 10S3

* At the manufacturer's option, Type 3 bolts may have additional distinguishing marks to indicate the bolt is atmospheric corrosion resistant and of weathering type.

Nuts of all classes, in nominal diameter M5 and larger, shall be marked with the property class designation (5, 9, 10, 12, 8S, 10S, 8S3, 10S3) on the top or bearing surface, on the top of flange, or on one of the wrenching flats. Additionally, nuts of Classes 10, 12, 8S, 8S3, 10S, and 10S3 shall be marked with a symbol to identify the manufacturer. For Classes 8S3 and 10S3 nuts, the manufacturer may add other distinguishing marks to indicate the nut is atmospheric corrosion resistant and of a weathering grade of steel.

Type 3 bolts must be used when the structure is not being painted (WSDOT rarely utilizes unpainted structural steel for new structures). Nuts and washers used with Type 3 bolts must also have weathering characteristics.

Each fastener shall be tightened to provide, when all fasteners in the joint are tight, at least the minimum tension shown in the *Standard Specifications* for the size and grade of fastener used.

Turn-of-Nut Method:

When the turn-of-nut method is used to provide the specified bolt tension, all of the required minimum number of bolts within a bolted connection or splice shall be brought to a "snug tight" condition. The bolts shall be tightened to "snug tight" in a systematical order to ensure that all parts of the joint are brought into full contact with each other. This usually requires that the bolts located near the center of the connection or splice be tightened first. Then all remaining bolts shall be tightened from the center progressing toward the outer edges. "Snug tight" is defined as the tightness attained by (1) a few blows from an impact wrench, or (2) the full effort of a man using an ordinary spud wrench. The "snug tight" requirement also establishes the starting point for full tensioning by the turn-of-nut method.

Once the bolts are snug tight, the outer face of the nut and protruding part of each bolt shall be match-marked with crayon or paint. The match-marking provides the control to both ensure the bolt does not rotate during tightening and measure the nut rotation. The required minimum nut rotation is listed in Table 4 of Section 6-03.3(33) of the *Standard Specification*s. During this tightening operation, there shall be no rotation of the part not turned by the wrench.

Contractors often suggest a tightening method that eliminates marking the bolt as required in the turn-of-nut method. This suggested method requires calibration of the air impact wrench(es) and the inspection torque wrench. After calibration, the Contractor wants to snug tighten each bolt, then tighten to minimum tension using the air impact wrench without marking the nut and bolt. This method is heavily dependent upon the torque wrench test and is not accepted by WSDOT.

Direct-Tension-Indicator Method (DTI):

When the direct-tension-indicator method is used to provide the specified bolt tension, all of the required minimum number of bolts within a bolted connection or splice shall be brought to a "snug tight" condition. The bolts shall be tightened to "snug tight" in a systematical order to ensure that all parts of the joint are brought into full contact with each other. This usually requires that the bolts located near the center of the connection or splice be tightened first. Then all remaining bolts shall be tightened from the center progressing toward the outer edges. "Snug tight" is defined as the tightness attained by (1) a few blows from an impact wrench, or (2) the full effort of a man using an ordinary spud wrench.

This method uses a direct-tension-indicator washer that has formed protrusions on one face, leaving a gap. As the bolt is tensioned, the formed gap is reduced. The measurement of this gap verifies the bolt tension. Section 6-03.3(33) of the *Standard Specifications* lists two maximum gap openings. The maximum gap opening for direct tension indicators used on structures to be painted, is 127 micrometers (0.005 inches). The maximum gap opening for direct tension indicators used on structures that are not to be painted, is 0 micrometers (0.000 inches). In addition, the indicators on an unpainted structure must be coated with an approved epoxy. This epoxy coating is similar to the coating used on the steel reinforcing top mat of the concrete deck. The DTI is placed in a position such that the nut does not turn directly on top of the DTI. This may require an additional washer.

WSDOT has two concerns associated with the use of direct-tension-indicator washers. These concerns are (1) potential corrosion within the washer gap and (2) undetected bolt loosening as bolt tightening of a connection or splice proceeds. Following is a brief discussion of each item;

(1) Potential Corrosion: The *Specifications* address this potential corrosion problem by limiting the maximum gap opening for painted and unpainted structures. These gap opening limits are governed by both tension requirement and required corrosion protection. The direct tension indicator manufacturers address only the minimum bolt tension requirement. It is, therefore, very important that the Inspector be aware of this additional concern of potential corrosion.

(2) Undetected Bolt Loosening: The manufacturers of the direct-tension-indicator washers emphasize the ease and reliability of their product. They claim, and it is true, that if the gap is reduced to the specified maximum opening, the respective bolt is properly tensioned. The concern we have is that through the process of tightening all the bolts in a connection or splice, a warped plate may be progressively flattened, potentially loosening the initially tightened bolts. If this happens, the indicator washer still indicates the bolt(s) are fully tensioned. For this reason, WSDOT requires that bolt tension inspection, usually with a calibrated torque wrench, be performed. The Inspector should be aware of this potential problem and observe the tightening procedure with this in mind.

Inspection

The Inspector shall determine that the requirements of the *Standard Specifications* are met in the work. The Inspector shall observe the installation and tightening of bolts to determine that the selected tightening procedure is properly used and shall determine that all bolts are tightened and, in the case of the direct-tension-indicator method, that the correct indication of tension (gap) has been achieved. Bolts may reach tensions substantially higher than the value in

Table 3 of the *Standard Specifications*, Section 6-03.3(33), but this is not cause for rejection.

The condition of the bolts is critical to the bolt-up operation and inspection. Bolts to be installed in the structure shall be lubricated in accordance with the *Standard Specifications*. A good check is a nut that is easily turned on the entire threaded portion of the bolt.

The following inspection procedure shall be observed for:

1. Bolts tightened using the turn-of-nut method: The Contractor, in the presence of the Engineer, shall use an inspection wrench which may be a torque wrench. Calibration of the inspection torque wrench is explained in a following section.

Bolts that have been tightened using the turn-of-nut method shall be inspected by applying, in the tightening direction, the inspecting wrench and its job-inspecting torque to 10 percent of the bolts, but not less than two bolts, selected at random in each connection. If no nut or bolt head is turned by this application of the job inspection torque, the connection shall be accepted as properly tightened. If any nut or bolt head is turned by the application of the job inspecting torque, this torque shall be applied to all bolts in the connection, and all bolts whose nut or head is turned by the job inspecting torque shall be tightened and reinspected. As an alternate, the Contractor may retighten all of the bolts in the connection, and then resubmit the connection for the specified inspection.

2. Bolts tightened using the direct-tension-indicator method: The Contractor, in the presence of the Engineer, shall use a feeler gauge to verify that each bolt has been properly tensioned to the maximum specified gap.

If a bolt that has had its direct-tension-indicator washer brought to full load loosens during the course of bolting the connection, the bolt shall have a new direct-tension-indicator washer installed and be retensioned. Reuse of the bolt and nut are subject to the provisions in the *Standard Specifications*.

Calibration of Inspection Torque Wrench

Five bolts of the same grade, size, and condition as those under inspection shall be placed individually in a calibration device capable of indicating bolt tension at least once each working day. There shall be a washer under the part turned in tightening each bolt. Each bolt shall be tightened in the calibration device by any convenient means to the specified minimum tension. The inspecting wrench then shall be applied to the tightened bolt and the torque necessary to turn the nut or head 5 degrees (approximately 25 millimeters (1 inch) at a 300-millimeter (12-inch) radius) in the tightening direction shall be determined. The job-inspection torque shall be taken as the average of three values, thus determined after rejecting the high and low values.

If the bolts to be installed are not long enough to fit in the state-furnished tension calibrator, five bolts of the same grade, size, and condition as those under inspection shall be tested using Direct-Tension-Indicator (DTI) to measure bolt tension. This tension measurement test shall be done at least once each inspection day. The DTI shall be placed under the bolt head. A washer shall be placed under the nut, which shall be the element turned during the performance of this tension measurement test. Each bolt shall be tightened by any convenient means to the specified minimum tension as indicated by the DTI. The inspecting wrench shall then be applied to the tightened bolt and the torque necessary to turn the nut 5 degrees (approximately 25 millimeters (1 inch) at a 300-millimeter (12-inch) radius) in the tightening direction shall be determined. The job-inspection torque shall be taken as the average of three values, thus determined after rejecting the high and low values.

Figure 6-10 shows the operator calibrating a hand-indicator torque wrench. The bolt is brought to the proper tension by either method described above. The dial on the wrench was set at “zero” and sufficient torque applied to rotate the nut 5 degrees in the tightening direction. At this point, the wrench dial shows the kilonewtons required to further rotate the nut or bolt head. The torque wrenches used by inspectors of both the Contractor and WSDOT should be tested and compared at the same time for purposes of uniformity.

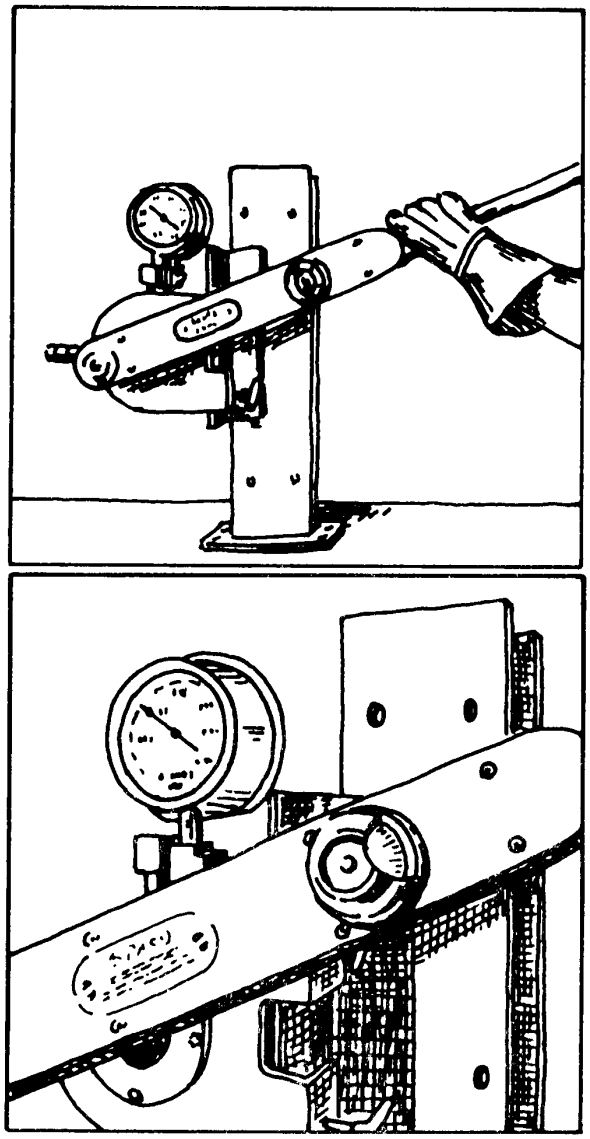


Figure 6-10

6-3.6C Welding

Welding of structural steel shall be in accordance with the requirements in Section 6-03.3(25) of the *Standard Specifications*. Welding will not be accepted as a substitute for bolting and should be done only where indicated in the plans. Adding even small welds not shown in the plans can induce high stresses in the members. This could seriously impair the strength and structural capability of the structure involved. The structure has been designed assuming that no additional welding will be done. The approval of the Olympia Service Center Construction Engineer, Bridges, is required before doing any welding not shown in the plans.

Good workmanship and proper materials are essential. Welding operators should be qualified for the type of welding they are required to do. Welding procedures shall be approved by the Bridge Engineer before starting to weld on the structure.

Welding defects should be corrected as indicated in the *Standard Specifications*.

Low hydrogen type electrodes must be dry when used. The care and use of these electrodes as given in the *Standard Specifications* should be completely observed. No relaxation of these requirements can be tolerated.

6-3.7 Placing Concrete Roadway Slab

As required in Section 6-03.3(39) of the *Standard Specifications*, the masonry plates shall be grouted and steel work, except railing, completely bolted and released from the falsework before forming for the roadway slab begins. Expansion dams shall not be bolted down until after the span is released from the falsework.

The camber diagram shown in the plans, especially for welded steel plate girders, quantifies the calculated deflection of the steel girder mass and the deflection of the girders due to the concrete slab mass (weight). The camber diagram for the mass (weight) of the steel girders only is utilized by the girder fabricator.

Once all the temporary girder supports are removed, it is important that elevation control points on the top of the flanges of the girders or floor beams be established and permanently marked before any external load such as form lumber, reinforcing steel, etc., is applied. These control points should be located at proper intervals to establish elevations for formwork and finished roadway slab grades. These control points should be at the span tenth points or at cross-frame locations (panel points).

Once these control point elevations are established, fills at each of these control points shall be calculated utilizing the camber diagram for the mass (weight) of the roadway slab and the profile grade. These control point fill values shall be used from that point on because it is extremely difficult, if not impossible, to calculate the deflection of the girders as formwork and reinforcing steel are added. These control point fill values will be used for the final adjustment of the roadway slab finish machine.

A pouring sequence for the roadway slab may be shown in the plans to reduce the size of the concrete pours, control deflection, and minimize tension cracking of the concrete slab during construction. Placing and finishing the concrete

in the roadway slab shall be the same as for Concrete Structures covered in Chapter 6-2 of this manual.

6-3.8 Railings

Steel railings may be erected in place at the same time the trusses are erected but they shall not be finally aligned or bolted until after the concrete deck is placed. Railings shall be true to line, and for single spans shall show the camber of the span. For two or more spans the railing shall show a uniform camber over all of the spans; that is, the individual camber of each span shall not be carried in the railing.

6-3.9 Painting

Steel structures shall be painted in accordance with the requirements in Section 6-07 of the *Standard Specifications*.

6-3.10 Measurement and Payment

Measurement and payment instructions are covered in Sections 6-03.4 and 6-03.5 of the *Standard Specifications*.

6-4 Timber Structures

6-4.1 General

Framing plans and details for treated timber structures shall be furnished by the Contractor and approved by the Project Engineer. Upon approval of the framing details, one set shall be returned to the Contractor and one set furnished the shop inspector. Inspection of shop framing and treating of timber is performed by shop inspectors of the Materials Lab. Inspection reports showing details of treatment and lists of materials shipped will be mailed to the Project Engineer. Representative pieces of each shipment will be stamped by the shop inspector.

Untreated timber may be accepted on the basis of an inspection certificate in accordance with Section 9-09.2(3) of the *Standard Specifications*.

6-4.2 Storage and Handling

Timber and lumber shall be stored off the ground and piled to shed water and prevent warping. Treated timber shall be handled carefully to prevent breaking of the outer fibers and rope or chain slings shall be used. Pike poles and peaveys are not to be used in handling treated timber.

6-4.3 Framing

All cutting, framing and boring of treated timbers shall be done before treatment insofar as is practicable. Framing shall be done in accordance with the requirements of Section 6-04.3 of the *Standard Specifications*.

6-4.4 Field Treatment of Timber

When field framing cannot be avoided, the cuts and holes shall be treated as required in the *Standard Specifications*. Timber for field treatment must be dry before applying the required treatment. Holes shall be bored for all bolts, drift bolts, boat spikes, dowels and truss rods using augers of the size specified in Section 6-04.3(5) of the *Standard Specifications*.

After removal of temporary scaffolding and formwork, the nail and bolt holes in treated timber shall be repaired in accordance with the *Standard Specifications*.

Field treatment for structures of untreated timber shall be in accordance with the requirements in Section 6-04.3(4) of the *Standard Specifications*.

6-4.5 Painting

Painting of timber structures shall be in accordance with the requirements in Section 6-07 of the *Standard Specifications*.

6-4.6 Measurement and Payment

Measurement and payment instructions are covered in Sections 6-04.4 and 6-04.5 of the *Standard Specifications*.

6-5 Piling

6-5.1 General

Piling shall conform to the requirements of Section 9-10 of the *Standard Specifications*. When piling is received on the project, it shall be inspected and a notation made in the section of Miscellaneous Notes in the Pile Record book. Untreated timber piles will be inspected in the field and accepted for use there. All other piling, except concrete piles cast on the job, will be inspected by Fabrication Inspectors before delivery.

6-5.2 Treated Timber Piling

Chain slings will be permitted in handling treated timber piles. The use of wire rope slings or bridles will not be permitted in handling treated timber piles or lumber. The use of wire rope slings on piling and caps used to anchor lines for moving the driver will not be permitted. Such lines shall be fastened only by means of manila rope slings around the piling or caps.

Treated timber piling shall be furnished and driven full length, i.e., without splices. The entire length shall be pressure treated. Therefore, the pile tip shall not be cut after treatment. If splices become necessary and the order length furnished by the Engineer is insufficient, the Olympia Service Center Construction Office should be contacted for direction. However, a splice probably will

not be considered if it cannot be located below the permanent water table elevation.

6-5.3 Precast Concrete Piling

Curing beds for steam cured concrete piles shall not rest directly on the floor but shall be elevated enough to permit the complete circulation of steam around the piles.

Lifting loops shall be removed to 15 millimeters (1/2 inch) below the surface of the concrete and the hole filled with mortar.

Concrete piles shall be handled as described in the *Standard Specifications,* the *Standard Plans,* or as shown in the plans in order to avoid excessive deflections and strains.

6-5.4 Cast-in-Place Concrete Piling

The casings for piles cast in place shall be carefully checked after driving, for water tightness and deformation of the casing due to the driving of adjacent piles. A mirror for reflecting light into the casing is the most common method for this check. On cloudy days a flashlight may be lowered into the casing.

Immediately after driving, the pile casing shall be covered to prevent dirt and water falling into it. All debris and water shall be removed from the casing prior to placing the reinforcing steel cage. No water will be permitted in the casing when concrete is placed.

Due to the ever increasing loading from earthquake activity, most cast in place piling require reinforcement for the full depth of the pile. This full depth reinforcement presents extreme difficulty in placing concrete with a rigid conduit the full depth, especially if the pile is battered. For this reason, Class 28P (4000P) concrete is required. This class of concrete has small aggregate and fly ash making the mix rather sticky and cohesive, which reduces the likelihood of segregation during placement. This concrete shall be placed continuously through at 1.5-meter (5-foot) rigid conduit directing the concrete down the center of the pile casing, ensuring that every part of the pile is filled and the concrete is worked around the reinforcement. The top 1.5 meters (5 feet) of concrete shall be placed with the tip of the conduit below the top of fresh concrete. The Contractor shall vibrate, as a minimum, the top 3 meters (10 feet) of concrete. In all cases, the concrete shall be vibrated to a point at least 1.5 meters (5 feet) below the original ground line.

No Engineer's order list will be given for cast-in-place concrete piling.

6-5.5 Vacant

6-5.6 Steel Piling

Steel piling shall be handled in such manner as to prevent bending of the flanges, and when stacked they shall be supported in such a manner that the piles will not bend. When steel piles must be spliced and splicing details are not shown in the plans, the splice should be made with a single V-butt weld over the whole cross-sectional area of the pile. Welding shall be done with specified welding rod and suitable equipment in accordance with American Welding Society Specifications and good industry practice. A qualified welder is required. See Section 6-05.3(6) of the *Standard Specifications.*

No Engineer's order list will be given for steel piling.

6-5.7 Pile Driving

6-5.7A General

It is suggested that the Olympia Service Center Construction Office be contacted before any piling are driven.

Piling shall be driven to develop the bearing value as shown in the plans or in the *Standard Specifications.* The penetration of the piles under the last few blows must be carefully gauged and the bearing value computed by use of the formulae shown in the *Standard Specifications.* Pile driving specifications should be administered with a great deal of common sense. There is no substitute for experience and good judgment.

Often the foundation reports contain two pile tip elevations, "estimated tip" and "minimum tip" elevations. The estimated tip elevation is simply the elevation that the tip is estimated to be driven to and is utilized to determine driving length quantities in the bid item for furnishing piling. Minimum tip elevations are often specified in the contract plans. These are usually to ensure that piles do not hang up on logs, a thin hard soil layer and other obstructions, or to achieve a minimum pile penetration (e.g., uplift and/or lateral load capacity). Minimum tip elevations are also specified where resistance to uplift is taken into consideration in the design of the foundation seal thickness. The minimum tip elevations should be higher than the estimated tip elevations. The Project Engineer should always review the tip elevations in the plans and compare them to the foundation report recommendations. Any discrepancies should be reported to the Olympia Service Center Construction Office.

In foundations without seals, where the minimum tip elevations cannot be attained, the Project Engineer may accept the pile if it is within 1.5 meters (5 feet) of the minimum tip elevation and the pile has been driven to 120 percent of the specified bearing. Where minimum tip

elevations cannot be reached in foundations with seals, or where piles are more than 1.5 meters (5 feet) short of reaching the minimum tip elevation, the Olympia Service Center Construction Office shall be notified.

Foundation piles must be driven true to line and in their proper position so that full bearing and lateral support is secured for each pile. Each pile has been definitively positioned in the design, and piles should be driven as nearly as practicable to the position shown. Any variation of 150 millimeters (6 inches) or more from the plan shall be reported to the Olympia Service Center Construction Office before accepting the pile. The tolerance for all types of battered piles is 20 millimeters in 1 meter ($^1/_4$ inch in 12 inches). Any deviation exceeding this tolerance shall be reported to the Olympia Service Center Construction Office for evaluation.

The type and size of hammers to be used to drive piling are specified in Section 6-05.3(1)C of the *Standard Specifications*. The Project Engineer shall require the Contractor to furnish full information on any hammer proposed for use so it can be determined whether or not the hammer meets the requirements of the specifications and that the bearing capacity of driven piles may be computed. It is very important to verify that the drop of the ram is in accordance with the submitted data. Otherwise, the pile bearing calculations will not be correct.

The *Standard Specifications* and special provisions govern the hammer size by specifying the minimum ram mass (weight) and the minimum energy required for each type of pile, required bearing, and hammer. The most commonly used hammers are air, hydraulic, or diesel activated. The hammer energy output is simply the mass (weight) of the ram times the distance the ram falls. This energy determination is a simple matter with a drop, hydraulic, or air/steam activated hammer. The measurement of the energy output of a diesel activated hammer is more complex. The minimum energy required by the specifications is the energy output of the hammer at the point of impact at the required pile bearing. The hammer needs to operate at or above the required minimum energy level in order to achieve the specified pile bearing capacity.

The Project Engineer may approve the Contractor's proposed hammer if it meets the criteria of the *Standard Specifications* and the special provisions. During field operations, the pile driving hammer must be capable of delivering at least the required minimum energy at the required pile bearing value. The Olympia Service Center Construction Office should be consulted for any unusual hammer submittals or insufficient performance in the field.

Drop hammers, which are rarely used, must be weighed before any piles are driven. The drop hammer stroke should be carefully measured. This can be done by taping a piece of rope or rag around the hammer line at the height above the hammer for the drop desired. The hammer operator can then gauge the drop with reasonable accuracy. The stroke (drop) of the hammer ram must be consistent with the required minimum energy.

Air or steam activated hammers lift the ram by either air or steam pressure to a predetermined distance and release the ram. The energy is produced by the falling ram. These hammers usually operate at 50 to 60 blows per minute depending on the hammer manufacturer. A count of the actual blows per minute will provide verification that the hammer is operating properly. If the blows per minute exceed the published manufacturer's data sheet for the specified minimum energy, and the Contractor is not able to find and rectify the problem, the Olympia Service Center Construction Office shall be notified. No additional piling are to be driven until the problem is resolved.

Hydraulic activated hammers lift the ram by hydraulic fluid pressure to a predetermined distance and then release the ram. The energy is produced by the falling ram. There are two types of hydraulic activated hammers, single and double acting. The hydraulic activating systems for both of these types of hammers are totally enclosed using a vegetable oil medium, rendering them environmentally friendly. The method for measuring the energy output is different for each type of hydraulic activated hammer. The energy output for each type can be varied by using simple adjustment procedures. Again, the respective hammer must be operating at or above the specific minimum energy when the required pile bearing capacity is reached.

Diesel activated hammers lift the ram by energy produced when diesel fuel is ignited. The energy produced is a combination of the fuel explosion and the drop of the ram. There are two types of diesel activated hammers, single and double acting. The method for measuring the energy output is different for each type of diesel activated hammer. Diesel hammers produce a variable energy. The variable energy output of a diesel hammer is dependent on a number of factors which include fuel quality, fuel setting, soil conditions, and resistance from the pile being driven. As the pile resistance increases, the energy output of a diesel hammer usually increases. The manufacturer's maximum energy value for each diesel hammer is measured in the laboratory using a hammer in tip top shape. For this reason, it is a good idea to have a hammer on the project with a maximum rated energy higher than the contract minimum required energy. A good rule of thumb when selecting a diesel hammer is that, if 80 percent of the maximum energy of a hammer equals the contract minimum required energy, the diesel hammer will produce sufficient energy to meet the contract energy requirements.

A single acting diesel activated hammer is open at the top, and at the top of the ram stroke a portion of the ram is usually visible. The bearing value of the pile being driven is determined by the number of blows per 300 millimeters (foot) at a blows per minute rate. The energy output of a single acting diesel hammer is determined by the blows per minute of the running hammer. The manufacturer is required to submit this energy data. The rate (blows per minute) is dependent on how high the ram raises up (stroke) due to the diesel fuel combustion. Thus, the longer the stroke, the greater the energy and the longer it takes. In other words, as the rate (blows per minute) decreases the energy output increases.

A double acting diesel activated hammer is closed at the top. This closed top acts as a pressure chamber driving the ram back down where the diesel fuel explosion occurs. The bearing value of the pile being driven is determined by the number of blows per 300 millimeters (foot) at a measured pressure within the top bounce chamber. The energy output of a double acting diesel hammer is determined by the measured bounce chamber pressure while the hammer is operating. The manufacturer is required to submit this energy data. Each double acting diesel hammer comes with a hose running from the bounce chamber to a box containing a pressure gauge. There is usually a button on this pressure gauge box. When the button is depressed the gauge is activated with the bounce chamber pressure. If this button is depressed continuously, the hammer efficiency decreases because of the pressure bleed off created by the pressure gauge operation. The button should only be depressed periodically when an energy reading is required. The pressure reading and corresponding energy shall meet the minimum energy at the required pile bearing value.

On some projects, pile driving vibrations will be monitored for potential damage to adjacent structures or buildings. When that monitoring indicates a potential for damage, the Project Engineer should ensure that the minimum size hammer specified for the piling being driven is actually being used. If so, and vibrations are still potentially damaging, the Olympia Service Center Construction Office should be notified to determine if preboring or jetting should be used to reduce vibrations. Should preboring or jetting, or other methods be determined necessary, such work shall be considered a change in accordance with Section 1-04.4 of the *Standard Specifications*.

The contract allows the use of vibratory hammers to initially set piles. As of yet, there is no reliable means of determining the actual bearing capacity of a pile driven by a vibratory hammer. Often, the contractor wants to initially set piles with vibratory hammers if the soils and/or limited access are such that impact hammer operation would be difficult. The contract allows this but requires that an impact hammer be used to acquire the bearing capacity. Since static friction is usually much higher than dynamic friction, the actual bearing capacity is determined while the pile is in motion. This requirement is governed by the contract requirement that the pile must be driven at least an additional 0.6 meters (2 feet) using an impact hammer with the blow count (blows per 25 millimeters (per inch)) constant or increasing. If the contractor uses a vibratory hammer to initially set the piles, there must be a comprehensive procedure to ensure proper location an plumbness of each pile. This is usually accomplished by providing a rigid steel template and using good conscientious control while setting and initially driving each pile.

The use of water jets may be required for driving piles, especially for concrete piles. The piles must be driven at least 150 millimeters (6 inches) after the jet is removed, or to the required bearing. Do not allow the nozzle of the jet to penetrate below the tip of piling previously driven. Mark the jet pipe in such manner that the operator and Inspector can determine the depth required. The Olympia Service Center Construction Office should be notified if water jets are proposed for use.

Preboring may also be used to secure the minimum specified penetration. Usually the prebored hole should be slightly smaller in diameter than the pile. However, conditions may exist which make it necessary that a larger hole be prebored and the space around the pile be filled with sand while the pile is being driven to the specified bearing. Unless water-jetting, preboring, or other means of securing minimum penetration is specified and payment is provided for in the contract provisions, this work will be at the Contractor's choice and expense. However, the procedure used must be approved by the Engineer and shall result in a satisfactory pile and will not damage the integrity of the structure, roadway, adjacent structures, or utilities. Any damage done must be repaired to the satisfaction of the Engineer at the Contractor's expense.

The lengths of piling required are determined by driving test piles or by other information which may be available. The Project Engineer provides the Contractor with an order list for timber and precast concrete piles. This list must show the length of piles required below cut-off (the top of the pile within the footing). The Contractor should be informed that the lengths shown on the order list should be increased, at their expense, the necessary amount to provide for fresh heading and to reach from the cutoff elevation up to the position of the driving equipment. Payment for piling will be made for the number of meters shown on the order list except that if greater lengths are driven, with the approval of the Project Engineer, payment will be made for the lengths actually driven below cut-off. Itemized lists for cast in place piles or steel piles will not be furnished by the Engineer.

Rejected piles shall be removed or cut off 0.6 meter (2 feet) below the bottom of the footing. Rejected casings for cast in place piles that are left in place shall be filled with sand.

The handling and driving of treated piling require special care. Heads of piles should always be freshly cut, and rings or wire mesh screens placed on top during driving. In wet weather the final cutoff should be at least 0.3 meter (1 foot) long and the creosote, pitch and fabric cover placed immediately after the pile is cut. Do not make a cut-off and then wait until the next day to place the cover. Fabric covers should be well tacked to the pile and neatly trimmed to within 75 millimeters (3 inches) of the top of the pile so that the fabric will not have ragged edges. A follower driving cap should be used on treated piles. This is to help hold the pile in line to minimize the use of chocks in the leads during driving. Timber piles must be strapped in accordance with the requirements of Section 9-10.1 of the *Standard Specifications* before they are driven.

Precast concrete piles require special care in storage and handling, especially when raising them into the leads. The general method of attaching slings for handling is described in the *Standard Specifications* and the *Standard Plans*. Long piles must be supported at the ends and at intermediate points to prevent undue bending and cracking of the concrete. In special cases the plans may show the method for lilting long piles. Some pile driving crews lack experience with concrete piles and handle them as they are accustomed to doing with timber piles. Such handling will probably result in damage to the concrete piles and must not be allowed.

In driving precast concrete piles, several layers of plywood or a 90 millimeter ($3^1/_2$-inch) wood block should be placed between the top of the pile and the steel driving head of the hammer. Care should be taken to prevent crushing of the pile head before the desired penetration is reached. Where crushing occurs, the top of the pile should be checked to determine if the end is square with the body of the pile; also, the hammer should be checked to determine if a fairly flat blow is being delivered to the pile. In driving concrete piles it may be advisable, in order to prevent crushing of the head and to obtain the required penetration, to operate a hammer at less than full throttle until just before completing the driving, after which the throttle should be fully opened in order to obtain the true bearing value of the pile.

Large diameter prestressed concrete cylinder piles are not completely covered in the *Standard Specifications*. The requirements of the special provisions must be observed. Accuracy of placing and driving is most important. Every effort should be made to prevent these piles from drifting out of line or out of plumb during driving, but care must be taken to avoid applying excessive lateral force which may crack the pile. These piles do not have to be very far out of plumb before excessive overstress occurs. When a driven pile is found to be cracked or is out of plumb, it should be referred to the Olympia Service Center Construction Office for a decision regarding corrective action to be taken.

Care shall be taken in driving steel H piles to ensure that the driven pile is oriented as close as possible to that shown in the plans. Pile design usually involves horizontal forces due to temperature, concrete shrinkage, earthquake, and wind as well as axial forces, and if a driven pile is not aligned as shown in the plans, the pile may become overstressed due to excessive bending stresses. Any deviation of more than 20 degrees from the pile axis or more than 150 millimeters (6 inches) from the position shown in the plans shall be reported to the Olympia Service Center Construction Office for evaluation and acceptance.

6-5.7B Test Piles

A careful study should be made of the foundation exploration data shown in the plans and/or included in the Geotechnical Report before driving any test piles. Care should be taken that the test piles are not stopped on a relatively thin hard layer overlaying softer material. After the test piles have been driven, an effort should be made to correlate the results with the foundation data before ordering the permanent piles. The results from driving the test piles should be discussed with the Regional Operations/Construction Engineer if they do not correlate with the foundation data.

Test piles must be driven to at least the minimum penetration and at least 130 kilonewtons (15 tons) over the bearing capacity specified for the permanent piles. They may be driven over these minimum requirements to obtain as much information as possible. Good judgment must be exercised in the amount of overdriving to be required.

Preboring, jetting or other approved means may be used to secure minimum penetration with the test pile if such means is necessary and will be used for the permanent piles. The reason for driving the test pile is to obtain information for ordering the permanent piles, and to obtain additional information relative to driving the permanent piles.

It is the responsibility of the Contractor to supply test piles of sufficient lengths to provide for variation in soil conditions. If the piles furnished are not long enough, or are unsuitable in other ways, it will be necessary for the Contractor to supply acceptable piles. Followers will not be permitted in driving test piles. A follower is a member interposed between a pile hammer and a pile to transmit blows while pile head is below the reach of the hammer (pile head below the bottom of leads).

The Construction Office should be notified of the date test piles will be driven.

6-5.7C Pile Driving Records

Pile driving records are to be kept in the Pile Driving Record Book, Form 450-004, which becomes part of the project final records. This book has sufficient room for a condensed pile driving history, pile layout, and miscellaneous notes in addition to the driving log for each pile. Number the piles on the sketch in the pile layout and use these for the Pile No. on the pile driving log.

The pile driving record book contains instructions for completing the driving log. In order for this log to furnish complete information on the pile driving work, it is imperative that it be filled out completely in accordance with the instructions in the book. If more space is necessary, use more than one page for the pile. Items in the heading which are the same for several piling, may be marked "Same as Pile No. ___."

The piling should be marked every 300 millimeters (foot) of their lengths with crayon or paint unless there is some other method of determining when each 300 millimeters (foot) of the pile has been driven. Count and record the number of blows per 300 millimeters (foot) and hammer energy as the pile approaches bearing.

Test piles shall also be recorded in the pile driving record book. In addition, following the driving of each test pile, the Test Pile Record form shall be completed and sent to the appropriate offices the following day. This form should be filled in completely, including the rate/pressure of the hammer. Record the bearing value of the test pile for each 300 millimeters (foot) as it is driven.

6-5.8 Measurement and Payment

Measurement and payment instructions are covered in Sections 6-05.4 and 6-05.5 of the *Standard Specifications*.

6-6 Bridge Railings

6-6.1 General

Railings shall be carefully aligned, both horizontally and vertically, to give a pleasing appearance. On multiple span bridges, the rail and wheel guard or curb heights at the ends of each span should be varied a sufficient amount to produce a uniform camber or grade from end to end of the bridge.

At the beginning and ends of horizontal curves and through vertical curves, the height of curbs may need to be varied so that the rail heights will be uniform above the curb. On any structure on which occurs a break in grade, horizontal curve with superelevation, vertical curve, or a combination of the three, the Project Engineer should plot to a large scale, the profiles of the roadway grades at the curb lines. From these profiles the grades for the tops of the curbs and railings can be properly determined. A slight hump in the rail over the whole structure is usually not objectionable, but a hump and then a sag is not permissible.

6-6.2 Measurement and Payment

Measurement and payment instructions are covered in Sections 6-06.4 and 6-06.5 of the *Standard Specifications*.

6-7 Painting

6-7.1 General

When inspecting bridge painting for steel structures, the Inspector should prepare a plan for the structure they will be inspecting. This plan will enable the Inspector to locate sections of the structure where painting activities occurred.

An Inspector's Daily Report should be filled out after every work day with the activities performed and related to the Inspector's bridge plan. In the daily report, the Inspector should identify the activities such as cleaning, blasting, and applying the base, intermediate, and finish coats. These daily reports should accurately represent the work accomplished and any noted deficiencies.

The Inspector should become familiar with the latest safety requirements. Contract environmental requirements should be reviewed as well.

Manufacture and shop mixing of paint materials are controlled from the Olympia Service Center Materials Laboratory. Each container in each shipment of paint should bear a lot number, date of manufacture, type of paint and manufacturer's name.

When quantities of paint required for a particular job are 75 liters (20 gallons) or less, they may be manufactured and shipped without inspection and testing by the laboratory. A certificate of compliance with specifications signed by the manufacturer shall be presented to the Project Engineer by the Contractor at the time the paint is brought to the project site.

All paint shall be thoroughly mixed before using. Paint may be mixed by stirring with hand paddles and boxing by pouring from one container to another or by using power shakers.

The mass (weight) per liter (gallon) of the paint shall be checked on a random sampling basis by weighing 1 liter (1 gallon) of paint taken from the top of a container of thoroughly mixed paint. The mass (weight) should be not less than that specified in the *Standard Specifications*. Low mass (weight) per liter (gallon) indicates unsatisfactory paint, improper mixing or excessive thinning. Remix the paint and again take the mass per liter (weight per gallon).

If the required minimum mass (weight) is not met, the shipment should be held in abeyance until a 1/2-liter (1-pint) sample shall have been tested by the state laboratory and a report is received indicating approval or rejection.

All paints bearing dates of manufacture over one year old should be sampled on the basis of one sample per 190 liters (50 gallons). Paint showing appreciable deviation from normal should be sampled and set aside until checked and released by the laboratory. Random field samples on the basis of one sample per 380 liters (100 gallons) of material should be taken as a matter of routine and submitted for test even though the paint is used without waiting for the results. Paint samples should be taken from the painter bucket being used.

The paint should be capable of application at the required thickness without any sags or runs. If it is not possible to do this, the Materials Laboratory should be contacted for necessary steps to be taken.

6-7.2 Cleaning Metal

Cleaning for removal of rust or corrosion spots in repainting and cleaning of new steel shall mean "commercial" sandblasting as defined in the *Standard Specifications* or the Special Provisions.

Wire brushing and scraping shall normally be limited to removal of dirt and loose paint where corrosion is not involved.

All rust which cannot be removed by sandblasting shall be removed with chisels, hammers or other effective means as directed by the Engineer.

When called for in the Special Provisions, the entire structure shall be pressure flushed with water from the top down before other cleaning or painting is started. The nozzle should not be more than 230 millimeters (9 inches) from the surface being cleaned. A biodegradable detergent may be added to the water jet to remove oil and grease. Biodegradable detergents shall be approved by the Materials Laboratory and precautions taken to avoid harmful residue on the steel.

In addition to the initial pressure flushing, all sandblasting residue must be removed after blasting and spotting and before application of additional paint. Pressure flushing may be required for this purpose if the Project Engineer deems it necessary.

New steel, shop coated before erection, shall have all erection and transportation scars, rivet heads, and welds cleaned and spot coated. If a dirt film has accumulated on the steel during the erection period this must be removed by flushing. All concrete residue must be removed from the floor system after the deck pour is completed. Generally, this may be accomplished by flushing before the residue has set up and while the pour is in progress.

On repainting projects, the Engineer or Inspector should observe and report to the Bridge and Structures Engineer any spot or area where corrosion or other deficiencies are of such extent as to threaten the strength of the steel member. They should also observe areas where water becomes trapped to ultimately endanger the steel through corrosive action, and advise the Regional Operations/ Construction Engineer, so the condition may be corrected.

6-7.3 Applying Paint

Paints are formulated at brushing consistency and should require no field thinning. Spray painting is not to be used unless authorized in the special provisions.

Brushes and spray equipment (if allowed) should be in good condition. Paint should be applied to the metal edges and bolts first and the "flat" painted from the center to the edges. The paint should be applied with a circular, scrubbing motion and finished with light strokes on the long dimension of the surface. Although sags and runs are not desirable, a full brush must be used at all times and a heavy coat of paint applied. Extension handles on brushes and sheepskin daubers may be required to paint deep pockets. The use of inspection mirrors is required for reflecting light into the interior of boxed sections or members for locating painting defects.

The Inspector must check to see that the proper film thickness of paint is applied. Wet film thickness is to be measured immediately after the paint is applied and the dry film thickness is to be measured after the paint has become thoroughly dry and hard. It is difficult to measure the dry film thickness of paint on galvanized metal so it is necessary to measure the wet film thickness for each coat of paint as it is applied.

When an Inspector finds an area where the painting does not meet the specifications, they should mark the area with contrasting brightly colored alkyd paint from an aerosol can. A light coat of this spray paint will not adversely affect the paint job and it will effectively mark the area to tell whether correction work was performed on the area. Marking the area with spray paint provides the Inspector with an easy method of marking deficient areas and provides the Contractor a ready method of locating the areas that require additional work. This will also free the Inspector to concentrate on areas of serious deficiencies without losing control over those requiring minor corrections. When marking the final coat, be careful to mark only the area to be reworked.

The protection of the structure, traffic, and property from splatters and airborne paint spray is the responsibility of the Contractor. Since WSDOT may be criticized because of damage from paint, the Engineer must enforce the provisions of the contract to ensure protection therefrom.

Adequate staging, scaffolding, ladders, and fall protection are required to be provided by the Contractor to ensure safety to workmen, room for good workmanship, and adequate facilities for proper inspection.

Technical assistance and equipment are available at the Olympia Service Center Materials Lab, and on request can be provided at the job site to ensure a good paint job.

During the preparation and painting of steel bridges, it is very important that the Inspector be aware of the potential impact to the surrounding environment. The air, water, and land quality are of major concern. WSDOT and environmental agencies are working together to establish guidelines for bridge painting. Policies and procedures involving environmental concerns will be addressed in the contract. Compliance to these specifications should be closely monitored.

6-8 Waterproofing

The instructions for this work are quite complete in Section 6-08 of the *Standard Specifications*.

6-9 Cribbing

6-9.1 General

Cribbing shall be constructed in accordance with the requirements of Section 6-09 of the *Standard Specifications*.

The foundation or bed for the cribbing shall be excavated to the specified grade and shall be approved for bearing quality before any crib work is placed.

The cribbing must be handled carefully to prevent any damage to the cribbing materials.

When constructing cribbing in areas where there is ground water present, proper drainage facilities must be constructed to protect the cribbing from excessive ground pressures. During the excavation for the cribbing, the Project Engineer must check to see if there is any evidence of ground water which will require special drainage facilities. The cribbing shall be backfilled with a free draining material which normally will be gravel backfill for walls. The cribbing shall be backfilled in horizontal layers simultaneously inside and outside and compacted to the specified density.

6-9.2 Measurement and Payment

Measurement and payment instructions are covered in Sections 6-09.4 and 6-09.5 of the *Standard Specifications*.

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7-1 Drains

7-1.1 Roadway Subdrainage

Underground streams and seepage zones which require installation of water collection systems may be encountered in roadway excavation. The gradation of gravel used in water interception channels is of prime importance. Gravel backfill for drains has been developed for this use. This drain material is an open graded gravel which will become plugged with infiltered fines if not protected with a filter. It should always be used with a filter cloth which has proven effective in inhibiting the infiltration of fines.

When installing perforated drain pipe, the perforations should be in the lower half of the pipe. This will minimize infiltration of fine material and ensure longer service.

Where a subdrain installation is intended to pick up flow from intermittent seepage zones, nonperforated pipe should be used between the seepage areas to avoid possible loss of water into otherwise dry areas. In some cases, it may be necessary to supplement the pickup system with a carrier pipe system.

The Project Engineer's attention is directed to the fact that control of water during construction is the responsibility of the Contractor. See Chapter 2-3.4 of this manual for temporary water pollution/erosion control.

7-1.2 Installation of Drains

Most of the instructions for the installation of culverts covered in Chapter 7-2.4 of this manual are equally applicable to the installation of drains.

7-1.3 Measurement and Payment

Measurement and payment for structure excavation is covered in Sections 2-09.4 and 2-09.5 of the *Standard Specifications*. Measurement and payment for drain pipe and gravel backfill for drains is covered in Sections 7-01.4 and 7-01.5 of the *Standard Specifications*.

7-2 Culverts

7-2.1 General Instructions

The life of the roadway depends largely upon proper drainage, and it is essential to give diligent attention to adequacy as well as to quality of construction. In addition to providing for the passage of existing natural drainage channels through the project, a highway drainage system must provide for the collection and disposal to natural drainage channels of all rainfall on the right of way and of all ground water flow that may be intercepted during roadway construction. It is attempted during location and planning to provide for necessary drainage systems, however, particularly with respect to underground water flow, it is impossible to foresee all drainage problems that may result from the construction of the highway. It is the responsibility of the Project Engineer to evaluate the sufficiency of the provided drainage systems and to initiate action for changes or additions where necessary. The Project Engineer should carefully review all provisions of the applicable Environmental Impact Statement, right of way agreements and other commitments made by WSDOT which have direct bearing on the project. Many of these commitments involve drainage matters. Although such elements should have been incorporated into the design, in some cases they have been overlooked or require revision. Such a lack of oversight which directly affects adjacent property or individuals is sure to trigger an immediate negative response reflecting on WSDOT integrity.

The Project Engineer should go over the project, particularly during severe storms, closely observing the quantity and action of the storm water run-off to determine the sufficiency of openings and ditches or the need for larger openings and ditches than those contemplated, reporting the results of this observation to the Regional Office. Attention is directed to location instructions for methods to be followed in determining size of opening required. Any changes made in the size of drainage openings must be approved by the Regional Office before the Contractor is advised of the change.

Tables showing the allowable heights of embankments over the various types of pipes are in the *Hydraulics Manual*. Quite often, upon locating culverts to fit the drainage conditions, the height of embankment is more than was anticipated during the location work. After the culverts are staked, a check should be made to see that the allowable embankment height for the particular type of pipe is not exceeded.

Pipe arches shall not be constructed until the site has been investigated by the Regional Materials Engineer and the materials and methods for the construction have been approved by the Regional Materials Engineer.

7-2.2 Roadway Surface Drainage

Curb and gutter systems must be constructed in such a manner that water will not pond on the roadway or flow at random over fill slopes. Manholes, catch basins, and spillways should be checked for location, size, and number to ensure efficient removal of collected water. Controlled drainage should be carried to a point beyond the roadway to where damage to the roadway cannot occur.

Water pockets are very apt to be formed in superelevation transitions and roadway width transitions, especially where the roadway grade line is quite flat. It is necessary that the Project Engineer investigate these areas to be sure that proper drainage is installed.

In placing the grates for catch basins and gutter inlets, it is imperative that they are placed at the proper elevation. If they are placed too low, they constitute a traffic hazard and if they are placed too high, they will not intercept the water. In keeping with design safety requirements many culvert entrance structures utilize catch basins or grate inlet facilities. Such installations are particularly susceptible to deciduous debris and roadside trash. Grate opening size allowing passage of such debris is very critical in rural and mountainous locations.

Surface ditches may be necessary above cut slopes to prevent water from flowing over the cut face. Roadside ditches at the ends of cut sections should be diverted well away from the adjacent embankment to avoid erosion of the fill material.

7-2.3 Design of Culverts

Present standard design practice permits the Contractor to select the type of culvert and drain pipe to be installed except in those instances where a specific type is called for in the plans. Approved types are detailed in the contract plans and specifications.

When changes or additions are determined necessary by the Project Engineer, consideration must be given to the type of pipe being furnished to the project. Specific types should be required only when engineering considerations substantiate that preference should be given to one type or another.

Corrugated metal pipe arches fill a need where headroom above the invert is restricted and where more capacity and wider clearance for discharge of debris is required than would be afforded by a multiple pipe installation. Due to the method of forming the pipe arches, it is usually more difficult to obtain a watertight joint. The construction of the joints must receive careful attention when the installation is in material susceptible to erosion.

7-2.4 Installation of Culverts

The ability of the culvert to withstand the height of cover as shown in the tables is predicated on the culvert being constructed in accordance with the *Standard Specifications* and the Standard Plans. All phases of culvert installation should receive thorough attention and inspection to achieve that end.

7-2.4A Grade and Flow Line

The flow line grade of a culvert should not be less than the stream channel which it replaces. As much fall as possible should be allowed to carry away debris which otherwise might accumulate at the inlet. The elevation of the inlet end of the culvert should be slightly higher than the flow line of the existing water course to overcome the tendency for silt to be deposited around the inlet due to the retarded velocity of the stream just above it. The additional grade given the culvert will prevent silting in the upper end of the culvert. Where the grade of the water course is quite flat, it may be necessary to raise the outlet of the culvert slightly above the flow line of the channel. When necessary to construct inlet and outlet channels to culverts, the channels shall be of ample size and shape to take the maximum flow. They shall present a neat and workmanlike appearance upon completion and shall be open and ready for operation upon the completion of the contract.

7-2.4B Foundation

Care must be taken to ensure that the ground upon which pipes are to be laid has sufficient stability to support the pipe without excessive or non-uniform settlement. Where the underlying soil is soft or spongy, or subject to excessive consolidation under load, adequate support shall be obtained by excavating and removing the unstable soil and replacing it with satisfactory (usually granular) material, provided this procedure is feasible. Such backfill must be placed to extra width as provided for by the *Standard Specifications* in order to prevent overloading the pipe in the event the adjacent embankment foundation settles under the embankment load. In some cases installation of the pipe should also be laid with a slight camber to over-come anticipated settlement. Where the unstable foundation soil is of such depth that the above procedure is not practical, other means must be used. This may involve the use of partial backfill of granular material to spread the load, placement of a timber or brush mat, the construction of a pile and timber cradle, or other such means. Before selecting a method, the Regional Materials Engineer should be consulted.

Uniformity of support is essential to successful installations. Where transition is made from foundation soils that may consolidate to firm, unyielding ground, special consideration should be given to the transition zone.

7-2.4C Bedding

Where pipe is laid on existing ground, special care must be taken to ensure full, uniform support along the barrel of the pipe. Hand shaping and checking with a template may be necessary. When placing concrete pipe with bell-type joints, depressions must be constructed to receive the bell so that full barrel support is achieved. Isolated stones or boulders which may cause point bearing must be removed.

When granular bedding material is used (as is usually the case in trench construction or where rock soils exist) workmen sometimes become careless on the assumption that the bedding material will in itself ensure adequate support. Inspection should ensure that proper depth is used and that the pipe is seated in the bedding material to provide full, uniform barrel support.

Extreme care must be exercised in placing pipe in rock fills or where solid rock, hardpan, or cemented gravel is encountered. Pipe installed on these hard materials must be bedded on a cushion of suitable earth, fine gravel, or sand at least 150 millimeters (6 inches) in depth to eliminate concentrated points of loading.

Gravel having sizes larger than 25 millimeters (1 inch) should not be used for bedding material. The importance of good quality material and good workmanship cannot be over-stressed. The load supporting capacity of the pipe is directly affected by the quality of the bedding.

When suitable material is not readily available on the project for bedding the pipe, gravel backfill for pipe zone bedding should be used. Normally this material is to be used only from 150 millimeters (6 inches) below the pipe to the limits shown on the Standard Plan. In areas of rock embankment, where there is only fragmentary rock material available on the jobsite to backfill the pipe installation, gravel backfill for pipe bedding should be used for the backfill within 300 millimeters (12 inches) of the sides and top of the pipe. If it is necessary to remove the material under the pipe excavation zone to produce a firm foundation, this void should be backfilled with gravel backfill for foundations which is more stable than gravel backfill for pipe bedding.

If the Engineer deems it desirable or necessary to construct part of the embankment prior to construction of the culvert, the embankment shall be constructed at least 5 diameters of the culvert each side of the installation and compacted to 95 percent of the maximum density of the material. The embankment shall be constructed to a minimum height above the pipe invert elevation of at least one half the diameter of the pipe. If the Contractor elects to construct the embankment to final grade, shoring will be required for embankments more than 1.22 meters (4 feet) in height above the bottom of the trench. The upper limit for measurement of structure excavation is a maximum of 1.22 meters (4 feet) above the invert of the pipe as specified in Section 2-09.4 of the *Standard Specifications*.

Concrete pipe must be laid with the bell or groove end up grade. Metal pipe must be laid with the outside laps of circumferential joints pointing up grade and with the longitudinal laps positioned other than in the invert.

It is important that concrete pipe with elliptical reinforcement, fabricated to form an elliptical section, be installed with the “top” or “bottom” position as marked on the pipe exactly on the vertical axis. There are special cases, such as on side-hill installations, where the imposed load will be at some angle other than vertical. In these cases, the pipe should be tilted to meet the direction of load. Theoretically a small departure from the correct position does not greatly affect the supporting strength of the pipe, as the reinforcement cages may not be shaped to true ellipses, or they may not remain in the true shape during placing of the concrete. Practically, the steel may be in such a position that a large percentage of its effectiveness is lost a short distance away from the vertical axis. Elliptically reinforced concrete pipe is manufactured with lift holes in the top of the pipe or is clearly marked to simplify true positioning. Many culvert pipe failures have resulted because of carelessness in installation with respect to position of the vertical axis. Installations other than vertical shall require approval by the Olympia Service Center Construction Office.

7-2.4D Backfill

The load supporting strength of any pipe is directly affected by the condition of the material around and above the pipe as well as the bedding material. In general, the higher the degree of compaction of the fill or backfill under the haunches and along the sides of the pipe, the less the pipe will deform under load. Also, the higher the compaction, the less the material along side the pipe will consolidate, which consolidation would result in an increased transfer of embankment load onto the pipe. For these reasons, the backfill or embankment material adjacent to the pipe should be selected material free from large rocks and lumps, containing sufficient fines so that it will compact to a relatively impervious mass and it must be compacted to a density and width not less than that required by the *Standard Specifications* or Standard Plans.

Special care shall be taken to obtain proper compaction under the haunches of the pipe and to place and compact the backfill uniformly on both sides of the culvert. Firm support must be obtained. Caution shall be used to avoid over- tamping to the extent that the pipe is lifted out of position.

Many failures of culvert pipe in the past could have been avoided by proper backfilling. Neither type of pipe can withstand heavy embankment loads unless the backfilling is performed in strict accordance with the Standard Plan for Pipe Compaction Designs and Backfill and the *Standard Specifications*.

When concrete pipe is constructed in accordance with Design C as shown on Standard Plan B-11, it is important that the backfill material is first placed and compacted to the limits of the pipe compaction. The trench for the baled hay or straw is then excavated with vertical sides and to the width shown on Standard Plan B-11. The baled straw or hay is then placed in this trench. The wires or twine on the baled straw or hay must be cut to loosen the material enough so it is capable of compressing as the load from the embankment increases.

7-2.4E Placement of Fill Over Culverts

The load that will be imposed on a culvert pipe is affected largely by the manner in which the embankment around and above the culvert is constructed. The maximum height of fill allowable over various sizes and types of pipe and pipe arch culvert is dependent upon backfilling and constructing the embankment over the culvert in strict compliance with the Standard Plans and the *Standard Specifications*. Careful attention shall be given to constructing pipe installations in accordance with the appropriate standard except as modified by special provisions.

Equipment shall not be permitted to operate across the culvert until the embankment has been constructed 600 millimeters (2 feet) above the culvert when constructed by backfill design A or 600 millimeters (2 feet) above the backfill zone when constructed by backfill design C. The operation of equipment over the culvert installation shall be in accordance with Section 1-07.7 of the *Standard Specifications*.

Mitered ends of metal culverts require some type of weighted protection to keep the end of the culvert from floating due to hydrostatic pressure. Usually concrete headwalls are specified for this purpose. Concrete headwalls must be constructed as soon as the embankment is constructed to the height of the headwall so the mitered ends of the culvert will be protected when the first storm is encountered.

7-2.5 Measurement and Payment

Measurement and payment for structure excavation and gravel backfill are covered in Sections 2-09.4 and 2-09.5 of the *Standard Specifications*. Measurement and payment for pipe and end sections are covered in Sections 7-02.4 and 7-02.5 of the *Standard Specifications*.

It should be noted that if the Contractor constructs pipe in excess of the length designated by the Engineer, the excess length will not be measured or paid for. It is quite often undesirable to have culvert pipe constructed in excess of the necessary length from both hydraulic and aesthetic considerations thus the Engineer should have the excess removed at the Contractor's expense when this occurs.

7-3 Structural Plate Pipe, Pipe Arch, Arch, and Underpass

7-3.1 General Instructions

Most of the instructions for the construction of culverts covered in Chapter 7-2 of this manual are equally applicable to the construction of structural plate pipes, pipe arches, arches, and underpasses.

In the construction of multi-plate structures, it is quite important that the bottom plates be correctly positioned for alignment and grade of their edges before the other plates of the section are bolted up so the completed structure will be in proper alignment. Manufacturers of multi-plate structures normally supply detailed assembly instructions with their multi-plates, which should be closely followed, as they will prevent creep or spiral. If the structure starts to creep or spiral, the only way to correct this condition is to remove the plates to where it is in correct alignment and reconstruct the structure.

High-strength bolts are used in bolting the plates together. In order for the connections to function as designed, the bolts must be tightened to the specified tension. Chapter 6-3.6B covers the instructions for construction and inspection of high tensile strength bolts. The specifications require that 19-millimeter (3/4-inch) high strength bolts be used and torqued during installation to 135 to 400 newton•meter (100 to 300 foot-pounds). Impact wrenches must be calibrated as specified since over-tightening may over-stress the bolts and under-tightening will not give the connection the required strength. If more than one crew is assembling the structure, the impact wrenches must be calibrated to tighten the bolts to the same torque.

7-3.2 Measurement and Payment

Measurement and payment instructions are covered in Sections 7-03.4 and 7-03.5 of the *Standard Specifications*.

7-4 Storm Sewers

7-4.1 General Instructions

Most of the instructions for the construction of culverts covered in Chapter 7-2 of this manual are equally applicable to the construction of storm sewers.

The grade line that storm sewers are constructed on is rather critical since the capacity of the pipe is dependent on its flow line grade. The storm sewer system has been designed to carry the anticipated flow if it is constructed on the grade lines shown in the plans. It is quite important that the effect on the capacity of the pipe be checked whenever it becomes necessary to vary the flow line grade to avoid obstacles that may be encountered on construction.

Careful attention must be paid to the construction of the joints or the storm sewer line may not meet the tests that may be required in the contract.

7-4.2 Sewer Trench

Trenches shall be constructed as specified in Section 7-08.3(1)A for culvert pipe.

If the trench is 1.22 meters (4 feet) or more in depth, shoring shall be constructed or the sides of the trench sloped as necessary to protect the workmen in the trench. See Section 2-09.3(4) of the *Standard Specifications* and Chapter 2, Section 2-9.1 of this manual.

Backfilling will be in accordance with Section 7-04.3(3) of the *Standard Specifications*.

7-4.3 Measurement and Payment

Measurement and payment instructions are covered in Sections 7-04.4 and 7-04.5 of the *Standard Specifications*.

7-5 Manholes and Catch Basins

The instructions for this work are quite complete in Section 7-05 of the *Standard Specifications*.

7:DP:CM

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Introduction

Many of the specifications in Division 8 of the *Standard Specifications* are complete and do not require additional instructions for proper staking, inspecting and documenting the construction, and will not be covered in this manual.

Although many items of construction in this chapter are specialized, the procedures of sampling the materials, documenting the construction and requiring that the work be done in accordance with the specifications is not different from other types of highway construction work.

8-1 Roadside Seeding

8-1.1 General Instructions

After the slope stakes are set, a thorough review of the project should be made. This is recommended to ensure that all surface water within the project is controlled. It is important that run-off to adjacent property not be permitted except in natural water courses. Whenever the ground slopes so the surface water would drain over the cut slope, the Project Engineer should investigate the need for constructing ditches longitudinally along the roadway to intercept the water or making use of down drains. A review of soil types is quite important. If erodible soils are in evidence, consideration must be given to reducing erosion when these materials are encountered in cuts or used in embankment construction on the project.

There will be times when sub-surface water is encountered in the slopes of a cut section. The Project Engineer should notify the Regional Operations/Construction Engineer if this occurs. In most cases some corrective action will be necessary whether it be perforated pipe or other methods. There are some cases where the Regional Operations/ Construction Engineer may want to consult with the Materials Engineer on matters and ways of controlling the flow of sub-surface water.

Erosion problems can lead to unsightly slopes and add to the maintenance problems after completion of the project and, in some cases, create a safety hazard and water pollution if not properly taken care of during construction.

8-1.2 Construction Practices

Many problems can be prevented in the initial stages of construction if the Contractor will protect the roadway as the work progresses to prevent water from running over fill slopes by sloping or crowning the area and eliminating duck ponds or low spots. Poor construction practices can, in the long run, cost the Contractor additional money to correct the damage.

The permanent protection of earth fill and cut slopes should be accomplished as soon as possible. When provided in the contract, topsoil should be evenly placed on the slopes at the specified depth for areas to be seeded. After placement of top soil on slopes flatter than 1:2.5 ($2^1/_2$:1), all litter, hard lumps, and rocks over one inch in diameter shall be raked up and removed. On slopes steeper than 1:2.5 ($2^1/_2$:1), all hard lumps and rocks over three inches shall be raked up and removed. The topsoil shall then be compacted by use of a sheeps-foot roller or other approved equipment which gives similar results. The purpose for using this type of equipment is to penetrate the topsoil layer, bonding it to the underlying material and to lessen the possibility of losing the topsoil by erosion. A minimum of two passes of the sheeps-foot roller is required parallel to the natural flow of water on the slopes.

Seed and fertilizer are to be uniformly applied on the slopes at the rate and mixture specified in the contract. Application shall be by an approved hydro-seeder, blowing equipment, properly equipped helicopters or power drawn drills or seeders. Where areas are inaccessible for this equipment, approved hand seeding will be permitted.

In order for the Contractor to order the proper amount of materials for the project and to provide the Inspector a method of checking the rate of application of the seed and fertilizer to determine if the required rate of application is being met, the Project Engineer shall measure the areas to be seeded and fertilized as soon as they can be determined and inform the Contractor of the anticipated acreage. During the seeding and fertilizing operation, the Inspector shall see that the material is placed at a uniform rate and compare the amount of seed and fertilizer applied with the area covered to verify that the proper rate of application is being placed.

The seed and fertilizer may be applied in one application provided the seed and fertilizer are not mixed more than 30 minutes prior to application because the fertilizer will burn the seed. Otherwise, the seed shall be applied in a separate application prior to fertilizing and mulching. Fertilizer and wood cellulose fiber mulch may be applied in one operation with good results. Mulch must be uniformly applied to the seeded areas within 48 hours after seeding. Hay mulch is to be applied with a forced air spreader. Wood cellulose fiber is normally applied with hydraulic equipment. Checks are also necessary to determine that the mulch is applied uniformly and at the

required rate. In areas which cannot be reached by a mulch spreader, hand methods resulting in uniform application may be used.

In some areas, it may be desirable to anchor the mulch with an application of asphalt emulsion. The *Standard Specifications* are quite complete in the method of applying asphalt emulsion. The rate of application is varied from area to area to obtain the best results. Check with the Landscape Architect for advice on the proper application rate.

In order to control the possible erosion resulting from fast runoff on steep slopes, jute matting or excelsior matting is often used. It also has its use on flatter slopes where erodible soils are encountered. The purpose for using matting is to provide a quick temporary protection until the grass has grown enough to be permanent protection for the soil, but the matting cannot be expected to cope with water other than rainfall that falls on the exposed slope. Drainage from above or beyond the raw slope should be controlled by ditching or drains. The Inspector is charged with being alert to this potential problem and making every effort to ensure that this kind of runoff is diverted away from the slope.

8-1.3 Measurement and Payment

Measurement and payment instructions are covered in Section 8-01.4 and 8-01.5 of the *Standard Specifications*.

In some cases, a separate bid item will be established for extra fertilizing to permit additional applications on a seeded area during the life of the contract. In these cases, payment for the acreage fertilized will be made for each application.

8-2 Roadside Planting

8-2.1 General

Inspection of all roadside plantings should be performed by trained and experienced personnel. Recognizing that this is not always possible, this section is written to serve as a guide for project personnel. It is not intended as a substitute for professional assistance. When questions of adequacy of planting stock and procedures are encountered, or when differences of opinion concerning the acceptance or rejection of plants occur and the answers are not readily found in this section, the Inspector should request the assistance of a landscape architect or horticulturist. In cases where insect damage and diseases are suspected, the services of an entomologist or plant pathologist may be required.

The highway right of way is largely a construction disturbed environment, lacking in natural soil profiles and subject to unusual runoff, abnormal air turbulence, pollutants, temperature variations, and other extremes. In this environment the designer is faced with providing appropriate highway vegetation.

Plants are living things in contrast to concrete, steel, and stone, which are inanimate materials. Plants change in shape, size, color and texture from season to season and from year to year, while inanimate materials remain constant except for slight changes in color and texture due to weathering or wear. Functional plantings serve to improve traffic guidance, reduce headlight glare, provide safety features, reduce pollution, provide screening, and contribute to improved aesthetic values. The interest and variety created by imaginative planting design are important aesthetic values. Plantings can also be used to create a smooth transition from rigid geometric cross-section and structural forms to nearby natural vegetation and land forms.

Of concern is the survival of plantings under the conditions imposed by the design and the environmental conditions of the site. The best conceived and designed planting may not produce the desired results if the quality of plants and the planting procedures fail to meet the requirements of the contract specifications.

Before commencing any work on the project, there should be a meeting with the Project Engineer, the inspectors, and the Landscape Architect. The agenda for the meeting scheduled by the Project Engineer should include but not be limited to the following:

1. The basic concept of what is to be achieved with each individual area and the project as a whole. (Revegetation, open forest, screening, focal attention and all other aspects to be discussed must be understood if the ultimate concept of design is to be accomplished.)

2. The growing characteristics, weaknesses, and strong points of each plant should be discussed especially as they relate to the environment over which the Inspector has some control (drainage, exposure, etc.). Modifications of the plans should be discussed with the Regional Landscape Architect.

3. Discuss possible maintenance problems with the maintenance personnel. Modifications that were unexpected during the design stage may need to be implemented. At the initial layout stage, the maintenance personnel may be better qualified to discuss the project. Any modifications to the plans should be coordinated with the Landscape Architect to ensure that concept is maintained.

8-2.2 Landscape Terminology

Acid Soil/Alkaline Soil

pH is a measure of hydrogen ions in the soil. Various plants respond differently to pH variations. Generally the soil west of the Cascades is acidic, while east of the Cascades is more basic. The pH scale ranges from 0 to 14. pH of 7 means a neutral soil. pH below 7 is acidic soil. pH above 7 is alkaline soil or basic soil. Generally, plants are selected for a particular area without a need to change pH of soil. When a pH change is desired, a soil test is taken, analyzed and the pH is changed appropriately upon recommendations from a Landscape Architect or Horticulturist.

Balled and Burlapped (B&B)

Plants are prepared for transplanting by digging them so that the soil immediately around the roots remains undisturbed. The ball of earth and root is then bound in burlap or similar mesh fabrics. An acceptable B&B root ball should contain 90 percent (visual estimate of volume) of the earth material held together with root system when removed from the burlap.

Bare Root (BR)

Most deciduous plants are dug when dormant. The roots are cleaned, pruned and usually stored in moist material. Deciduous bare root plant materials must be pruned or thinned to about ⅓ of its limb area to balance the loss of root area (due to digging and root pruning). The shock of transplanting can be compensated by thinning, not just tip removal, using care not to change configuration of the plant. Roots must remain moist and not allowed to dry out.

Botanical Name

The botanical name is the plant name, written in Latin, that is used universally. The common name is the name used in a local area, and is not necessarily the same name used in other areas. The correct botanical name is usually found in "Standardized Plant Names," available from the District Landscape Architect. The botanical name usually consists of two names, Genus and Species, but may include additional names.

Genus	1st word
Species	2nd word
Variety	3rd word (if appropriate)
Form	4th word (if appropriate)

Example: Juniperus chinensis pfitrzeriana "glauca"

Branch

An offshoot from a trunk or main stem. It could be also called a bough or a portion of a main stem.

Caliper

The diameter of the trunk of a deciduous tree is measured 150 millimeters (6 inches) above ground level, up to 100-millimeter (4-inch) caliper size. If greater caliper than 100 millimeters (4 inches), it is measured at 300 millimeters (12 inches) above ground level.

Candle

The new growth at the terminal end of a twig.

Cane

A primary stem which starts from the ground of a shrub or at a point not higher than ¼ the height of the plant. A cane generally only refers to growth on particular plant material, such as roses, etc.

Clumps

Plants with at least double the number of canes required for standard material; trees with three or more main stems starting from the ground. Vine maples are sometimes sold by the clump.

Collected Material

Trees, shrubs or other plant material collected from native stands, including Christmas tree stock and plants from native stands or forest plantings. After one growing season at the nursery, they are no longer considered collected material.

Conifer

Conifers are plants which bear seeds in a cone, usually evergreen, with needles or scales in lieu of broad leaves. Examples of conifers include pine, spruce, fir, giant arborvitae.

Container Grown

Plants grown and delivered to the job site in cans or other containers. Container grown plant material can be planted any time of the year and should not be allowed to dry out while in the container. Usually, plants grown in containers are in a very free draining soil mixture made up of nutrient free components. Container grown plants have a tendency to dry out and decline in vigor when not under the care of the nurseryman. Container grown material should have a firm root ball which will hold 90 percent (visual estimate of volume) of the ball material when removed from the container. Good container grown materials will hold virtually all of the soil in the root zone when a good growing medium is used. Some root growth should be visible in the outer edges of the ball. Excessive roots at the bottom of the ball indicate lack of proper root pruning at

the time of canning. Excessive roots at the side or bottom of the container could indicate a rootbound condition.

Culls

Plant materials that do not meet the minimum standard requirements for individual grades. An allowable percentage can be installed on a project and still be fully compensated to the Contractor.

Cuttings

Cuttings are detached leaf buds or portions of branches which under favorable circumstances are capable of producing roots when placed in a growing medium.

Deciduous

Plants that shed all their leaves at the end of the growing season and remain leafless during the winter or dormant period.

Evergreen

Plants that maintain green foliage throughout the year. Some leaves may be shed, however, the terminal foliage will remain on the plant.

Fertilizer

Any natural or artifical material added to the soil or directly to the leaves to supply one or more of the plant nutrients. Generally, a complete fertilizer refers to a fertilizer that contains nitrogen, phosphorous, and potassium (NPK). Indications on a container are usually numerical 10-8-6 or 20-10-5, etc. These numbers indicate the percentage of actual nutrient element available i.e., 10 percent nitrogen, 8 percent phosphorous and 6 percent potassium (10-8-6). Other minor nutrients are sometimes added to NP&K such as magnesium, manganese, boron, iron, zinc, calcium, sulfer, etc.

The nitrogen in a fertilizer can be readily available or slow release (controlled availability) depending upon how water soluble it is. The slow release nitrogen (high percentage of water insoluble nitrogen) will allow the nitrogen to be available to plants over a long period of time. The readily available 100 percent water soluble fertilizer can leach away with heavy rains or damage the plant by the high concentrations of nutrient.

Additional nitrogen and other elements are often necessary for plant growth when mulches are used. The decaying activity of the mulch ties up the plant nutrients and is thus unavailable for plant growth.

Form

A plant sub-division of botanical variety, usually the fourth word in the botanical name. It distinguishes some minor characteristic such as “dwarf,” “columnar,” or “white flower.”

Friable

A granular soil, easily crumbled by cultivation.

Genus

A plant family is divided into groups of one or more related plants called genera (plural of genus). The first word in a plant’s botanical name is the name of the genus to which the plant belongs: for example, Pinus contorta, Pinus ponderosa, Pinus densiflora.

Hardy (Hardiness)

Hardiness usually refers to a plant’s tolerance to cold temperatures, however, it could be tolerance to heat, drought, abundance of moisture, etc., as it relates to survival.

Heeling In

A method of temporary storage by covering plant roots with sawdust, mulch or a mixture of other materials capable of good moisture retention, to keep the roots from drying out.

Herbicide

A herbicide is a pesticide chemically formulated to control or destroy weeds. Herbicides are broken down into main groups: Postemergence Herbicide and Preemergence Herbicide. Postemergence herbicide is a plant killing material that acts on the active growing surface of a plant after the plant has emerged from the soil. It is usually most effective during the rapid growth of the plant. Preemergence herbicide is a plant killing herbicide which acts to prevent the seeds, bulbs, tubers, stolens, etc., from sprouting (before-emergence).

Humus

Decomposed or partly decomposed organic matter in the soil. Humus is generally found on the upper surfaces of the soil. Humas frequently imparts a dark color to the soil. It is beneficial because of its nutrient and moisture storage capacity.

Horticultural Variety (Cultivar)

A plant “variety” or “cultivar” originating as a result of controlled fertilization, selective breeding of progeny, or hybridization. Such plants are given a “variety” name which is added to the rest of the plant name and usually set off by single quotation marks or small capitals: GLEDITSIA triacanthos inermis ‘MORAINE.’

Inoculated Seed

Seeds of the legume family (i.e., clover) that have been treated with nitrogen-fixing bacteria to enable them to make use of nitrogen from the soil atmosphere.

Leader

The main stem or trunk that forms the apex of a tree. If the leader is missing, another leader will try to establish itself. Often several leaders take off and a multi-set tree results from that point.

Liner

Liners are small plants such as seedlings, plants from cuttings; unfinished nursery stock or whips usually under 1 meter (3 feet) in height. These plants are usually lined out in nursery rows or planted using reforestation methods.

Mulch

Mulch is any loose material placed over soil, usually to retain moisture, reduce or prevent weed growth, insulate soil or improve the general appearance of the plant bed. Additional fertilizer is usually necessary in order to offset the loss of plant nutrients used by the micro-organisms that break down the mulch.

Pesticide

A pesticide is any substance or mixture of substances intended to control insects, rodents, fungi, weeds, or other forms of plants or animal life that are considered to be pests.

Pinching Back (Heading Back)

Pinching back or heading back is a process of pruning a branch back to a bud or side branch. This process encourages the plant to branch out, resulting in a bushier plant.

Plant Classification

Plants are universally known by their Latinized botanical names. Generally, only two names are used (Genus and Species). However, varieties or cultivars may break down the species into small subgroups. Pinus mugho mughus is an example of a varietal breakdown of Pinus (genera) mugho (species) mughus (variety).

Puddling

Puddling is a process used to settle the soil with water by eliminating air pockets during the planting process.

Root Ball

Ball of earth encompassing the roots of a plant. Generally, the root ball will have a good portion made up of root networks. A “manufactured-root ball” is one where the root system is not adequate to hold the soil in place. Manufactured root balls should not be accepted, since the root system is not developed sufficiently.

Rootbound (Pot Bound)

The condition of a potted or container plant whose roots have become densely matted and most often encircle the outer edges of the container. Generally, this condition is a result of holding the plant in the container for too long a period. Root bound plants should be rejected. See Section 9-14.6(2) of the *Standard Specifications*.

Root Collar (Plant Crown)

Root Collar is the line of junction between the root of the plant and its stem, also known as the plant crown.

Root Pruning

Cutting back and trimming the outer edges of the roots with a sharp tool to encourage a better, more fibrous root system. This is done periodically at the nursery. It should not be done at the project site before planting.

Runner

A long, slender, trailing stem that puts out roots along the ground. Where the nodes make contact with the ground, a new plant is produced. (For example: Hedera helix, English Ivy.)

Seedling

Seedling refers to a plant grown from seed as distinguished from a plant grown from cuttings. Trees less than 1 meter (3 feet) in height, shrubs, and other plants grown under natural conditions from seeds that are lined out in the growing field are called seedlings.

Species

A genus may include one or a great number of species. Each species is a particular kind of plant (i.e., Pinus ponderosa, Pinus contorta, Pinus mugho). The second word in a plant’s botanical name designates the species, distinguishing it from other plants in the same genus (plants with the same first name). Species in the same genera share many common features, but differ in one or more characteristics.

Soil Mixture

A mixture of growing medium such as sand, sawdust, perlite, vermiculite, peat and bark dust which is used to grow plant materials. The soil mixture usually contains two or more items and may be combined with the native top soil.

Stem

The main upward growing axis of a plant. The main stalk or trunk of a tree, shrub, or other plant. The main body of the above ground part of a plant.

Stolon

A stem growing horizontally on or just below the surface of the ground and usually rooting and producing a new plant at the nodes. (For example: Gaultheria shallon, Salal or Hypericum calycinum, Aaronsbeard St. Johnswort.)

Sucker

Any unwanted shoot. A side shoot from the roots of a plant. A side growth arising from an auxiliary bud.

Systemic

A substance (hormone, insecticide, herbicide, etc.), that, when absorbed and translocated makes the plant poisonous to certain pests and diseases. In the case of a herbicide, it can move into the root system and kill the root system.

Thinning

Thinning is the removal of some of the plants in a row or area, or trees in a stand, to open up or avoid crowding of plant or material. Thinning could involve the removal of branches, buds, flowers, or fruits for superior results.

Tolerant

A plant that is capable of withstanding unfavorable growing conditions (i.e., cold, heat, moisture, drought, etc.).

Tube Container

A tube container is a deep narrow container either single or in blocks used to produce deep root systems or unfinished nursery stock. A deep root system has advantages for establishment of plants where soil moisture is limited.

Unfinished Nursery Stock

Unfinished nursery stock is plant material not normally showing form characteristics of a mature plant. Unfinished nursery stock generally does not exceed 1 meter (3 feet) in height and is normally planted bare root. It can be planted from containers such as tubes or gallon cans (see Finished Nursery Stock and Liners).

Finished Nursery Stock

Coniferous trees taller than 1 meter (3 feet); deciduous trees taller than 1.8 meters (6 feet); shrubs and ground cover plants that begin to show form characteristic to their normal habit of growth are known as finished nursery stock.

Perlite

A lightweight, granular material made out of an expanded volcanic material and used in a growing medium or soil amendment. This material allows for a more aerated growing medium, with good drainage.

Vermiculite

A lightweight expanded mica product often used as a rooting medium for plants or as a soil amendment.

Watering In (Puddling)

The procedure of watering the backfill and the planting hole during the planting procedure. The purpose is to eliminate air pockets and voids around the roots, not to irrigate.

Whip

A young tree that has not started to branch.

WSNA

Washington State Nurserymen's Association.

8-2.3 Reference Reading

It is recommended that each office administering roadside planting, sit-in-parks, view point development, and rest area contracts, obtain and maintain a library of the following books and reference materials before the Contractor commences work.

Required Category — These books must be readily available to all landscape inspectors and Project Engineers:

1. Any literature referred to in the Special Provisions and *Standard Specifications*.

2. American Standards for Nursery Stock — American Association of Nurserymen, Inc.

3. Inspection Guide for Landscape Planting — AASHTO Subcommittee on Roadside Development 1973.

Recommended reading and reference material for all personnel involved in landscaping, roadside planting, and rest area projects:

1. A Technical Glossary of Horticultural and Landscape Terminology — Horticulture Research Institute.

2. Common Weeds of the United States — United States Department of Agriculture, Dover.

3. Ground Cover Plants — Donald Wyman.

4. Hortus Second — Bailey/Hortus Third — Staff of L.H. Bailey Hortorium.

5. Manual on Cultivated Trees and Shrubs — A. Rehder.

6. Shrubs and Vines for American Gardens — Donald Wyman.

7. Standardized Plant Names — American Joint Committee on Horticultural Nomenclature.

8. Sunset Western Garden Book — Lane Books.

9. Trees for American Gardens — Donald Wyman.

8-2.4 Inspection of Planting Stock

A. Inspection at the Nursery:

Whenever possible an inspection of planting stock should be made at the nursery or other approved source to ensure that quality planting stock will be provided. The Regional Landscape Architect and/or WSDOT Horticulturist should be requested to attend or participate.

The size and quality of planting stock cannot be rigidly standardized because of varying growing conditions. Judgment should be exercised and allowances made for reasonable variation in growth and appearance.

All planting stock should be of the genus, species, variety, and sizes specified and shall conform to the contract specifications for the particular species, or variety, regarding straightness of trunk, branching structure, proportion, and size of material.

Individual plants should be measured to determine conformance with contract specifications. If a particular detail of measurement has not been specified, the current edition of "American Standard for Nursery Stock, Z60.1" should be used.

Inspection at the nursery or other source of supply should include the following checks:

1. Check the general condition of the plant in the block from which the stock is to be taken for:

a. Uniformity of leaf coloration: Plants which exhibit yellowing or other discoloration could indicate poor drainage, fertilizer deficiency, herbicide damage, insect damage, or disease, and may not meet specifications.

b. Bud development: During dormant periods of the growth cycle plants should have buds that are firm, moist, and uniformly spaced. A slight cut into the bark may be made to determine that the cambium or growing layer just beneath the bark is moist and green.

c. Uniformity of growth: The plants in any given block should exhibit uniform vigor and health. Plants with less growth and which are less vigorous than the majority of the plants in the block may not be acceptable.

d. Spacing of plants in the row: Vigorously growing, well-rounded, fully developed plants will transplant well. Quality nursery stock should be grown with sufficient spacing to permit good development of the individual plant. Plants spaced too closely may be extremely high headed.

e. Soil: Plants to be balled must be grown from soil which will hold a firm ball. Broken or loose balls are a cause for rejection because of possible damage to the hair roots, a very important part of the plant's feeding system.

f. Presence of weeds: An overgrown, weed-infested nursery block indicates lack of care and the plants growing in it may be in a poor state of vigor because of the weed competition. Weeds should not be growing in containers.

2. Check individual plants for freedom of defects such as:

a. Decay: On trees, look for spots of decayed tissue on the trunk and branches.

b. Sunscald or sunburn: The destruction of tissue caused by the sun rays striking a plant on the south or southwest side. This may result in the death of cambium tissue and bark, exposing the plant to secondary insect and/or disease infestation.

c. Abrasions of the bark: Abrasions severe enough to damage the cambium tissue may be sufficient for rejection.

d. Girdling roots: Roots that grow around another root or a stem, thus tending to strangle the plant.

e. Improper pruning: Stubs resulting from improper pruning, which have died back, are an excellent point of entry for disease organisms. All cuts should be flush with the trunk or supporting branch. When a cut is made to encourage branching, it should be made back to a bud.

f. Frost cracks: Long vertical splits in the bark and/or wood may occur on the south and southwest sides of young and thin-barked trees. Such cracks may become invaded by canker or decay-producing fungi and bacteria.

g. Signs of injury: Dead leaves, dry buds; die-back of twigs and branches; blackened

sapwood and sunden, discolored patches of bark (sunscald) on the trunk or limbs.

3. Check individual plants for freedom from plant diseases and pests such as:

a. Diseases: These will appear in a variety of forms such as abnormal growth of leaves, twigs, fruits, discoloration of leaves and bark, unusual discharges of sap through the bark, etc. Any plant showing evidence of disease should be rejected.

b. Insects: Look for insect eggs, spider webs or evidence of damage from insect feeding on leaves, twigs, buds, or other plant parts. Examine the trunks of trees for borer holes which appear as tunnels drilled into the bark and inward into the wood of the trunk. Trees with evidence of borers or other insect damage should be rejected.

4. Check individual plants for proper habit of growth as follows:

a. If a particular habit, i.e., single stem, multiple stem, etc., has been specified, be sure to obtain plants that conform to this requirement.

b. If no particular growth habit has been specified, then the current "American Standard for Nursery Stock, Z60.1" as published by the AAN should be used as a guide.

c. Shade and flowering trees should have top growth symmetrically balanced. Shade trees should have a single leader. The branching should be well developed and characteristic of the species.

d. Evergreen trees should be full foliaged plants with uniform density. Sheared plants, such as pines sheared for Christmas trees, should be avoided unless specified.

e. Shrubs should be well branched in a manner characteristic of the species. The current "American Standard for Nursery Stock, Z60.1," is an excellent guide for determining the proper number of branches for certain size shrubs.

5. Check all container grown plants to determine that they meet the requirements outlined in 1 through 4, above. In addition, a random sampling of plants should be removed from their containers to determine that the root system is healthy. Plants which are found to be pot bound and plants which have insufficiently developed root systems to hold the soil together when removed from the container should be rejected. Healthy roots should be able to hold the soil mass together yet not be crowded around the outside perimeter of the container.

6. Planting stock which is based on the above criteria may be tagged with seals placed on all plants or representative samples at the nursery. This will assist in future inspection of these plants when delivered on the job site. Seals placed on planting stock for later identification do not imply acceptance on the construction site.

B. Inspection at the Construction Site:

Inspection of stock at the construction site is to ensure that the plants are from an approved source, are in a healthy and undamaged condition, and conform to sizes, quantities, and standards called for in the specifications.

This inspection should consider the condition of the plant and the use of proper handling procedures from the time of digging to delivery at the construction site.

Inspection at the construction site should include the following checks:

1. Each shipment of plants should be free of disease and insect pests, and meet all applicable State and Federal certification requirements. All necessary quarantine or State nursery inspection certificates should accompany each shipment.

2. All trees and a representative sample of shrubs should be legibly tagged with the correct botanical name, common name, and size to agree with the specifications and plant list. Bare-root plants should be shipped in bundles with each bundle properly tagged.

3. Planting stock which has not been inspected at the source should be inspected as appropriate, in accordance with items 1 through 6, "Inspection at the Nursery." This should be done as the material is being unloaded, or immediately thereafter, so that plants which are unacceptable can be set aside for removal from the project side.

4. Where root formation is irregular, measurement of the spread of bare-root plants should be the average, considering all sides of the plant, rather than the maximum root spread. The Inspector may allow moderate deviations from exact measurements in the case of plants which normally have irregular root systems.

5. Large root stubs on nursery grown balled or bare-root stock should be considered evidence of lack of proper care and root pruning, and sufficient grounds for rejection of such plants. Root stubs frequently characterize "collected" stock and

precautions should be taken to ensure that root systems are adequate.

6. Damage to plant material caused by improper operation of mechanical diggers may be sufficient cause for rejection at the construction site. Plants dug with equipment leaving a cone-shaped ball should be carefully checked to make sure that an excessive portion of the feeder-roots have not been cut away.

7. Bare-rooted plants should have adequate live, damp, fibrous roots, free of rot and mold. Earth balls should be unbroken and of specified size.

8. Precautions should be taken to prevent the drying of root systems in all shipments of plants to ensure arrival in good condition. During transport, plants must have been protected by a covering such as canvas or plastic sheeting. Bareroot plants should have been protected by moist burlap, sawdust, plastic, etc. Under no conditions should the roots system have been allowed to dry out. All plants must exhibit normal thrift and vigor.

Plants damaged in transit, or not conforming to the specifications, should be rejected. All rejected plants should be removed from the site immediately, and should be marked with something like spray paint to preclude the possibility of their future use on the job.

Following completion of inspection, all plants accepted should be carefully stored as required until planted.

C. Storage of Plants:

Plants not planted on the day of arrival at the site should be placed “in storage” and handled as follows:

1. Outside storage should be shaded and protected from the wind.

2. Plants stored on the project should be heeled-in to protect them from drying out at all times by covering the bare root or balls with moist sawdust, wood chips, shredded bark, peat moss, or other approved mulching material. Plants, including those in containers, should be kept in a moist condition until planted by using a fine mist spray or soaker hose, instead of a heavy stream which may cause damage.

8-2.5 Layout

The layout of landscape features should clearly show where exact dimensions are required and where some variances will be permitted. Accurate location of all buildings, roads, walks, paved areas, and features such as sculptures, walls, pools, etc. must be accomplished. Landscape beds, trees and indigenous features must be laid out to mold the Landscape Architect’s patterns to the existing topography and available area. Some variances are generally allowed in the bed areas and tree locations of the proposed plan to fit the particular situation, however, coordination with the various other plans and with the Landscape Architect is advised.

Trees must be adjusted for minimum clearance to roadways and allowances must be made for mowing (especially when the tree is fully grown). One must ensure that placement of trees is not over existing utilities or drains or that tall growing trees are not placed under overhead utility lines. Shrubs and ground cover beds are often intended for unmowable areas. The outline must be adjusted to fulfill the intent and the edge should create a “flowing” outline that is aesthetically pleasing and mowable. It is important that sufficient stakes are used to clearly outline the planting areas.

Inspection During Planting

The Inspector should determine that planting operations at the construction site are properly completed in conformance with contract plans and specifications and good horticultural practices.

Planting stock on hand and ready for planting at the construction site should have been inspected upon delivery, in accordance with items 1 through 8, “Inspection at the Construction Site.”

A. Preliminary Preparation:

1. The Inspector and Contractor should jointly review and become familiar with all plan sheets, quantities, details, specifications, and other provisions of the contract. At this time, questions or interpretations can be answered or problems resolved through discussion with the Landscape Architect, Horticulturist, or other authorized persons.

2. All materials that have specification requirements shall have an approval of source prior to incorporation or use on the project. Additionally, samples of these materials will be required to verify that the specifications are being adhered to. See Chapter 9 for further instructions and Chapter 8-2.6 for examples.

3. The Inspector should check and approve the stakeout of all planting areas and planting hole locations prior to excavation. Minor relocation of planting areas and holes can be done at this time to avoid utility lines, rock outcrops, drainage ditches, or impervious or wet soil conditions. If minor relocations of plantings are not possible, the Inspector should contact the Landscape Architect to adjust the design requirements.

B. Site Preparation

Prior to installation of plant materials at the construction site, the following preparation should be completed according to the requirement of the contract plans and specifications.

1. Weed control around planting holes or entire bed areas as called for by the contract specifications. The Inspector should check to be sure that weed root systems have been killed. The interior color of dead or dying roots is usually tan or brown, whereas healthy roots are usually white. if the root systems are alive, planting should be delayed until they can be killed. Perennial weeds with extensive root systems such as Canada thistle, Horsetail, Wild pea, Field bindweed and Quack grass (see Common Weeds of the United States — United States Department of Agriculture) should not be controlled by hand weeding; they should be controlled with herbicides by a licensed applicator.

2. Excavation of planting holes, pockets, or beds to the required size and depth and spaced as shown on plans.

3. Preparation and stockpiling of backfill mixture as called for by contract specifications.

4. The planting holes are to be excavated minimally to the sizes indicated on the contract plans. In mixed planting areas, usually trees are planted first followed by the larger shrubs, low shrubs and finally planted with ground cover plants. The holes for trees and large shrubs may be dug well ahead of time, provided that the holes are backfilled with an approved soil or soil mix within a day or two after digging. Where drains are needed, they are not to be dug or backfilled until planting time. This provides good inspection to aid in determining if a drain is actually warranted. Before backfilling, especially in drilled holes, the sides and bottoms must be scratched and loosened to break all “glazing.” This promotes moisture transfer between different soils (existing and backfill).

C. Interim Care of Planting Stock

Care must be taken to avoid damaging plants being moved from the storage area to the planting site. B&B plants should be protected against drying and handled carefully to avoid cracking or breaking the earth ball. Plants should not be handled by the trunk or stems. Bare-root plants should be “puddled” when removed from the heeling-in bed to protect the roots from drying. Plants should be protected against freezing or drying by a covering of burlap, tarpaulin, or mulching material during transportation from the heeling-in bed to the planting site. Should damage occur, or be found at this time, the plants should be rejected and removed from the site.

At the time of planting, the Inspector should be alert for any damaged balls, leaders, major branches, or roots. Pruning should be permitted to remove minor damaged branches which will not affect the characteristic shape of the plant (See Western Garden Book — Pruning Techniques). All rejected plants should be replaced during the current planting season.

In order to ensure against reuse of discarded plants, seals should be removed at the trunk or stems above the root crowns should be marked with a small spot of paint or dye. Since discarded plants are the property of the Contractor, they should not be marked or mistreated in such a way as to make them unfit for other uses.

D. Planting Operation

Unless in conflict with the contract specifications, the following check list of horticultural practices may be used by the Inspector.

1. Plantings should be performed only during the specified planting season.

2. The Inspector should check for proper positioning of the plants and the spread of the bare root system in the planting hole. When laying out shrub and ground cover beds, it is essential that the perimeter be defined by placing plants in a flowing line that clearly outlines the bed border. The interior should then be staked in accordance with the plant pattern and spacing. After B&B plants are set, burlap and any twine should be loosened, laid back and cut away or buried, if bulky, without damaging the ball. During the planting operation the burlap should have been pulled back from the base of the plant and either removed or buried. If the burlap is allowed to remain above the ground it will generally act as a wick and thus the plant will be surrounded by a dry barrier which the roots cannot penetrate. The twine should be cut or, if degradable, must be buried or it will girdle the plant and death of the plant will result. If non-biodegradable materials have been used, they should be removed entirely.

Planting Bare Root or Potted Ground Covers:

If the soil is dry, irrigate the planting bed the day before planting. The flats may be tilted up and the ends jarred against the ground to shift the soil and plants toward the lower end. Flats must be watered the day before planting. Block or cut out the plants and remove from the flat, retaining as much soil as possible. The hole must be large enough to take the root system without forcing or distorting.

3. Check for correct depth of the root collar.

4. Place approved backfill material around plant roots or plant balls, being careful not to damage the ball or the fine root system of bare-rooted plants. Backfill which is frozen or wet should not be used.

5. Eliminate air pockets in the backfill by filling, tamping, and watering as required by the specifications. It is generally advisable to water the plants thoroughly before the backfilling of the pit is completed. Container plants should be moist at the time of planting.

6. When the above operations have been completed, unless otherwise specified, a berm of soil should be placed around the perimeter of the pit to form a basin or saucer to facilitate watering and retention of rain or irrigation water.

7. Plants should be mulched to the specified depth with approved mulch material. The use of mulches about plants prevents rapid temperature fluctuation, reduces moisture loss, and aids in weed control. If herbicides are called for, a minimum waiting time must be observed unless specified to be applied over mulch. The herbicide label will give instructions such as intended use of the product, directions for use, and warnings. Care should be given to the mulching of ground covers, so as not to bury these plants with mulch.

8. Sometimes it is found that excessive moisture will necessitate drastic curtailment or elimination of planting in an area, or a different plant may be required. Consult with the Landscape Architect when excessive moisture is encountered. Mounding may be considered when it is necessary to raise the bed above the water table. It is lack of oxygen around the roots of plants that usually kills the plant, rather than ponded water.

E. Wrapping, Staking, and Pruning

All plants should be wrapped, staked, and pruned if specified.

1. Stakes should be driven solidly into the ground and guying installed to prevent movement of the plant until the roots system is firmly established in the new planting location.

2. Trunks or stems of plants should be wrapped from the root collar or plant crown to the lower limbs with approved material to protect against drying or other physical damage.

3. Deciduous plants should be pruned at planting time to restore a balance between the root and top growth. Tops should be pruned to compensate for the partial loss of roots when the plant was removed from the nursery, in a manner that will retain the characteristic shape of the plant. The larger pruning wounds and those made with a pruning saw should be finished smoothly with a pruning knife and dressed with pruning paint (see Sunset Garden Book — Pruning Techniques).

4. Generally, all deciduous trees should be pruned by removing one-third to one-half their former branch structure. Broken or damaged branches, plus competing leaders, should be removed. Birches, Maples, and Cherries should not be pruned in late spring. The running sap causes “bleeding” which is harmful and attracts diseases.

Trees may be pruned before planting to save time and trouble. At this time, hand clippers can be used to cut closer than can be done with pole pruners — usually used for trees in an upright position. Pruning and wrapping may be done under Inspector’s supervision prior to planting.

5. All broken, torn, or damaged roots should be pruned, leaving a clean cut surface to help prevent rot and disease.

6. Deciduous shrubs should be pruned to approximately one-half their former branch structure.

7. Coniferous evergreens normally should not be pruned except for broken branches, unless otherwise specified or directed.

Watering:

The planting operation is completed by watering all plants as specified. Weather and soil conditions dictate the need for watering. Over-watering is as harmful as under-watering.

8-2.6 Materials

Materials on landscaping projects include many items besides plant material, such as planting media, pesticides, fertilizer, mulch, staking and guying material, irrigation/electrical material (pipe, pumps, sprinklers, backflow control devices, valves, etc.) drainage, surfacing, and more. Chapter 9 of this manual, covers the inspection and testing of the more common highway construction materials encountered.

Plant Material

Sampling of plant materials must be done with judgment and selectiveness. Look the entire lot over, carefully, noting the general size differential, and coloring, the sturdiness, the shapes, needle dropping on evergreens,

condition of bare root, bare root drying, denseness of bare root hair and fibrous root system, firmness of the ball for B&B, general size of balls, wrapping method, evidence of handling methods and all items of emphasis pointed out in the plans and specifications.

Bare root plants must be dormant when gathered and prepared for shipping. This can normally be ascertained in distant areas by calling on the services of the agricultural extension agent in the vicinity of the nursery. If trees are not generally dormant, an on site inspection must be made as nurseries may be able to satisfactorily induce dormancy by cold spraying or other means. The normal test for dormancy is observation; if the plant has been subjected to cooling environment and the majority of the leaves have fallen naturally it is a good indication of dormancy. Expert advice of a trained horticulturist should be obtained in all other cases.

In Section 8-02.2 of the *Standard Specifications*, the Contractor is required to submit a sample of each plant specified, except trees. Photographs shall be submitted for trees. These photographs are to clearly show enough detail for positive identification of the variety and form of the plant materials. The purpose for these samples is to identify all of the plants to verify that they are the plants intended by the Landscape Architect. A plant name may be identified with different plants in other parts of the country. Once the identities of these plants by botanical name are approved, they should be properly cared for at the field office so the project staff may study and learn to recognize them through association.

Planting Media

Various additives are used to improve the root growing environment of that soil that exists on the site (such items as perlite, vermiculite, sand, gravel, sawdust, peat, etc.). The additives may be either used singularly or in combination with the existing soil. The planting (growing) media material should be checked against the specification.

Pesticides

Pesticides should be applied with caution, by a licensed applicator. The label should be checked for the proper material and timing of application. The label also indicates if the material is registered for use on a particular type of plant material. Pesticide Application Record (WSDOT Form 540-509) shall be completed daily by the Licensed Applicator with a copy to the Project Engineer daily. The Project Engineer shall distribute a copy of this record daily to the Regional Operations or Maintenance Engineer and to the Roadside Maintenance Section at the Field Operations Support Service Center in Olympia.

Fertilizers

Fertilizers should be applied in accordance with the specifications. The formula should be cross checked with the specifications and the label on the bag or container. When water soluble nitrogen fertilizers are used, particularly in lawn areas, adequate moisture is needed to prevent fertilizer burning.

Irrigation Materials

Irrigation materials include such items as piping, backflow control devices, valves, backfill material, electrical, sprinkler heads, etc. They are normally approved by the Olympia Service Center Materials Laboratory. These items should be cross-checked with the specifications and/or the Landscape Architect to ensure products are satisfactory and are being installed correctly.

Drainage

Drainage materials include gravel backfill, culvert piping, french drains, etc. These drainage items should all be checked as to functionality and compliance with the *Standard Specifications*.

Surfacing

Surfacing may take the form of gravel, asphalt, cobblestones, concrete, brick, wood, combinations of different materials, etc. The use expected, effect desired, and budget allowed determines the material selected. The surfacing materials should be checked in accordance with the specifications.

8-2.7 Progress Schedule

The Contractor's progress schedule should show the order in which the Contractor proposes to perform the work within the contract time. It should show the beginning and completion times for the several prominent features of the work provided in the contract. If specified by the contract, such schedule will be in the form of bar graphs developed under the critical path method, PERT, or other methods. Upon request of the Project Engineer, the Contractor will submit supplementary progress schedules in the form required by the Project Engineer. In the case of material to be grown, it shall, in detail, specify planting and propagation times. Times in or out of greenhouses and times shown for activities related to dormant or seasonal requirements will be anticipated times to be adjusted to actual times for the year involved when they become known. The "energizing" time for electricity and water must be checked with the servicing utility for feasibility and scheduling.

The schedule must contain the weed control plan before starting work on the project, the anticipated planting per day and areas to be worked concurrently. The underground

irrigation, electrical or other work within the planting areas must be completed and working before planting.

The correct timing for herbicides, fertilizing, mulching, pruning and all other phases must be specified in relationship of one event to another.

8-2.8 Inspection During the Plant Establishment Period

The completion of planting in any given area may preceed the start of plant establishment by considerable time. When plant establishment is started, the area should be inspected to make sure that all plants are in place and healthy.

Although planting stock has been properly selected, delivered to the planting site in a vigorous, thrifty condition, and planted in accordance with good horticultural practices, survival and normal growth depend to a large degree upon appropriate care during the establishment period.

If differences of opinion concerning the need for a particular procedure occur, and the answers are not readily found in this guide, the Inspector should seek the counsel of a horticulturist or landscape architect.

Ideally, the establishment period should encompass the time required by the planting to become acclimated to the growing conditions at the planting site. The project specifications should clearly indicate the length of the establishment period, which may vary from one area of the State to another, depending on the local conditions, climate, and the type of plant materials utilized.

A well rounded program of horticultural practices used during the establishment period may include watering, fertilizing, pruning, insect, disease, and weed control, and replacement of unsatisfactory plants in accordance with the specifications.

A. Inspection Check List

The following inspection check list includes critical items which should be observed periodically during establishment.

1. Plants must be kept in proper position as appropriate for the species. Plants may require repositioning as a result of settlement, wind action, vandalism, etc. Care should be exercised in straightening to minimize disturbance to the root mass and should include replacing topsoil as required.

2. Stakes should be firmly imbedded, redriving may be necessary.

3. Guy wires should be snug. Adjustments may be necessary to keep the tree straight and to prevent swaying.

4. Protective wrapping on trunks or stems should be secure.

5. Vehicular, fire, or damage due to vandalism should be noted and corrective action taken.

6. Note damage caused by animals (i.e., deer, rodents) and seek advice on control measures.

7. Report infestations of insects and disease to the horticulturist or other appropriate professional for corrective action.

8. Inspect for broken branches or sucker growth and have them removed by pruning.

9. Where discoloration of foliage occurs, especially in evergreen material, advice on corrective measures should be sought.

10. Dead and severely damaged plants should be removed immediately and replaced during the next appropriate planting period.

11. Inspect for settlement of soil or soil mix and replace to required grade, repositioning the plant if necessary.

12. Check overall depth of mulch and add or replace as required.

13. Inspect berms and water basins (constructed for the purpose of retaining water) to ensure that they are functioning properly. Repair and rebuild as necessary.

14. See that project areas are weeded as specified.

15. If natural rainfall during the establishment period is insufficient for normal plant growth, supplemental water should be supplied. The method of application and quantity of water used should be specified.

16. If planting projects require the use of fertilizers, specifications should be followed.

17. Pruning should be performed at the appropriate time by qualified personnel, utilizing the best horticultural practices and tools.

B. Inspection at the End of the Plant Establishment Period

The inspection should include a plan-in-hand review of each planting area or bed to determine that the arrangement, number, and species of healthy plants called for on the planting plans are present.

Since this inspection is of major importance to the ultimate success of the project, a landscape architect and horticulturist, as well as the Inspector and Contractor, should be members of the inspection team.

All plants rejected during the inspection should be removed and replaced by new plants which meet all of the requirements of the contract and the Standard Specifications.

The final acceptance of the project shall not be completed until all plant requirements have been satisfactorily made.

8-2.9 Measurement and Payment

Measurement and payment instructions are covered in Sections 8-02.4 and 8- 02.5 of the *Standard Specifications*.

Payment for trees, shrubs and ground cover plants is to be made as specified in the contract. The Project Engineer shall make an inspection of the planting areas before payment is made, to determine if the required work has been accomplished and the number of plants are in a healthy condition. No payments shall be made for plants that are not in a healthy condition although partial payment may have been made following a previous inspection.

8-3 Irrigation System

8-3.1 General

Irrigation has been defined as "The artificial watering of land (as by canals, ditches, pipes, or flooding) to supply moisture for plant growth."

Frequently, irrigation systems are designed to produce optimum soil moisture levels, thereby encouraging maximum plant growth and/or maximum crop yield. The use of irrigation in WSDOT landscaping projects differs from this, however, since our primary concern is different from that of commercial growers.

The objective of WSDOT is to help ensure plant survival by supplementing natural precipitation during dry periods. This can often be accomplished with far less water than that required to obtain maximum growth and yields. Application rates of irrigation systems are, therefore, designed from the standpoint of minimum moisture requirements of the plants.

A properly designed and installed irrigation system will distribute water uniformly over the intended planting area at a predetermined precipitation rate. Many factors influence the efficiency of a system's operation and must be taken into consideration during the design stage. In addition, care must be taken when inspecting installation of the irrigation system to ensure that the system not only follows the designer's intent, but also fully conforms to the *Standard Specifications*, project plans and provisions, and the manufacturer's requirements and recommendations.

The most efficient and economical irrigation design is only as good as its installation, and this depends upon careful and thorough inspections.

8-3.2 Layout

Turf areas and planting beds shall be laid out prior to staking the irrigation system. If adjustments to the irrigation system are required, they must produce a system which will provide a uniform sprinkling pattern without leaving dry areas.

Sprinkler heads to be located adjacent to the perimeter of planting beds should be laid out first to approximate as closely as possible the designed or approved revised configuration of the planting area. The remainder of the planting area should then be filled with the spacings between heads not to exceed that which is shown on the plans or recommended by the manufacturer.

Review all layouts and measure the distance between adjacent heads to ensure that full coverage of water will be attained. If the pattern is not uniform in coverage, or if the distance between heads exceeds that recommended by the manufacturer, the layout will need to be adjusted.

Unless otherwise specified in the project provisions, all irrigation systems shall be completed, tested, approved, and properly backfilled before landscaping can begin.

Advise the Regional Landscape Architect when the irrigation system has been staked in the field.

8-3.3 Materials

All components intended for use in an irrigation system must receive approval from the Materials Engineer prior to their incorporation into the project.

Approval of items is determined from information supplied on "Request for Approval of Material Sources," Form 350-071, and accompanying catalog cuts. All components of the irrigation system shall be listed and identified by their corresponding bid item number where applicable. Sufficient information must be included to positively identify each item listed. Each item shall be identified by size, catalog number, and the name of the manufacturer.

Four copies of catalog cuts of all items listed shall accompany the Request for Approval of Material Sources Notification of approval or rejection of either the source or the components will be forwarded by the Materials Engineer to the Project Engineer. The Project Engineer will inform the Contractor of the approval action.

If samples are requested for preliminary evaluation, it will be the Contractor's responsibility to obtain and submit the designated items to the Materials Lab for testing. Unless destructive testing is required all items will be returned to the Contractor upon completion of testing, at which time approved items may be incorporated into the project.

8-3.4 Inspection

An efficient irrigation system is the result of, and depends upon, proper design, installation, and maintenance.

A properly installed system is one that not only follows and fulfills the designer's intent, but which in addition meets the requirements of the project plans and documents and has been installed according to the manufacturer's suggestions and recommendations.

Thorough inspections, carefully conducted during construction, are of utmost importance to help ensure proper installation. To be adequately prepared for inspecting the installation of irrigation systems, it is of great benefit for the Inspector to have previous knowledge, preferably some experience, in at least one of the various aspects of irrigation design, installation, and maintenance. This not always being possible, it becomes necessary for the Inspector to first familiarize himself with those portions of the *Standard Specifications* and contract documents that pertain to inspection and irrigation systems before attempting the necessary inspections. In addition, since irrigation inspection requires such varied and versatile knowledge and experience, it is advisable for the Inspector to obtain additional advise and/or assistance from WSDOT personnel having the expertise in these specialty areas.

An inspection shall be conducted on all irrigation system components delivered to the project site to determine acceptance or rejection. If at any time, until the system is completed and turned over to WSDOT, components are found that are either damaged, defective, or not formally approved for use on the project, they shall be rejected. Information indicating acceptance or rejection of components shall be properly documented and maintained by the Inspector at all times.

Section 8-03.4 of the *Standard Specifications* states that measurement of irrigation systems is determined by the actual length of materials and/or the actual number of the various items incorporated in the completed work. Therefore, the Inspector shall tabulate all quantities of in-place irrigation system materials and components prior to backfilling. In addition, all information supplied by the Contractor to produce the as-built plans in regard to component quantities, sizes, and locations, shall be verified by the Inspector prior to backfilling.

8-3.5 Installation

Once the irrigation system layout has been staked and approved by the Project Engineer, the Contractor may commence excavation.

Trench bottoms shall be relatively smooth to provide support along the entire length of pipes to be installed. In addition, and as specified in Section 8-03.3(2) of the *Standard Specifications*, trench bottoms shall be of sand or other suitable material free from rocks, stones, or any material which might damage the pipe.

All system components shall be installed in accordance with the project plans and documents, using methods or techniques recommended by the respective component manufacturers. Solvent welding is a technique used to bond PVC pipe and fittings together. The solvent cement used in this type of installation is, as its name implies, a solvent which dissolves those portions of the pipe and fittings surfaces to which it is applied, to form a continuous bond between the mating surfaces. During the construction of PVC solvent weld joints, excess cement is forced out by the insertion of the pipe into the fitting socket. This excess cement, if not immediately removed, will dissolve the surface of the pipe at its point of accumulation and will result in a permanently weakened spot. It is necessary, therefore, that this excess cement be wiped at the time the joint is made and that the Inspector check to ensure that it has been done.

Plastic pipe is subject to considerable expansion and contraction with temperature changes. To provide for this, pipe should be "snaked" from side-to-side in the trench.

Care shall be taken during the installation of the pipe to ensure that rock, dirt or other debris is not allowed to enter the open ends of the pipe.

Electrical control wire between the automatic controller and the automatic control valves, shall be bundled together at ten-foot intervals and "snaked" from side-to-side in the trench, either adjacent to or beneath the irrigation pipe. Snaking of the wire helps eliminate wire stressing or breakage caused by expansion or contraction of the earth due to variations in moisture content or extreme seasonal temperature fluctuations. Placement of the wires adjacent to or beneath the irrigation pipe is for protection against damage from possible future excavation.

Electrical splices shall be permitted only in valve boxes, junction boxes, pole bases, or at control equipment. No direct burial splices shall be allowed. Types of electrical splices allowed in WSDOT irrigation projects shall be only those approved for use by the Materials Engineer.

Freeze protection must be provided as specified in the project documents. Either a three-way valve with compressed air fitting for blowing water out of the lines, or

drain valves placed at the low point of each lateral must be used. If the three-way valve and air fitting is to be used, it must comply with one of the designed installations approved for use by the Department of Social and Health Services. If drain valves are used, care must be taken to ensure that the lateral lines are properly sloped to provide complete drainage.

8-3.6 Cross-Connection Control, Backflow Prevention

A cross-connection is any actual or potential connection between a potable water supply and a source of contamination or pollution.

A cross-connection is not in itself dangerous. It is only when contamination passes through it and into a potable water system that a health hazard is created.

Backflow is the unwanted reverse flow of liquids in piping system and is the major means by which contamination of potable water can occur.

Backflow is the result of either back pressure or back-siphonage. Backflow from back pressure can occur any time pressure produced in the non-potable piping system is greater than that existing in the potable side. Backflow from back-siphonage is the result of a negative or subatmospheric pressure within a potable water system, causing contaminants from the non-potable side to be suctioned in.

Irrigation systems supplied by domestic potable water systems are potential pollution hazards to the potable water. Such cross-connections require protection to prevent the possibility of backflow.

A backflow prevention, cross-connection control device is any device, method, or type of construction used to prevent backflow into a potable water system.

An approved backflow prevention, cross-connection control device is one that has been investigated and approved by an appropriate regulatory agency. The approving or regulatory agency for backflow prevention, cross-connection control devices for the state of Washington is the Department of Environmental Health. This agency periodically publishes a list of approved cross-connection control devices.

The local water purveyor determines the type of backflow prevention device to be used to protect domestic water supply systems under his jurisdiction. This determination is based upon the water purveyor's estimation of the probability of backflow occurring and the degree of hazard created if it should. Once the type of device to be used has been determined, the device shall be selected from the Department of Environmental Health current list of approved cross-connection control devices.

Installation of cross-connection control devices shall conform to the *Standard Specifications*, the project plans and documents, the manufacturer's recommendations, and the "Accepted Procedure and Practice in Cross-Connection Control Manual." In all cases, the backflow prevention device shall be tested by a certified inspector prior to activating the system. Additionally, Form 540-020, shall be filled out and the appropriate distribution made.

8-3.7 Serving Utility

The Project Engineer shall contact the serving utilities as soon as the Contractor's schedule is known, to arrange for the actual service connections, and to ensure that all agreements are completed and billing procedures are established.

8-3.8 As-Built Plans and System Orientation

The Project Engineer is required to submit As-Built Plans in accordance with Chapter 10-3.7 of this manual.

Accurate As-Built Plans are a valuable and necessary aid in designing and constructing future projects for the area, and for maintenance and repair of the irrigation system. Therefore, it is imperative that these As-Built Plans show the true location, size, and quantity of components installed.

Sections 1-05.3 and 8-03.3(10) of the *Standard Specifications* state that the Contractor is responsible for supplying working drawings, corrected shop drawings, schematic circuit diagrams or other drawings necessary for the Engineer to prepare corrected plans to show the work as constructed. To help ensure accuracy of this information requires that the Contractor or field representative record each change as it is completed. In addition, the Inspector shall inspect and verify this information prior to the commencement of backfilling. Upon completion of this, all working drawings and pertinent information shall be submitted for the Project Engineer's approval and use in preparing the As-Built Plans.

The Contractor is also required to conduct a training and orientation session for WSDOT personnel covering the operation, adjustment, and maintenance of the irrigation system. The Project Engineer shall arrange to have the maintenance personnel who will be involved with the irrigation system attend this orientation session. The As-Built Plans shall be available so they can be reviewed and all features explained. One copy of the As-Built Plans shall be presented to the maintenance personnel at that time, along with parts lists and service manuals for all equipment.

8-3.9 Measurement and Payment

Measurement and payment instructions are covered in Sections 8-03.4 and 8- 03.5 of the *Standard Specifications*.

8.4 Curbs, Gutters, Spillways, and Inlets

8-4.1 General

The *Standard Specifications* specify the class of concrete to use when constructing the various items. Quite often the Contractor places the concrete for these miscellaneous items at the same time of placing concrete for other work. When this is the case, it is usually more convenient for the Contractor to use the same class of concrete for all the work during the day. At the Contractor's request, the Project Engineer may accept a higher class of concrete in lieu of the class specified at no increased cost to WSDOT. This substitution should be documented in the diary, Inspector's daily report or other records.

8-11 Guardrail

8-11.1 General Instructions

Since guardrail is expensive to construct and requires continual maintenance, it should be constructed only where hazardous conditions justify its use. During construction, the Project Engineer should investigate eliminating the need for guardrail by flattening the slopes, or otherwise removing, relocating, or modifying the hazard whenever possible. The final evaluation of the need for guardrail should be made in the field after the embankment has been constructed. Even though the fill has been widened for guardrail, it should not be constructed if it is determined at this time that guardrail is not needed.

See Section 710 of the *Design Manual* and other pertinent instructions for design criteria for guardrail.

For safety reasons the guardrail shall have the ends flared away from the roadway and anchored in accordance with the appropriate Standard Plans. The construction inspector should pay particular attention to make sure that the rail washers are consistent with the current Standard Plan.

8-11.2 Erection of Posts

The posts shall be set to the true line and grade of the highway and spaced as shown on the Standard Plans. Post may be placed in dug or drilled holes. Ramming or driving will be permitted only if approved by the Engineer and if no damage to the pavement, shoulders and adjacent slopes results therefrom. The post holes shall be of sufficient dimensions to allow placement and thorough compaction of selected backfill material completely around the post.

8-11.4 Measurement and Payment

Measurement and Payment Instructions are covered in Sections 8-11.4 and 8-11.5 of the *Standard Specifications*.

8-12 Chain Link Fence and Wire Fence

8-12.1 General

Six types of chain link fences are provided in the Standard Plans. Type 1 and 6 are the highest quality fence with top rail and tension wire along the bottom of the fabric. Type 5 fence will normally not be used on initial construction work.

Two types of wire fence are provided in the Standard Plans. Type 1 is a combination of barbed wire and wire mesh. Type 2 consists of barbed wire. Steel or wood posts may be used with either type provided that only one material is used consistently throughout the job.

8-12.2 Clearing and Grading

Since preservation of natural growth is being stressed, clearing will have to be performed specifically for the fence construction on many projects. In these cases, only the width necessary to accommodate the fence construction should be cleared. Some grading is usually necessary to prevent short and abrupt breaks in the ground contour that will affect the aesthetic appearance of the top of the fence. Care needs to be exercised to prevent clogging natural drainage channels while grading the fence line.

8-12.3 Measurement and Payment

Measurement and payment instructions are covered in Sections 8-12.4 and 8-12.5 of the *Standard Specifications*.

8-14 Cement Concrete Sidewalks

8-14.1 General

Air entrained concrete Class 20 (3,000) shall be used for construction of sidewalks. Forms may be of wood or metal and full depth of the sidewalk. The forms should be straight or uniformly curved and in good condition.

In rest areas and park areas where the sidewalks are normally laid out in a winding pattern rather than in straight lines, care must be taken in setting the forms so that the sidewalk will present a pleasing appearance with no kinks or angle breaks. The forms must be braced and staked sufficiently to maintain them to grade and alignment. Usually, spreaders are necessary to properly space the forms and hold them in position until the concrete is placed. If the Contractor uses thin strips of form material for winding sidewalks, more than one thickness with staggered joints should be used to obtain the smooth flowing lines. In forested areas, all roots should be

removed or cut back. After the forms have been set to line and grade, the foundation shall be brought to the required grade, compacted and well dampened before placing the concrete.

8-14.2 Placing, Finishing, and Curing Concrete

After the concrete is placed, it should be tamped and then struck off with a heavy iron-shod straightedge. The concrete should be troweled smooth with a steel trowel and then lightly brushed in a transverse direction with a soft brush. On grades of over 4 percent the surface shall be finished with a stipple brush or as the Engineer may direct. Following brushing of the surface, the concrete shall be edged and jointed as shown in the plans or the Standard Plans. In areas adjacent to existing sidewalks, the jointing pattern should be similar to the existing pattern.

Expansion joints shall be constructed at the locations and of the sizes as detailed in the plans or in the Standard Plans.

All concrete sidewalks shall be properly cured. During this curing period, all traffic, both pedestrian and vehicular, shall be excluded and vehicular traffic must be excluded for additional time for it to obtain most of its design strength.

8-14.4 Measurement and Payment

Measurement and payment instructions are covered in Sections 8-14.4 and 8-14.5 of the *Standard Specifications*.

8-20 Illumination, Traffic Signal Systems, and Electrical

8-20.1 General

Illumination and traffic signal systems, due to the very nature of the work, are a highly specialized type of installation. In designing these systems, every effort is made to foresee all of the problems that may arise, from the construction viewpoint, the future maintenance viewpoint, and the viewpoint of the serving utility company upon whom we must depend for electrical service. As in most projects, it is impossible at times to foresee all of these problems. The following sections are intended to cover some of the problems which may be encountered. Undoubtedly, other problems will come up. When they do, it is suggested that the Engineer contact those responsible for the design and operations for help in solving the problems to the best interest of all concerned.

8-20.2 Materials

8-20.2A Approval of Source

All materials for installation on illumination and traffic signal projects shall be listed on the Request for Approval of Material Source and be submitted to the Materials Laboratory for appropriate action. This list shall be complete and cover all materials which are identified on the plans or in the specifications. The list shall include the source of supply, name of manufacturer, size and catalogue number of the units, and shall be supplemented by such other data as may be required including catalog cuts, detailed scale drawings, wiring diagrams of any non-standard or special equipment. All supplemental data shall be submitted in six copies.

The Record of Materials form from the laboratory will normally list the items for which preliminary samples or data are required. Control samples will be required of all conduit, wire, electrical wire connectors, luminaires, lamps, and any other material requested by the Materials Laboratory. Preliminary and control samples shall be submitted as required by form 350-029, Record of Materials, received from the laboratory at the beginning of the project. When electrical materials which are unique or unfamiliar are encountered, samples or data should be submitted to the Materials Laboratory.

8-20.2B Shop Drawings for Illumination and Signal Standards

The Contractor is required to submit shop drawings for all types of signal standards and for light standards without pre-approved plans. If light standards with pre-approved plans are proposed, no shop drawing submittal is required. However, at the Contractor's request, the Engineer will provide H1 distances.

There are two different approval procedures for shop drawings. They are Bridge and Structures office approval, and Project Engineer approval only. In either case, the Contractor is required to submit six sets of drawings. The two approval procedures include the following:

A. Bridge and Structures Office Approval

1. Light standards without pre-approved plans.

2. Types II, III, IV, V signal standards without pre-approved plans.

3. Type SD (Special Design) signal standards without pre-approved plans.

B. Project Engineer Approval Only

1. Types PPB, PS, I signal standards, Standard Plan J-7a.

2. Types II, III, IV, V signal standards with pre-approved plans.

After the Contractor has submitted shop drawings, the Engineer shall make a field check of both contract plans and shop drawings. The Project Engineer is responsible for checking the geometric features of these items. Specific items that should be checked include the following:

1. Foundation locations.

2. Light source to base dimension (H1) and clearance to overhead utility wires.

3. Mast arm lengths. If foundation offsets are changed, mast arm lengths must be adjusted.

4. Horizontal dimensions from single standard pole centerline to signal head attachment points.

5. Vertical dimensions from signal standard base plate to signal mast arm connection points. Assistance is available from the Traffic Design office in estimating mast arm deflection to ensure vertical clearance requirements are met.

6. Orientations of mast arms and all pole-mounted appurtenances.

7. Signal head mounting details.

8. Handhole location and orientation.

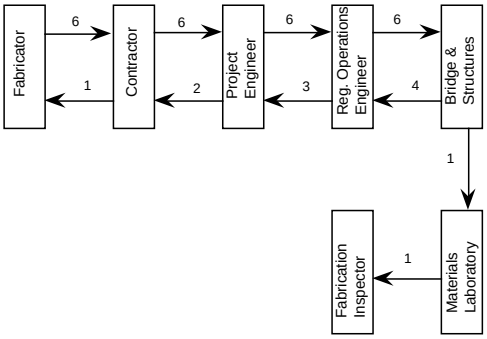
9. Base treatment for lighting standards (fixed, or slip or breakaway.)

If there are no changes to dimensions or orientations, the Project Engineer shall mark the drawings with a statement that all standards shall be fabricated according to dimensions and orientations shown in the Contract.

If there are corrections, the Project Engineer shall note all corrections on one set of shop drawings with green markings only and attach copies of signal standard chart and/or luminaire schedule from contract, noting any dimension changes in green. Transmittal letter Form 410-025 shall be used to submit the entire package.

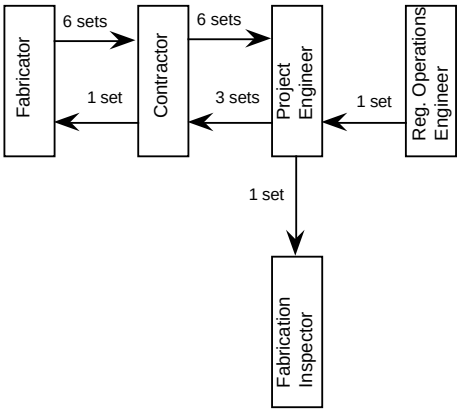
The Bridge and Structures office will conduct a structural review, and mark all sets in red, incorporating the Project Engineer's geometric review comments.

The six sets of shop drawings for supports without pre-approval shall be submitted to the Bridge and Structures office, which will coordinate approval with the Materials Engineer. After approval, the Bridge and Structures office will retain one set and forward one set to the Materials Engineer and send four sets to the Regional Operations/Construction Engineer. The Materials Engineer's set will be forwarded to the Fabrication Inspector. The Regional Operations/Construction Engineer will forward three sets to the Project Engineer. The Project Engineer will send two sets to the Contractor, who will forward one set to the Fabricator (see Figure 8-1).



Shop Plan Approval Flow Chart
Bridge and Structures Office Approval
Figure 8-1

If pre-approved shop plans have been submitted, a structural review by the Bridge and Structures office is not required. The Project Engineer shall mark all changes in red on all six copies. The Project Engineer will then retain one set of plans, forward one set to the Regional Operations/Construction Engineer, one set to the Fabrication Inspector, and three sets to the Contractor, who will forward one set to the Fabricator (see Figure 8-2).



Shop Plan Flow Chart
Project Engineer Approval Only
Figure 8-2

All drawings shall be clearly marked ("Approved as Noted," "Returned for Correction," etc.) before returned to the Contractor, whether reviewed and checked by the Project Engineer or the Bridge and Structures Office.

8-20.3 Relations with the Serving Utility

Generally, during the design of an illumination or traffic signal system, the serving utility is consulted concerning the availability of power, the voltage needed, the location of the most convenient point of service, and agreements are prepared prior to the awarding of the contract. The Project Engineer should review all utility agreements and contact the serving utility as soon as the Contractor commences work to arrange for the actual service connections and other work which may have been agreed upon. The matter is important since, in many cases, the utility will have to extend lines, install transformers, and do other related work. Upon completion of the contract, the Project Engineer will instruct the serving utility to direct all future billings to the appropriate maintenance division.

8-20.4 Inspection

Inspection on electrical projects involves two aspects of work. The first of these is the physical aspect wherein conformance to the plan requirements relative to the materials used and general construction techniques must be the criterion for judgment. An Inspector who is thoroughly familiar with the requirements of Section 8-20 of the *Standard Specifications* and with normal construction techniques should be assigned the inspection responsibility for this portion of any signal or illumination project. The Fabrication Inspector shall be consulted if lighting or traffic signal standards arrive on the jobsite without prior inspection.

The second aspect of electrical work involves the conformance by the Contractor with the contract requirements in addition to the requirements of the State electrical construction codes and the National Electric Code. This aspect of inspection must be performed by an electrical Inspector. A further consideration within this aspect of work involves any changes authorized in the contract plans as it may affect circuit stability, circuit adequacy and the ability of related electrical control devices to properly function through any such change of plans. The performance testing of the system is part of the second aspect of the electrical work.

Electrical work is a specialized field of endeavor within WSDOT; therefore the Project Engineer must arrange for the assistance of an electrical Inspector from the Regional office. The electrical Inspector shall make periodic inspections throughout the course of construction of all electrical projects and shall advise the Project Engineer of appropriate times to enable the Project Engineer to occasion the required field tests of electrical circuits, as discussed in Section 8-20 of the *Standard Specifications*, at such times that cause a minimum interference of the work scheduled by the Contractor. Should any question arise on a project pertaining to the technical nature of the work, the Project Engineer shall consult with the electrical Inspector or with the Regional Traffic Engineer if necessary.

Our plans and specifications are designed to conform with existing national and State electrical codes. Generally local inspection authorities do not inspect highway work. From time to time, however, State or local electrical inspectors may visit a project to inspect or review the Contractor's work. They should be treated courteously and their judgment respected. Should any question arise over a conflict between our plans and their opinions, the matter should be referred to the Olympia Service Center Construction Office for advice.

8-20.5 As-Built Plans

The Project Engineer is required to submit As-Built Plans in accordance with Chapter 10-3.7 of this manual. For proper maintenance and repair of the electrical system, it is imperative that the location of all conduits and the diagram of all circuits be properly shown on the As-Built Plans.

Normally the conduits should be constructed in the locations shown on the contract plans. Many times these conduits are positioned in a particular place to eliminate conflict with future construction.

Section 8-20.3(17) of the *Standard Specifications* requires the Contractor to submit any corrected shop drawings, schematic circuit diagrams or other drawings necessary to prepare the corrected as-built plans.

8-20.6 Construction

8-20.6A Foundations

The foundations shall be located and constructed as detailed on the plans wherever possible. When foundations cannot be constructed as detailed, due to rock, bridge footings, drainage structures or other obstructions, an effective foundation will have to be developed for the conditions encountered and approval obtained. The location of lighting standards or signal standards shall not be moved without discussing the problem with the Regional Operations/Construction Engineer and the Regional Traffic Engineer.

Foundations located on fills, especially those adjacent to bridge abutments, shall be deepened to provide stability as provided for in Section 8-20.3(4) of the *Standard Specifications*.

8-20.6B Conduit

Generally, conduit runs should be located on the outer shoulder areas, well away from the position where signs, delineators, guardrails and other facilities will be placed.

On new construction, all conduit located under paved surfaces shall be placed prior to construction of base course and pavement. It shall be the responsibility of the Project Engineer to see that all contractors on any project coordinate their work to this end.

At locations where plastic conduit is allowed and hard rock is encountered within the minimum depth required, steel conduit should be substituted for the affected runs, and the depth adjusted as necessary. Sufficient cover must be provided to protect the conduit from damage as provided in Section 8-20.3(5) of the *Standard Specifications*.

8-20.6C Junction Boxes

In most designs, precast concrete junction boxes are being used. These boxes are simple to install. A sump is excavated and partially filled with gravel. The open-bottom box is then seated by working it into the gravel until the required grade is reached. Care must be taken in junction box location to provide for drainage.

8-20.6D Wiring

An electrical system is only as good as its conductors, terminals and splices, and it is important that the requirements of Section 8-20.3(8) of the *Standard Specifications* be strictly adhered to. It is permissible to allow the Contractor to use pressure connectors for illumination circuit splices in lieu of soldering provided adequate connection is obtained. There are several good connectors available, “Scotchlock,” “Burndy,” “T & B,” to name a few. If there is any doubt concerning the adequacy of a connector, the advice of the District Electrician should be obtained. Practically all wiring for traffic signal and illumination systems is exposed to the elements, and it is very important that all splices be insulated with waterproof material, as prescribed in Section 9-29.12 of the *Standard Specifications*.

8-20.6E Ground

Because of the hazards of electrical shock, all grounds and ground bonds referred to in the plans and in the special provisions should be given special attention to ensure their effectiveness and completeness. See *Standard Specifications* Section 8-20.3(9) and Standard Plan J-9a.

8-20.6F Lighting Standards, Strain Poles

In erecting lighting standards or strain poles, rope slings should be used to reduce the danger of damage to galvanized or finished aluminum surfaces.

8-20.6G Existing Illumination Systems

Where existing illumination or traffic signal systems are to be removed, and the material stockpiled at the site of the work for delivery to WSDOT, it will be advantageous if prior arrangements are made to have a WSDOT truck available so the material can be loaded directly as it is removed. These arrangements should be made with either the Regional Maintenance Engineer or the Regional Traffic Engineer.

8-20.6H Service Equipment

Generally, Type “B,” “C,” “D,” and “E” service equipment, cabinets etc., will be factory assembled from drawings submitted with the material lists. Type “A” service equipment and service equipment for traffic signals will be assembled in the field. Care shall be taken to ensure compliance with all provisions of the plans and specifications, and to determine that all bonds and grounds are complete.

Service equipment and conduit risers shall be located on the back side of poles away from traffic to reduce the danger of damage.

8-20.6I Traffic Signal Systems

Traffic signal systems are a very specialized type of work. All work shall be done in strict accordance with the plans, the special provisions, and the *Standard Specifications*. The Regional Traffic Engineer will be responsible for the proper timing of each signal installation and will assist the Engineer in any way needed to ensure the proper completion of the work.

8-20.6J Testing

All illumination and traffic signal systems shall be tested as outlined in Sections 8-20.3(11) and 8-20.3(14)D of the *Standard Specifications*. Particular care shall be taken in the performance of test no. 3. The Project Engineer shall cause readings of the megohmmeter taken on every electrical circuit to be furnished to the Regional Electrician. Caution must be exercised in the performance of this test to protect control mechanisms from damage due to the nature of the test voltages used. Also, the records made of this series of tests must identify the readings observed with each branch of the electrical circuit involved. Representative sampling of the Contractor’s test readings shall be made by the Electrical Inspector using State test equipment.

Field Test No. 4 of Section 8-20.3(11) of the *Standard Specifications* is to be performed on all illumination and signal projects. It is especially important that the Project Engineer obtain the consultation of the Regional Traffic Engineer in this portion of the field test when the tests are being performed in a traffic signal controller. Since the mechanism in these controllers is so interrelated and complex, only persons thoroughly schooled in such control

mechanisms are qualified to determine when particular timing circuits and sequences are functioning properly. The simple turning on of an electrical switch and watching a light come on is not an acceptable electrical test.

8-20.6K Electrical Safety Tags

Commencing at the time that the serving utility makes the power drop to WSDOT electrical service cabinets, electrical safety tags shall be used. Any electrician working on any main or branch circuit shall cause that circuit to be de-energized and shall place an electrical safety tag at the point that the circuit is open. The electrician shall sign the electrical safety tag and only that electrician may make subsequent circuit alterations or remove the tag.

If the circuit that the electrician de-energized to work on is serving traffic, the electrician shall arrange the work so the circuit may be energized for nighttime operation. The electrician shall remove the safety tag and energize the circuit before leaving the jobsite and upon returning to work on the circuit, shall de-energize it again and place an electrical safety tag back on the circuit.

8-20.7 Prevention of Corrosion of Conduit

Corrosion of metallic conduit may result from chemical or electrical causes. Chemically-caused corrosion is commonly most severe with aluminum conduit. For this reason, the National Electrical Code places restrictions on the use of aluminum conduit in earth or embedded in concrete. For those installations in which aluminum conduit is directly specified within a contract, care should be exercised on the project to ensure that it is physically separated from possible interaction with pozzoliths (admixtures for concrete), brackish water or chlorides. Hot dipped galvanized steel conduit, while susceptible to corrosion, sustains less physical damage than does the aluminum conduit. Installation of such conduit should be supervised to ensure against physical abrasion of the conduit or for rust on threads which would destroy the integrity of the galvanizing.

Electrically caused corrosion of metallic conduit is easy to avoid by proper construction supervision. If the causes of this type of corrosion are not properly inspected and controlled, the extent of electrically caused corrosion is commonly far more severe than the chemically caused corrosion.

In any metallic conduit system, the metallic conduit itself serves an electrical function. This function is to provide a low resistance return path for electricity which may leak out of an electrical conductor due to scraped insulation, cracks, or other causes. A point at which electricity can leak or escape from an electrical wire is called a “fault.” When electricity flows through any non-insulated path (conduit), it can establish an electrical phenomenon called electrolysis. Electrolysis results in the transfer of metal from one location to metal at another location. Through this means, the metal that was used to make the metallic conduit may be transferred to other locations on the same conduit run or to other metallic appurtenances. With the ultimate degeneration of conduit at any point, the return path for the electricity through the conduit system itself is destroyed. In the event that a portion of a conduit was destroyed in this means and with the subsequent damage or failure of electrical conductors beyond that point, electricity would not have the ability to complete the circuit from the wire through the conduit system and return to service enclosure which would, in turn, cause a fuse to blow or a circuit breaker to trip. Hence, the protection offered by our electrical overload equipment is totally nullified.

To prevent this type of ultimate failure of the electrical system, all conduit joints should be carefully inspected to ensure that they are physically tight and that a good electrical bond does exist from one piece of conduit through the nipple to each adjoining piece of conduit. Additionally, conduit threads should be painted with an approved corrosion inhibiting conduit paint. Any loose or improper union between conduit sections or conduit and junction boxes is a point of high resistance to the flow of electricity. When such a condition exists and with the faulting of an electrical conductor within the system, electricity does not have an easy return to its point of service. Electricity then takes alternate routes through the earth, structures, etc. This, in particular, establishes the condition of electrolysis and results in even greater failure of the physical system. The physical system failure attributed to this may present itself from two to five years after construction.

The seriousness of this matter cannot be overstressed in electrical construction. It is so important that if one factor, and only one factor, was to be examined on each electrical project, it would be the search for conditions that would result in electrolysis and the sloppy workmanship that causes them.

Additionally, to prevent electrical damage to the conduit system and, in particular, during the time of project construction, the conduit shall not be used as a temporary neutral return nor shall the conduit be used for the ground of construction equipoment, i.e., welders, hand tools, etc.

8-20.8 Measurement and Payment

Measurement and Payment instructions are covered in Sections 8-20.4 and 8-20.5 of the *Standard Specifications*.

8-21 Permanent Signing

8-21.1 General

The complex design of today's freeway facilities has created an increased demand on signing. Signing is one of the features a layperson readily can evaluate on a new facility. Improper or inadequate signing detracts from the quality of the basic construction features of the project. Misplaced or irregular usage of signs on interchanges creates a critical hazard to traffic and hinders the proper operation of the facility.

Today's destination sign has increased in size to the extent that it is no longer a minor installation problem and the amount of time required to install an average freeway sign project has been extended to the point that close cooperation between all forces on highway construction projects is vital so that the facility is signed properly when opened to traffic.

Any sign that is erected on a section of roadway carrying traffic ahead of the time the message on the sign will be applicable to the traffic shall be covered in accordance with Section 8-21.3(3) of the *Standard Specifications* until the appropriate time for uncovering it. It is essential that signs with conflicting messages not be displayed.

8-21.2 Sign Location

Since it is impossible to visualize the actual physical features of final grade elevations, vertical curves, trees, and other factors that affect proper sign placement in the initial sign plan stage, it becomes necessary to make adjustments in sign location just prior to installation. The Project Engineer and Regional Traffic Engineer should coordinate a study of each location to determine that each sign will be in the most efficient location for visibility and nighttime reflectivity. Advance Destination signs (1 or ½ mile) may be moved up to 150 meters (500 feet) in either direction if severe ground or slope conditions are encountered. If the sign must be moved more than 150 meters (500 feet), consideration should be given to revising the distance on the sign. All sign locations shall be staked by the Engineer prior to installation by the Contractor.

Following staking of the signs, the Project Engineer should furnish the Contractor with the list of post lengths for steel posts. For wooden posts, the Contractor should be able to order posts in commercial lengths from the approximate lengths shown in the plans. Final lengths of timber posts will be determined or verified by the Engineer at the request of the Contractor prior to fabrication.

Anytime a new Bridge Mounted Sign Bracket, Cantilever Sign Structure, or Sign Bridge Structure is erected, a new structure inventory identification number needs to be assigned to the structure by the Bridge and Structures Office Bridge Preservation Section. The Project Engineer shall request a name plate with the number on it for installation on the sign support. Installation instructions will be provided by the Bride Preservation Section.

Anytime an existing Bridge Mounted Sign Bracket, Cantilever Sign Structure, or Sign Bridge Structure is removed from service the Project Engineer shall notify the Bridge Preservation Section so the sign structure can be removed from the inventory.

8-21.3 Approval of Materials

All materials for installation on permanent signing projects shall be listed on the Request for Approval of Material Sources and be submitted to the Materials Laboratory for appropriate action as soon as possible. Shop drawings of sign structures shall be reviewed by the Project Engineer for conformance with Standard Plans G-2 through G-6a. If no special design is involved, they shall be approved by the Project Engineer.

Six sets of shop drawings of special design sign structures and/or special sign fittings shall be transmitted to the Bridge and Structures Office, which will coordinate approval with the Materials Engineer. After approval, the Bridge and Structures office will retain one set and forward one set to the Materials Engineer and four sets to the Regional Operations/Construction Engineer. The Materials Engineer will forward his set to the Fabrication Inspector. The Regional Operations/Construction Engineer will forward three sets to the Project Engineer. The Project Engineer will send two sets to the Contractor, who will forward one set to the Fabricator (see Figure 8-1).

The special provisions of the contract deal to a great extent with the proper fabrication of the signs to be installed and the manufacturing process requiring the use of approved application equipment. It is necessary, therefore, that the firm who actually makes the signs be approved as a source of supply. Such approval is made by the Materials Laboratory.

8-21.4 Inspection

When requested by the Materials Laboratory, the Engineer shall provide a current set of contract plans and change orders related to signing to the area sign Inspector for use during in-plant inspection.

Arrangements will be made by the Materials Laboratory so that an inspection is made of all signs at the sign fabricator's plant before the signs are shipped to the project. A "fabrication approval" decal dated and signed by the Inspector shall appear on the back of all permanent signs that are received on the project. Signs without such indicated approval shall not be permitted on the project. Damaged signs shall be rejected at the project site. Upon

completion of inspection, a copy of the sign Inspector's report will be submitted to the Engineer through the Regional Operations/Construction Engineer.

At the completion of a sign installation, the Project Engineer shall request the Regional Traffic Engineer to assist in making a final inspection.

8-21.5 Bolting Fuse Plates

Fuse plates are bolted together with high strength bolts. In order for the fuse plates to function as designed, the bolts must be tightened to the stress specified on Standard Plate G-4. In addition, supplemental signs which span the several posts shall not be located below the fuse plate.

Procedures for assembling and inspecting high strength bolts are covered in Chapter 6-3.6B of this manual. All fuse plate assemblies shall be checked with a torque wrench. This can be accomplished either by observing the Contractor's torquing or by the Inspector utilizing the Region's torque wrench. Documentation of the torquing method used should be accomplished by proper entries in the Inspector's Daily Reports.

8-21.6 Measurement and Payment

Measurement and Payment instructions are covered in Sections 8-21.4 and 8-21.5 of the *Standard Specifications*.

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9-1 General

9-1.1 Introduction

The quality of material used on the job will be evaluated, first by a laboratory examination of typical samples to determine whether deliveries can be expected to meet the specifications, or whether they can be made to do so; second, by tests of definite lots actually delivered on the job or set aside for shipment; third, by visual examination on the job to guard against defects in workmanship, damage in handling and contamination; and fourth, by verification samples to confirm that certified materials did, in fact, comply with the specifications.

The manner in which the work of controlling the quality of materials is to be divided between the Laboratory and the Project Engineer is given in detail in this chapter.

9-1.2 Requirements

Requirements for materials are given in Section 1-06 and Division 9 of the *Standard Specifications*. Tolerance limits and a procedure for acceptance of certain materials are given in Chapters 9-5.6 and 9-5.4 of this manual. Thickness of courses and tolerances are listed in Chapters 1-5.7 and 1-5.8 of this manual.

9-1.3 Sample and Test Numbering

A separate series of numbers, starting with No. 1 in each instance, shall be used for acceptance, assurance, independent assurance, and verification samples for each type of material for which there is a separate bid item. Assurance samples shall be referenced to the corresponding acceptance sample. Verification samples shall be referenced to the corresponding manufacturers certificate.

9-1.3A Preliminary Samples and Tests

Preliminary samples are intended to show the general character of the materials available or proposed for use. The sample may be taken from a natural deposit, the general stock of a dealer, or elsewhere. The materials sampled may require further treatment before it will meet the specification requirements. Preliminary samples are a basis for approving the source from which materials are to be obtained. Deliveries cannot be accepted on the basis of preliminary samples unless the samples represent an identified lot.

Unless specified for a particular purpose, sampling and testing materials from a potential source is not a mandatory function. It is to be performed when such results will be of value to the Project Engineer or when requested by the Contractor.

Before sampling a potential source, check to see whether previous test reports are available or reliable.

9-1.3B Acceptance Samples and Tests

Acceptance samples and tests are all of the samples and tests used for determining the quality and acceptability of the material and workmanship which have been, are being, or will be incorporated in the project. The results of these tests are to be used by WSDOT to determine conformance to contract documents. The minimum frequency for taking acceptance samples is detailed in Chapter 9-5.7 of this manual.

9-1.3C Assurance Samples and Tests

Assurance samples and tests are used for the purpose of making checks on the reliability of the results obtained in acceptance sampling and testing. Assurance samples and tests also serve to correlate results from field labs through the Regional Materials Laboratories and Olympia Service Center Materials Laboratory to the American Association of State Highway Officials (AASHTO) Materials Reference Laboratory (AMRL) and the Cement and Concrete Reference Laboratory (CCRL), that are operated by the National Institute of Science and Technology (NIST). The minimum frequency for assurance samples is detailed in Chapter 9-5.7 of this manual.

9-1.3D Verification Samples and Tests

Verification samples and tests are used for the purpose of making checks on the reliability of manufacturers test results when acceptance of the material is based upon a manufacturer's certification of compliance.

9-1.3E Ready Mix Concrete Plant Verification Inspection

Verification inspections shall be performed on all concrete plants furnishing concrete under a Certificate of Compliance. Inspections shall be made at least monthly when a plant is producing concrete under a Certificate of Compliance. Additional inspections shall be performed for each approximate 1,500 cubic meters (2,000 cubic yards) of concrete per month based on the frequency sampling requirements for fine aggregates (i.e., a verification inspection for every other fine aggregate sample). At least one day shall elapse between inspections.

Designation and assignment of individuals to accomplish the verification inspection shall be the responsibility of the Region. It is recommended that an individual experienced and familiar with the operation and inspection of concrete plants be assigned.

9-1.4 Form Letters

A number of form letters have been prepared as an aid in transmitting information to the Laboratory. In preparing letters of transmittal, care should be used to include all information that is in any way pertinent to the sample in question. Transmittal letters should be prepared in duplicate; the original is enclosed with the sample and the copy is retained by the Project Engineer. Following is a list of the forms used for transmittal of samples and/or information to the Olympia Service Center Materials Laboratory.

350-009 Concrete Test Cylinder Transmittal Letter
350-016 Asphalt Sample Label
350-026 Preliminary Sample Transmittal Letter
350-040 Proposed Mix Design
350-042 Report of Beam Test
350-056 Sample Transmittal
350-071 Request for Approval of Material Sources
350-074 Field Density Test
350-092 Asphalt Concrete Pavement Compaction Control Report
350-114 Summary Report of Acceptance Sampling and Testing
350-115 Contract Materials Checklist
351-006 Soil Sample Transmittal Letter
351-015 Daily Compaction Test Report
410-025 Transmittal of Falsework, Form and Shop Drawings

9-1.5 Material Certification

The Project Engineer will be responsible for all documentation required to certify a construction project for the materials incorporated in the project. The Project Engineer, through the Regional Operation or Construction Engineer, will be responsible for resolution of all deficiencies on the project with the Construction Office before certification is complete. The Regional Documentation Engineer will be responsible for reviews of the material documentation of the projects at the Project Engineer's office. The Region will be responsible for the preparation of the Certification of Material letter listing all deficiencies and their resolution. The Regional Administrator will be responsible for signing and distributing the certification letters. The Olympia Service Center Materials Laboratory will perform compliance reviews of the completed certified projects.

Definitions

Certification: Documented evaluation of the project activities for conformance to the contract provisions, *Standard Specifications* and *Construction Manual* procedures for inspection, testing, and acceptance of materials. The certification reflects the project's compliance with the Record of Materials as adjusted for:

1. Actual project quantities utilized,

2. Acceptance practices as provided in this manual for minor quantities of material, and

3. Adjusted sampling/testing frequencies as approved.

Deficiency: Any shortcoming in compliance with the Record of Material requirements as adjusted for actual quantities or in conformance of results of sampling, testing, or inspection with the contract requirements. All deficiencies are required to be listed, explained, and justified or resolved. Resolution and justification of deficiencies occurs after completion of all work on the project and receipt of all possible documentation from the contractor.

Material Certification Process

Olympia Service Center

1. Olympia Service Center Materials Laboratory (Contract Documentation Section)

   a. Prepare the Record of Materials for all items listed in the contract.

   b. Provide technical support, certification guidelines and format, and suggested documents. See Figure 9-1 for Contract Materials Checklist (DOT Form 350-115, latest version). See Figure 9-2 for Certification Letter and Distribution.

   c. Conduct the Certification Compliance Review in accordance with Section 9-I.5D.

2. The Construction Office (Documentation Engineer)

   a. Receive deficiencies identified during Regional Certification.

   b. Coordinate FHWA and Region to determine funding eligibility.

   c. Prepare response to Region identifying degree of nonparticipation (Letter of Resolution).

Region

1. Project Engineer

   a. Set up materials documentation system.

   b. Maintain Record of Materials item by item for materials certification.

Washington State Department of Transportation

Contract Materials Checklist

Contract: _____ SR: _____ Fed. Aid #: _____

Title: _____

	Yes	No*	N/A	Item(s)
1. All items on ROM have approved sources, including items added by C.O.		**		
2. Approved sources were used for all items & source used is documented		**		
3. Use of approved proprietary products and QPL items is Documented				
4. Change of source letters were initiated when required (see 3-1.7 Const. Manual)				
5. Acceptance sample testing frequency is adequate with final quantities considered		**		
6. Assurance and verification of sample testing frequency is adequate with final quantities considered				
7. Acceptance sample test results produced satisfactory correlation with assurance test results		***		
8. Acceptance Sample test results produced satisfactory correlation with IAS test results		***		
9. All independent Assurance Samples are on file				
10. Justification is provided for all material which was accepted and incorporated into the project but which failed to meet specifications when tested		**		
11. Was a credit received for any nonspecification material used?		**		
12. All required approved catalog cuts and shop drawings are on file		**		
13. All required documentation for Inspected Items Acceptance (IIA) is on file		**		
14. IIA quantities match the final quantities		**		
15. All required Manufacturers Certifications & Mill Certs are on file		**		
16. The Manf. Cert. quantities match the final quantities		**		
17. Minor quantities are documented				
18. All material acceptance actions have satisfactory test results or other approved documentation prior to payment for the work				
19. Pavement & Surfacing depths meet plan requirements				
20. Pavement & Bridge widths meet plan requirements				

* All "No" checks constitute materials certification deficiency. These each require a comment or an explanation by the Project Engineer and an attachment to the Certification of Materials detailing the circumstances.

** These deficiencies reflect acceptance of nonspecification materials and may result in loss of participation on Federal Aid Contracts.

*** Follow up documentation for questionable & excessive deviations is attached.

Comments: (use additional sheet if necessary)

Project Engineer Signature _____ Date _____

Construction/Operations Engineer Signature _____ Date _____

DOT Form 350-115
Revised 9/94

◆ **Supersedes Previous Editions** ◆

Figure 9-1

Washington State
Department of Transportation
Sid Morrison
Secretary of Transportation

Transportation Building
P.O. Box 47300
Olympia, WA 98504-7300

(Name)
Assistant Secretary for Field
Operations Support Service Center
Transportation Building
Olympia, WA 98504

Cont. No: SR-
F.A. No.:
Section:

Date Completed:

Dear Sir:

This is to certify that:

The results of the tests on acceptance samples indicate that the material incorporated in the construction operations controlled by sampling and testing were in conformance with the approved plans and specifications, and such results compare favorably with the results of independent assurance sampling and testing.

Exceptions to the plan and specifications are explained on the attached sheet.

Very truly yours,

Regional Administrator

RGF
Attachment

cc: FHWA, 40943
OSC Materials Engineer, 47365
OSC Const. Documentation Engineer, 47354
OSC Comptroller, 47420
Regional Oper./Const. Engineer
Project Engineer

Figure 9-2

c. Identify, document, and justify **all** materials deficiencies including determination and acceptance of noncritical items in accordance with Chapter 1-2.8 of this manual.

d. Prepare certification package including identified deficiencies and submit to the Regional Operations Engineer for review. Certification Letter should be addressed to WSDOT Assistant Secretary for Field Operations Support Service Center.

2. Regional Operations/Construction Office

a. Review (by Regional Documentation Engineers) all projects according to Chapter 10-5 of this manual for documentation requirements including materials.

b. Resolve Materials deficiencies identified by Project Engineer through contact with the Construction Office Documentation Engineer.

c. Review Certification package for completeness.

d. Submit documentation to Regional Administrator for signature.

e. Distribute signed Material Certification. The original goes to the Assistant Secretary for Field Operations, with copies sent to FHWA, OSC Materials Engineer, OSC Construction Documentation Engineer, and OSC Comptroller. A copy of the letter of Resolution will be attached if there are any deficiencies.

3. Regional Administrator

a. Sign Material Certification.

4. Olympia Service Center Accounting

a. The federal aid section will make the appropriate transaction as necessary upon receipt of the Letter of Resolution.

b. Voucher a federal project only after receiving a copy of the Material Certification and the Letter of Resolution and insuring that the appropriate credit has been made to FHWA.

c. Attach a copy of the Letter of Resolution to the Journal Voucher sent to FHWA.

Compliance Review for Delegated Materials Certification Process

A Compliance review will be performed annually in each Region by the Olympia Service Center Materials Laboratory. The purpose of the compliance review is to assure that project records conform to materials certification standards.

Upon receipt of a copy of the Material Certification letter from the Regional Operations/Construction Office, the Olympia Service Center Materials Laboratory will notify the Region within thirty (30) days of an intent to perform a compliance review on that contract. A compliance review if needed will be scheduled no later than 90 days after notification to the Project Office.

The compliance review will normally be conducted at the project office unless arrangements are made for it to be conducted elsewhere.

The goal is for the compliance reviews to be conducted on at least 10 percent of each regions contracts with a minimum of one per project office every two years. Compliance reviews may be conducted more frequently when deemed necessary. The contracts will be selected at random from all contracts with consideration given to contract size and complexity.

This review is a two-phase review. Phase one is a review of the records kept and developed by the Project Engineer for acceptance of the materials and the identification of deficiencies. Phase two is a review of the records and the resolution of deficiencies by the Regional staff.

Upon completion of the review on any contract, the reviewers will discuss the findings with the Region. The form “Material Compliance Review” is then completed. It documents any deficiencies, recommendations, and general status of the Region’s ability to comply with Material Acceptance procedures and requirements. A copy of this review form will be submitted to the Region within 60 days after the review.

When the Compliance Review shows a discrepancy of a serious nature, the Regional Operations Engineer will correct any such discrepancy in the process.

The following items of documentation are required to develop the Material Certification and must be made available for review:

1. Contract Materials Checklist (DOT Form 350-115).
2. Record of Materials.
3. Request for Approval of Material Source.
4. Comparison of Quantities (Region Final).
5. List of Change Orders.
6. Reduced Frequency Testing Approval.
7. Test Results.
   a. Acceptance Test Reports.
   b. Assurance Test Reports.

c. Independent Assurance Test Reports.

d. Verification Test Reports (Cement and Liquid Asphalt).

8. Manufacturer's Certificates of Compliance.

a. Concrete Pipe Acceptance Report.

b. Lumber Grading Certs.

c. Certification of Cement Shipment.

d. Notice of Asphalt Shipment or Certified Bill of Lading.

9. Inspected Items Acceptance.

10. Catalog Cuts (Product Data Sheet).

11. Minor Quantity Acceptance Documentation.

12. Proprietary or QPL Item Acceptance Documentation.

13. Sign Acceptance Report.

14. Follow-up actions for unsatisfactory correlations between IAS and Acceptance Sample Test Results.

15. Final Record Measurements for Pavement and Surfacing Depths.

The origin, purpose, and description of these items are described in the following paragraphs 9-1.5 A through G.

9-1.5A Record of Materials

A listing of all major construction items is provided by the Olympia Service Center Materials Laboratory on the Record of Material. The Record of Material is a computer generated document and contains the kind and the quantity of all material deemed to require quantity control testing and the minimum number of acceptance, assurance, and independent assurance samples required. Also listed are those materials requiring other actions, such as fabrication inspection, Manufacturer's Certification of Compliance, shop drawings, catalog cuts, etc. The action or number of samples listed is the minimum required for materials certification by the Project Engineer and reflects the acceptance of minor quantities, those items for which plan quantity is less than an established threshold value. The Olympia Service Center Materials Laboratory will forward the Record of Material electronically to the Regional Administrator, Regional Materials Engineer, and Project Engineer shortly after the contract is awarded. The copy for the Project Engineer is intended to be used for keeping records of samples approved, samples tested, Material Acceptance reports received, and other pertinent data. The copy for the Regional Materials Engineer is intended to provided guidance to the Regional independent assurance samplers.

9-1.5B Request for Approval of Materials Source

Approval of source must be received from the Olympia Service Center Materials Laboratory or delegated authority for materials listed on the Record of Materials and as required by Chapter 9-4 of this manual. Requests shall be submitted by the Contractor on DOT 350-071. If the source requested by the Contractor is shown in the Approved Source of Materials Volume I or Volume II (Approved Pits and Quarries) and within the delegated authority of the Project Engineer to approve, the Project Engineer will note the approval action and the file number, sign and date the form, distributing copies as shown on the form. If the source requested is not within the delegated authority or not shown in the Approved Source of Materials Listing, the Project Engineer shall so note by the use of Approval Action Code No. 7, sign and date the form, and transmit the original to the Olympia Service Center Materials Laboratory for approval action.

Following Approval of Source by the Olympia Service Center Materials Laboratory, beyond the Project Engineer's delegated authority, subsequent requests for the same source and specified item on other contracts administered by the same Project Engineer may be approved at the project level. Such delegated approval action may be made within 12 months from the date of the original Olympia Service Center approval. The request (RAMS) should be annotated as to the Contract on which original approval was made. A copy of the "transferred approval" should be distributed to the Olympia Service Center Materials Laboratory Documentation Section.

Approvals requested in fulfillment of special requirements or substitutions as equivalents shall also be annotated as directed on the form. At the discretion of the Project Engineer, a request for approval of source may be required for those materials not listed on the Record of Materials for which there exists some doubt as to their acceptability. When a source or product is specifically called for in the contract documents, a request for approval of source need not be submitted unless the Contractor elects to use an alternate source or product. If the Contractor elects to use an alternate quarry or pit site, a letter requesting the change shall be submitted in accordance with Chapter 3-1.7 of this manual. When requesting approval of an item that requires fabrication, both the fabricator and the manufacturer of the base material will be identified. An inspection of the fabrication facility may be required prior to approval. The Olympia Service Center Materials Laboratory will make arrangements for such inspection. Fabricated items include structural steel, sign structures, precast median barrier, culvert pipe and others. See Chapter 9-4 of this manual for further details regarding fabricated items. In general, if an

item requires shop inspection, it can be considered to be a fabricated item.

As soon as the Project Engineer receives approval of the materials source, one copy of the approval shall be transmitted to the Contractor so materials can be procured. The date the Contractor was notified of the approval should be noted on the Project Engineer's copy.

The Project Engineer will keep accurate field notes of the sources from which each material was obtained. If the same kind of material is obtained from two or more sources, the notes will show on which portions of the work each was used. A summary of this information must be included in the Final Record Notes.

9-1.5C Vacant

9-1.5D Inspected Items Acceptance

Items which are inspected and found acceptable by a WSDOT Materials Fabrication Inspector are identified by a tag or stamp. These items formerly required follow-up action to generate a Materials Acceptance Report. These reports are no longer issued as the inspection tag or stamp constitutes acceptable evidence of conformance. This acceptance by inspected item tag supersedes and replaces the Materials Acceptance Report process. The tag or stamp with an identification number ink stamped on the inspected item or ink stamped on an "Approved For Shipment" tag attached to the inspected item attests that the item was in full conformance with specifications at the time of inspection. The ID number will be six digits prefixed with a letter. The letter identifies the Materials Inspector who inspected the item.

The Inspected Item Acceptance: Tag Identification table is a general guide for the items. Check the Record of Materials for documentation requirements. "Approved for shipment" items accepted on the basis of a tag or stamp require follow-up action by the Project Engineer to complete the inspection documentation.

The actions to obtain inspection are:

1. The source of the item must be approved.

Approval of source is given via the "Request for Approval of Material Sources" form. A copy of the approved Request for Approval of Material Sources is provided to the Fabrication Inspector in the area where the fabrication is taking place. This provides advance notice of the need for inspection.

If a verbal approval of source is given shortly before fabrication is to begin, it is the Project Engineer's responsibility to contact the appropriate Fabrication Inspector to make arrangements for inspection. If the Project Engineer fails to contact the Fabrication Inspector in cases of verbal approval of sources, it is likely that the proper inspection will not take place.

2. The item of work must be inspected by the WSDOT Fabrication Inspector.

The only evidence of inspection at this point is the stamp or tag which says "Approved for Shipment WSDOT" with an ID number.

3. At the time of inspection, the Fabrication Inspector will obtain the necessary mill tests or other documentation from the manufacturer and file reference them to the ID number.

4. The Project Engineer must verify delivery of the items to the project by means of an "Approved For Shipment WSDOT" tag or stamp with an ID number.

5. The Fabrication Inspector must prepare the Materials Acceptance Report.

The Project Engineer's responsibilities are summarized as follows:

1. Check the Record of Materials to see which items require off site inspection.

2. Ensure that Requests for Approval of Material Sources indicating fabrication sources are submitted by the Contractor in a timely manner. Two weeks is usually adequate from receipt of request to completion of inspection. In case of delayed or rush submittal or verbal approval because of imminent fabrication, contact the Fabrication Inspection Supervisor to make sure that arrangements have been made.

3. Once the fabricated item arrives on the job, check for "Approved for Shipment" stamps or tags with ID numbers. If there are no stamps or tags, inform the Contractor that the item is not acceptable and call the Olympia Service Center Materials Laboratory for instructions. Items lacking tags or stamps are not acceptable. They have either not been inspected or, if inspected, have been found not acceptable under the specifications.

4. If there are "Approved for Shipment" stamps or tags with ID numbers, record ID number, quantity, and brief description of the item for project records. The field inspector should note on their reports that the material was in satisfactory visual condition when installed and forward all information to the project office. In case of questions concerning an inspect item contact should be made with the inspection offices.

Seattle Inspection Office, Mail Stop NB-82, Northwest, MS-501
Spokane Inspection Office, Mail Stop Eastern, Materials Lab

Inspected Item Acceptance: Tag Identification

Item	*Tag Identification Number*
• Drainage metal castings	Each unit will have one ID No.
• Treated timber and lumber except guardrail post and blocks • Treated piling • Epoxy coated rebar • Anchor bolts • Type 1 raised pavement markers	Inspected in “lots,” ID Nos. repeated and representative number of tags placed on each shipment (each item not tagged)
• Bearings • Miscellaneous items that are shop welded • Miscellaneous galvanized steel items • Concrete and metal culvert pipe over 700 mm (27 inches) in diameter • Precast concrete panels • Prestressed concrete girders • Permanent precast concrete median barrier • Steel for bridges • Traffic signal and illumination standards • Vaults (depending on ROM requirements)	ID Nos. repeated (each item tagged with the same number)

Vancouver Inspection Office, Mail Stop Southwest S-15, Materials Lab

5. At the conclusion of the project, the records should be reviewed to determine that for all applicable materials were documented by numbered inspection tags.

9-1.5E Manufacturer's Certificate of Compliance

As designated by the specifications and special provisions, certain materials may be accepted on the basis of a Manufacturer's Certificate of Compliance. This acceptance is an alternate to job site sampling and testing. The Record of Materials is prepared to indicate the required sampling and testing and should provide a guide to the items for which a compliance certification is an acceptable basis of acceptance. The compliance certificate is required prior to installation of the material. Where this requirement is waived by written agreement, no payment shall be made for the work until the certification is received.

Acceptance by certificate will be permitted where designated by the contract provisions. The Record of Materials will provide a summary of requirements combining the special as well as general requirements of the contract.

The form of the certificate will vary considerably based on both the material and the origin and will range from standard state certificate forms, to individual letters from manufacturer's, to overstamps on bills of lading. Certain information is required and is designated by the specifications. This information includes the identity of the manufacturer, the type and quantity of material being certified, the applicable specifications being affirmed, and the signature of a responsible representative of the manufacturer. Supporting mill tests or documents may also be required. A certificate is required for each delivery of material to the project and the lot of material being certified shall be identified.

Upon receipt of the certification at the project level, it shall be reviewed for compliance with the specifications requirements using the preceding guidelines and the checklist for Transmittal of Manufacturer's Certificate of Compliance Form 350-572. The certification must be made by the manufacturer of the material. A supplier certificate is not acceptable except as evidence for lot number and quantity shipped and can only be accepted when accompanied by a certificate from the manufacturer which meets the requirements of Section 1-06.3 of the *Standard Specifications*.

If all the checklist items can be answered "YES," the Project Engineer shall sign the completed checklist thereby "APPROVING" the Manufacturer's Certificate of Compliance, attach a copy of the Manufacturer's Certificate of Compliance and make the distribution as shown on the checklist.

If all the checklist items except No. 2 and 7a, cannot be answered "YES," the Project Engineer shall sign the completed checklist, attach the Manufacturer's Certificate of Compliance and return it to the Contractor for corrections, clarification, and resubmit for approval and payment.

When routing to the Olympia Service Center Materials Laboratory, it is to be addressed Attention: Contract Documentation Section.

9-1.5F Concrete Pipe Acceptance Report

A modified form combining features of certified compliance and fabrication acceptance is utilized for concrete pipe. Fabrication inspection is periodically performed at approved sources of concrete pipe. During this inspection, samples of each type, size, and class of pipe are inspected and tested to verify compliance with the Standard Specification. For a 90-day period of manufacture from the date of inspection, concrete pipe less than 750 mm diameter may be shipped and accepted based on "Concrete Pipe Acceptance Reports." This report is prepared by the Fabrication Inspector and copies are thereafter supplied by the fabricator to accompany each shipment of pipe.

The Acceptance Report as received on the project will indicate the date and original test results as performed by the Fabrication Inspector and will bear a certification from the fabricator as to the certificate's application to the particular shipment it accompanies. The project inspector is responsible to verify the conformance of the shipment with the contract requirements and to examine the manufacture and shipping dates of the pipe for conformance with specifications and with the Acceptance Report. Upon such verification, the inspector will note receipt of the material for the specific contract and route the Acceptance Report to the Olympia Service Center Materials Laboratory, Attn: Contract Documentation Section.

9-1.5G Sign Acceptance Report

The Sign Acceptance Report (SAR) is prepared to verify that the signs have been inspected and approved for shipment to the project by having a "Fabrication Approved" decal attached.

1. The Project Engineer will make approval of source for the sign fabricator for those fabricators which are within the Project Engineer's delegated authority to approve, or forward the original Request for Approval of Material Sources to the Olympia Service Center Materials Laboratory for approval action.

2. The Project Engineer, after approving the sign fabricator, will notify the appropriate sign fabrication inspector of the need to provide sign fabrication inspection and provide the inspector with a detailed list of the types of signing materials intended for use on a specific project. Sign fabrication inspectors shall be contacted by letter and shall be provided with necessary plans and change orders to conduct an inspection. The Project Engineer shall use the form letter attached to the Record of Materials to notify the sign fabrication inspectors.

Sign Fabrication Inspectors

Seattle-Tacoma area — Contact Olympia Service Center Traffic or Northwest Region Traffic
Vancouver-Portland area — Contact Southwest Region Traffic Operations
Spokane-Eastern Washington — Contact Eastern Region Materials

3. The sign fabrication inspector will obtain from the fabricator samples of any untested lots of reflective sheeting and legend which have not been accepted for use under WSDOT specifications, and send them to the Olympia Service Center Materials Laboratory for testing. Test results will be sent back to the sign fabrication inspector. The inspector shall have all test reports on hand indicating that the lots of materials used in fabricating the signs are acceptable prior to making the final inspection of the signs and tagging the signs "FABRICATION APPROVED." As a follow-up to the inspection, the inspector will prepare the SAR, which includes date of fabrication inspection, an itemized list of all signs inspected, and source and heat/lot numbers for materials used in the fabrication of the signs. The SAR will be sent to the Project Engineer after all the signs have been inspected and approved for shipment.

The sign fabrication inspector shall have the following materials documentation at the time of sign fabrication:

1. Sign blanks or panels: Manufacturers Certificate of Compliance with accompanying mill certifications.

2. Reflective Sheeting and Cutout Legend: Test report from the Olympia Service Center Materials Laboratory for the lot of reflective sheeting and/or legend accepting the specific lot of reflective sheeting and/or legend used in the sign fabrication.

> **Note**: Reflective sheeting, legend, and prismatic reflectors shall be tested and accepted based on a "lot" of material. A "lot" is defined as the amount of sheeting or legend received by a fabricator in a single shipment. All rolls or individual shipping units within a lot shall be sampled, tested, and marked.

3. Demountable Legend and Prismatic Reflectors: Test result of sampled lot of materials indicating conformance with specifications.

The Sign Acceptance Report (SAR) shall include date of sign fabrication inspection, itemized list of all signs inspected, source, and heat or lot numbers for materials used to fabricate signs.

The Project Engineer will accept for installation and payment only those signs which have a "FABRICATION APPROVED" decal affixed. The SAR provided by the signing fabrication inspector will complete the documentation certifying the signing materials as to specification conformance.

9-1.6 Control of Materials

The succeeding parts of this chapter on materials outline the detailed method to be used in the control of materials. The expenditure made for materials is a large item in construction costs. If faulty materials are permitted to go into the work, the cost of replacement may exceed the original cost manyfold.

Chapter 9-2, Sampling Methods, is covered in considerable detail because of the importance of taking samples and performing tests by standardized methods. Careless methods of sampling and testing are inexcusable. The methods outlined have been carefully considered and must be followed in detail.

Chapter 9-3, Testing, describes the field equipment for testing and explains the proper test method to use for various materials. The field equipment for testing is a list of the major items needed for making field tests. The lists are not intended to cover minor items nor miscellaneous office supplies that may be needed.

Chapter 9-4, Specific Requirements for Each Material, includes the following information:

1. Whether or not an approval of source is required.

2. Whether or not a preliminary sample is required. If so, the size of sample needed is stated.

3. The basis on which materials are to be accepted as satisfactory for incorporation into the work.

4. Whether or not an assurance or verification sample is required. If so, the frequency that assurance or verification samples are to be sent to the laboratory, the size of the sample and the container in which the sample should be sent.

5. Samples are to be obtained and sent to one laboratory.

6. The visual inspection and the tests that must be made on the job.

7. Specification requirements.

Chapter 9-5, Guidelines for Job Site Control of Materials, provides the Engineer with additional information to assist in determination of the point of acceptance for materials from WSDOT and Contractor sources, the Basis of Acceptance, assurance or verification sampling and testing, tolerance limits, and the sampling and testing frequency guide.

Chapter 9-6, Radioactive Testing Devices, explains policy on the administration of radioactive testing devices.

Chapter 9-7, Final Record Measurements, explains record sampling and outlines the frequency for final record measurements. The final section of this chapter provides guidelines for final record measurements.

Chapter 9-8, WSDOT Test Methods.

9-2 Sampling Methods

9-2.1 Sampling Natural Deposits

This chapter includes sand and gravel pits, rock ledges, talus, and filler pits.

Sampling of natural deposits requires the utmost care and the exercise of the best judgment. Concurrently with the taking of samples, a careful estimate must be made of the quantity of material represented by each sample as well as the amount of material available in the deposit as a whole. Numerous instances of sites not proving out when operated, and the resulting costly moves, furnish ample evidence of the necessity for care in prospecting.

The first step in prospecting is to determine the logical place for the plant set-up and how the material can best be obtained. Then decide on the area and depth that can be worked economically. With this information in mind the logical place to take samples can be determined.

If crushed surfacing is to be made from sand and gravel pits, there must be a place provided to waste sand.

The availability of water for washing purposes during wet and dry seasons must be determined if concrete aggregates or mineral aggregates are to be produced. If washing is necessary, a site for the settlement of silt, before returning water to the stream, must be provided to comply with the requirements of the Departments of Ecology, Fish, and Wildlife, and our reclamation specifications.

A personal inspection by a representative of the Olympia Service Center Materials Laboratory will be required for each new site investigated and for each site previously used if there is any question as to the existence of satisfactory material. The Laboratory representative need not be present during the actual prospecting operations, but it is required that the personnel who do the prospecting shall point out to the representative at the site exactly how and where the sampling was done. The Laboratory representative will require that the sampling frequency be in accordance with the requirements listed hereinafter.

If it is necessary to fill the test pits before the Laboratory representative can make an inspection, representative samples of each type of material found in the test pits should be retained for examination. The presence of the Laboratory representative should be requested while sampling is in progress for pits and quarries that appear likely to be approved for an early project.

Complete notes on all features of the deposit should be taken during the prospecting. In the case of sand and gravel pits, such items as overburden depths, changes in grading with depth, presence of silt or clay balls, and presence of silt lenses and depths at which they occur are important factors in the analysis of the site.

In the case of ledge rock deposits, important features to be noted are the presence of vesicular rock, plastic material in seams of rock, and the manner in which the material is jointed. The geologist will need this information to complete an evaluation of the proposed source.

9-2.1A Sand and Gravel Pits

If a large cut face is exposed, good samples may be obtained there. Care must be taken to dig away all material that has sloughed from the face and all material on the face of the pit that has been washed by rain should be discarded. If greater depth than the exposed face is desired, sink a test pit at the foot of the slope. Deep test pits back of the face of the pit will be necessary except when there is no doubt at all of an ample supply of material. In such a case, however, shallow test pits should be dug to determine the depth of overburden over the area to be worked.

There are many instances of previously worked pits where the logical place to secure aggregate is from the floor of the pit thus obviating the necessity of stripping. In such cases sink test pits to determine the depth and character of material available.

The extremities of the pit should be tested first and then test pits sunk at 60-meter (200-foot) intervals. If the material is uniform in all holes it will not be necessary to test intervening spaces.

When there is no cut face present, test pits must be sunk to sufficient depth to prove a supply of satisfactory aggregate. Although there are many signs that may indicate the extent of a deposit, it is not logical to consider a test pit as indicative of the character of material for more than a 15-meter (50-foot) radius. Therefore, where large amounts are

required, test pits should be sunk at 30-meter (100-foot) intervals.

After test pits have been dug, notes should be taken on the following points while securing samples: The depth of overburden soil, the depth to which the material appears to be coated with clay or covered with stains that are difficult to remove by washing, the depth to which clay balls or disintegrated rock are present, and variations in the grading of the material. Separate samples should be taken for each change in character or grading encountered. Separate groups of samples should be taken from each test pit.

When preparing the samples for shipment to the Laboratory several things should be considered. Samples of material of different character should be sent separately with notes of the depth represented. Material of the same general character but of different grading can be combined in the field provided amounts proportional to the depth of each layer are taken.

The quantity needed for laboratory examination will vary with conditions. If the material appears to be reasonably uniform in composition 50 kilograms (100 pounds) will be sufficient. Obviously, samples of these amounts must be taken carefully to indicate the grading with any degree of accuracy. If the material appears to be unsatisfactory at certain depths, send separate 25-kilogram (50-pound) samples of such material.

If laboratory examination for use as concrete aggregate is desired, or may be requested based on preliminary test results, a larger sample of 250 to 300 kilograms (500 to 700 pounds) will be necessary. Therefore, it is always good policy to reserve a quantity sufficient for this purpose before filling the test pits.

9-2.1B Talus

Methods of prospecting and sampling talus will be similar to that for sand and gravel. It should be remembered that solid rock may lie close to the surface of an apparently deep deposit.

9-2.1C Ledge Rock

In examining ledges remember that the hardest, most resistant rock is always exposed most prominently and that softer rock probably occurs in the seams and depressions.

The rock in the greatest area of the state is basalt. This is formed by lava flows and the rock may be underlaid by soil of any description; therefore, it cannot be concluded that there is an unlimited depth to the deposits. In eastern Washington the rock is of comparative recent geological formation and will generally be found to be fairly uniform in composition throughout with the exception that the upper layers (as formed) are more or less vesicular (containing blow holes) which form a point of attack for weathering agencies. Several flows with long intervals between may have covered the same area in which case there may be several layers of dense and vesicular rock alternating. Basalts of western Washington, except in places along the Columbia River, are of older geological origin and usually have been subject to considerable alteration. Many of the western Washington basalts were formed by lava flowing into the water with the result that often they are intermingled with shales stirred up from the bed of the body of water. Sometimes they cooled so rapidly that glasses were formed which may, after quarrying, devitrify causing the rock to lose its strength. Coarse grained rocks have been formed either through intrusion from the depths of the earth or from very large lava flows. Coarseness of grain is usually an indication of a large quantity of rock although all of it may not be accessible.

Unless the quarry site has been opened up it will be necessary, in the majority of cases, to test-drill the ledge. When the volume of the rock is large compared to the quantity required and there are good surface indications of its uniformity, two or three holes may be drilled by hand and shot to secure samples. In more doubtful cases, down-holes or coyote holes should be drilled. At least one hole should be shot to obtain a sample.

From the way the rock shoots and by observation of seams and planes of fracture, an idea can be obtained of the size to which the rock will break in quarrying.

9-2.2 Sampling Manufactured Aggregates

The principal requirement in sampling concrete and mineral aggregates produced from operating plants is that the samples shall be as nearly representative of the general production of the plant as possible. No inexperienced person should be assigned to the work of sampling without good indoctrination in actual sampling by an experienced person.

The specifications require that aggregates meet grading and quality requirements at the time they are placed in hauling vehicles for delivery to the roadway or placement in a temporary stockpile except aggregates for portland cement concrete shall meet the requirements for grading and quality at the time they are ready for introduction into the mixer and aggregates for asphalt concrete shall meet sand equivalent and fracture requirements at the time of its introduction to the cold feed of the mixing plant and meet the gradation requirements in the final mix.

If aggregate is stockpiled at the pit site prior to use and will be hauled directly to the work from the stockpile, samples taken during the manufacture of the material will suffice for quality control provided that the stockpile is built in a workmanlike manner in accordance with the specifications.

If the Inspector feels that the Contractor has permitted contamination or abnormal segregation to occur in the stockpile due to the methods of stockpiling, the Inspector should sample the stockpile, preferably with an auger, and base acceptance of the material on the results of tests of representative samples from the stockpile.

9-2.2A Coarse Aggregates

At Crushing or Washing Plant: The Contractor shall provide an automatic or semi-automatic sampling device for obtaining samples in accordance with Section 1-05.6 of the *Standard Specifications*. The samples must be representative of the material being produced and at least large enough to yield the quantity required for the screen test.

Scows: If scow loads are stockpiled prior to use, sample the material after stockpiling. If the material goes directly from the scow to the mixer, have the load worked over with a clam shell. Take 100-kilogram (250-pound) sample, spread on floor or canvas and compare appearance of sample with the load on the scow. If sample appears representative, quarter down to size required.

Large Stockpiles: Large stockpiles should be tested during production but it may be necessary to check the contents. If it is not possible to obtain samples with a power auger start trenches at the sides near the top and work down towards the bottom making the trenches increasingly deep. Take samples at regular intervals along the trenches. Samples thus taken should total not less than 100 kilograms (250 pounds) which may be spread out and quartered to the size needed.

9-2.2B Fine Aggregates

The use of sampling tubes is recommended as a time-saver but satisfactory samples can be obtained by digging deep holes and scraping along the side of the holes. Samples should contain very little, if any, fine aggregate from the outer surface of piles because of the tendency for large grains to run to the bottom. Concrete aggregate deposited on the ground directly from the washing plant is apt to be very erratic in grading. The material should not be sampled at that point if it can be avoided.

Fine aggregate samples can be split to the size required more rapidly and accurately when damp than when dry. If the material is dry when sampled, the samples should be moistened before splitting.

9-2.3 Sampling Fresh Concrete

See WSDOT Test Method 803 — Method of Sampling Fresh Concrete.

9-2.4 Random Sampling

Use WSDOT Test Method 716 — Method of Random Sampling for Location of Testing and Sampling Sites.

9-2.5 Sample Size

The listing below indicates the required quantity for necessary testing. It is not critical that this amount be handled and shipped in a single sample container. Dividing the total sample into two or more sacks is permissible in order to accommodate the physical strength of the technician.

Preliminary samples should be a minimum of 35 kilograms (80 pounds) each unless specified otherwise in Chapter 9-4.

Assurance or verification samples to be sent to the Laboratory should be approximately the following mass (weight).

Item	Mass (Weight) per Sample
Gravel Borrow	25 kg (50 lbs.)
Sand Drainage Blanket	25 kg (50 lbs.)
Gravel Base	25 kg (50 lbs.)
CSTC	25 kg (50 lbs.)
CSBC	25 kg (50 lbs.)
Maintenance Rock	15 kg (30 lbs.)
Ballast	25 kg (50 lbs.)
Shoulder Ballast	25 kg (50 lbs.)
Backfill for Sand Drains	15 kg (30 lbs.)
Coverstone	15 kg (30 lbs.)
Cr. Screenings	15 kg (30 lbs.)
Gravel Backfill	25 kg (50 lbs.)
PCC Coarse Aggregate	25 kg (50 lbs.)
PCC Fine Aggregate	3 kg (5 lbs.)
Cement	5 kg (10 lbs.)
Asphalt Treated Base	
Aggregate	15 kg (30 lbs.)
Completed Mix	10 kg (12 lbs.)
Asphalt Cement Concrete	
Coarse Aggregate	15 kg (30 lbs.)
Fine Aggregate	10 kg (25 lbs.)
Blending Sand	5 kg (10 lbs.)
Mineral Filler	1.5 kg (3 lbs.)
Completed Mix	10 kg (12 lbs.)
Asphalt Materials	1 L (1 qt.)

Acceptance samples for sieve analysis should be the approximate size as shown in WSDOT Test Methods 102 and 104.

9-2.6 Sampling of Geotextiles

Use WSDOT Test Method 914 — Practice for Sampling of Geotextiles for Testing.

9-3 Testing

9-3.1 Field Equipment for Testing

9-3.1A Introduction

The following lists are given as a guide in assembling equipment necessary for the field inspection of the various materials. Unless otherwise noted, the items can be obtained from the Regional Materials Laboratory.

9-3.1B Concrete Aggregate

1 Sand sampling tube.

2 13-liter to 19-liter (3.5- to 5-gallon) water buckets.

6 Pans about 330 mm × 230 mm × 50 mm (13 × 9 × 2 inch) deep.

1 Set gravel screens with 37.5-mm (1½-inch), 31.5-mm (1¼-inch), 19.0-mm (¾-inch), 9.50-mm (⅜-inch), and 4.75-mm (No. 4) square opening screens.

1 Platform scale capacity 50 kilograms (125 pounds) by 0.01 kilograms (0.01 pounds).

1 Set sand sieves, 200 mm (8 inches) with pan and cover. The following sieves will be required: 4.75 mm, 3.35 mm, 2.36 mm, 1.18 mm, 0.60 mm, 0.30 mm, 0.150 mm, and 0.075 mm (U.S. No. 4, 6, 8, 16, 30, 50, 100, and 200).

1 Brass wire brush such as used for cleaning aluminum ware. (Purchase locally.)

1 Electronic balance, 11,000 gram Mettler PM 11 or equal reading to 1/10 gram.

1 Hot plate, gasoline stove, or equivalent.

1 Tablespoon. (Purchase locally.)

1 Colored glass for organic matter test.

6 250 ml (½ pint) milk bottles. (Purchase locally.)

2 950 ml (32 oz.) graduated prescription bottles. (Purchased at drug store.)

1 Sample splitter.

1 Preserving kettle with lip, not less than 1 liter (4 quart) by 100 mm (4 inches) deep. (This is required only when fine aggregate contains doubtful amounts of silt. Purchase locally.)

1 Shovel.

1 Piece heavy canvas, 2- to 3-meters (6- to 8-feet) square.

1 Glass-top Pycnometer Kit (for rapid test for water in sand). Supply of denatured alcohol. (Required only when hot plate not available for drying aggregates. Purchase locally.)

Supply of 3 percent sodium hydroxide. (Purchase made up at drug store, or purchase stick sodium hydroxide or household lye and make up solution containing 32 grams per liter (quart) of water. Use reasonable care in handling to avoid injury to skin.)

Supply of canvas sacks or plastic bags for shipping sand samples.

Supply of canvas sacks or 20-liter (5-gallon) plastic buckets in good condition for shipping gravel samples. (Obtain through Region Stores.)

9-3.1C Mineral Aggregates

2 Water buckets.

6 Pans about 300 mm × 300 mm × 50 mm deep (12 inches × 12 inches × 2 inches deep).

1 Set gravel screens, rocker type with screens as specified for types to be constructed. A portable set of screens is also available and may be used if preferred.

1 Platform scale.

1 Set sand sieves, 200 mm (8 inches) diameter, full height preferred, 6.30 mm and 2.36 mm, 2.00 mm, 0.85 mm, 0.425 mm, 0.30 mm, 0.180 mm, 0.150 mm, and 0.075 mm (U.S. No. 8, 10, 20, 40, 50, 80, 100, and 200).

1 Mechanical sieve shaker.

1 Brass wire brush such as used for cleaning aluminum ware. (Purchase locally.)

1 Electronic balance, 11,000 gram Mettler PM 11 or equal reading to 1/10 gram.

1 Hot plate, gasoline stove or equivalent.

1 Tablespoon. (Purchase locally.)

1 Piece heavy canvas, 2- to 3-meters (6- to 8-feet) square.

1 Sample splitter.

1 Sand Equivalent Kit.

Supply of canvas sacks or plastic bags for shipping fine aggregate samples.

Supply of canvas sacks or 20-liter (5-gallon) plastic buckets for shipping samples of coarse aggregate. (Obtain through Region Stores.)

9-3.1D Asphalt Road Materials

1 Pocket dial thermometer, 304 stainless steel stem, accurate to 1 percent of range, and range of 10°C (50 F) to 260°C (500 F) in five divisions.

1 Funnel, not soldered for use in filling sample cans.

Supply of 1-liter (1-quart) metal cans with felt and foil lined screw caps for shipping samples of all cutback and paving grade asphalt materials.

Supply of 1-liter (1-quart) plastic containers with lids for shipping samples of emulsified asphalt.

9-3.1E Surfacing Materials

1 Platform scale.

1 Set gravel screens, rocker type, with screens as specified for types being constructed.

1 Set sand sieves, 200 mm (8 inches) diameter, full height preferred, 6.30 mm and 2.36 mm, 2.00 mm, 0.85 mm, 0.425 mm, 0.30 mm, 0.180 mm, 0.150 mm, and 0.075 mm.

1 Sand equivalent test kit.

1 Sample splitter.

Supply of canvas sacks for shipping samples. (Obtain through Region Stores.)

9-3.1F Pavement Concrete

1 Slump cone.

1 16 mm × 600 mm ($^5/_8$ inch × 24 inch) bullet-pointed rod.

1 Field beam testing machine.

2 Test beam molds.

1 Square-ended spade.

1 Concrete vibrator (loaned by laboratory on request).

1 0.1 or 0.2 cubic meter ($^1/_2$ inch or $^1/_3$ cubic foot) bucket.

1 Platform scale.

1 Air meter.

1 Glass plate for yield bucket.

1 Wheelbarrow.

1 150 mm (6-inch) scoop.

3 20-liter (5-gallon) plastic buckets.

1 75 mm (3-inch) wide trowel.

9-3.1G Structural Concrete

1 Slump cone.

1 16 mm × 600 mm ($^5/_8$-inch × 24-inch) bullet-pointed rod.

1 0.1 or 0.2 ($^1/_2$ or $^1/_3$) cubic meter (foot) bucket.

1 Platform scale.

1 Air meter.

1 Glass plate for yield bucket.

1 Wheelbarrow.

1 150 mm (6-inch) scoop.

3 20-liter (5-gallon) plastic buckets.

1 75 mm (3-inch) wide trowel.

1 Curing box.

Supply of test cylinder molds.

9-3.1H Soil and Surfacing Density

1 A nuclear densometer.

1 Tool box with set of tools.

1 Large iron spoon.

1 Tablespoon.

1 50-mm (2-inch) paint brush.

4 4-liter (1-gallon) paint cans.

1 Platform scale, 25-kilogram (50-pound) capacity.

2 Pan 300 mm × 450 mm × 50 mm deep (10 inches × 12 inches × 2 inches deep).

1 Small ointment can.

1 2-meter (6-foot) folding rule.

9-3.1I Proctor Density Equipment

1 101.6-mm (4-inch) I.D. mold.

1 Standard compacting hammer.

1 Straightedge.

1 Mixing trowel (or spoon).

1 Electronic balance, minimum capacity 2,600 grams.

1 Large scale (see 9-3.1H).

1 Pan 300 mm × 300 mm × 50 mm (12-inch × 12-inch × 2-inch).

9-3.1J Asphalt Mixtures

1 Long handle, square point shovel.

3 20-liter (5-gallon) paint buckets.

1 Tablespoon, 300 mm (14-inch).

1 1.5 meter × 1.5 meter (4-foot × 4-foot) piece of canvas.

1 Electronic balance, 11,000 grams readable to .1 gram.

1 Maximum specific gravity density kit (Rice).

1 Set of sieves and shaker (see 9-3.1C).

Asphalt quick wash kit including:

Buchner funnel, 150- or 200-mm (6- or 8-inch) diameter.

Filtering flask, 4,000 milliliter.

Vacuum pump or aspirator capable of maintaining an air pressure less than 30 millimeter of mercury.

Vacuum gauge.

Two suitable pans with handles, 3-liter (3-quart) size, approximately 100 mm (4 inches) deep.

Infra-red drier, oven, or hot plate.

250-mm (10-inch) diameter funnel cut-off to small end diameter of 125 to 150 mm (5 to 6 inches).

Accessories, including thermometers, wash bottle, beakers, pan, rubber tubing, neobrene rubber gloves, etc.

Supply of:

Filter paper (E-D grade 615).

20 liters (5 gallons) alternate solvent.

Diatomaceous silica.

Clean, heavy wrapping paper.

Computation sheets for field extraction procedure.

Cartons for shipping samples.

9-3.1K Paint

Wet film thickness gauge.

Sample cans, 500 ml or 1 liter (pints or quarts).

Surface Thermometer.

Sling psychrometer.

Dew point chart.

Dry film thickness gauge.

9-3.2 Test Methods for Materials

Wherever designated, the test method as specified by WSDOT Laboratory Manual will be used to perform testing. These test methods are included, in numerical order, in Chapter 9-8 of this manual.

9-3.2A Test Methods for Aggregates

9-3.2A(1) Quartering Samples

Use WSDOT Test Method 116 — Method for Reducing Field Samples of Construction Materials to Testing Size.

9-3.2A(2) Screening Coarse Aggregate

Use WSDOT Test Method 104 — Method of Test for Sieve Analysis of Fine and Coarse Aggregates.

9-3.2A(3) Screening Fine Aggregate

Use WSDOT Test Method 102 — Method of Test for Aggregate Finer than the 0.075 mm (U.S. No. 200) sieve.

9-3.2A(4) Determining Percentage of Fracture

Use WSDOT Test Method 103 — Method for Determining Percentages of Fracture in Aggregates.

9-3.2A(5) Moisture in Concrete Aggregates

Tests for moisture in concrete aggregate should be designed to measure the free water, exclusive of the absorbed water.

Coarse Aggregate: The percentage of water in coarse aggregate should be determined on a sample of about 45 kilograms (100 pounds) carefully weighed to the nearest 0.1 kilogram (1/4 pound). Dry the sample at room temperature to avoid driving off the absorbed water. Spread out in a thin layer and stir occasionally. Preliminary wiping of individual pieces with a dry cloth will materially reduce the time required for drying. As soon as the surface film of moisture has evaporated from substantially all pieces, weigh the sample to the nearest 0.1 kilogram (1/4 pound). Record the percentage of water as the loss in mass (weight) due to drying multiplied by 100, divided by the air-dry mass (weight), and expressed to the nearest 0.2 percent.

Fine Aggregate: The percentage of water in fine aggregate should be determined on a sample of 500 grams weighed to the nearest gram. Heat may be used for the first part of the drying but the final evaporation must take place from sand at room temperature. As the sample is reaching the final stages of drying, roll it back and forth on a piece of paper. The end point of drying is reached when the individual

particles cease to cling together and just before the dark color due to a moisture film disappears. Weigh immediately to the nearest gram. Record the percentage of water as the loss in mass (weight) due to drying multiplied by 100, divided by the air-dry mass (weight), and expressed to the nearest 0.2 percent.

Fine Aggregate, Pycnometer Test: See WSDOT Test Method 117 — Method for Determination of Moisture Content of Fine Aggregates — Pycnometer Procedure.

9-3.2A(6) Bulk Specific Gravity

Bulk specific gravity is defined as the ratio of the mass (weight) of a given volume of a material including all voids contained within the particles to the mass (weight) of an equal volume of water. Bulk specific gravity may be reported on the basis of the mass (weight) of oven-dry material or on a saturated, surface-dry basis. The latter value is always given in reports from the laboratory since it is basically correct in calculating concrete mix proportions.

If the values for bulk specific gravity of the fine and coarse concrete aggregates to be used on the job as determined by the laboratory are not known, submit 2.5 kilograms (5 pounds) of fine aggregate or 7 kilograms (15 pounds) of well graded coarse aggregate with the request that this determination be made. The specific gravity of material from any pit is reasonably constant so that once it has been determined, new determinations need not be made. When a letter of approval is issued, the bulk specific gravity will be reported if known.

It is possible to make a rapid test for free water in sand provided its bulk specific gravity is known. The latter may be determined in the field if care is taken in performing the steps outlined below. It is preferred, however, that the values reported by the laboratory be used whenever they are available.

See WSDOT Test Methods 107, 108 and 118 — Methods of test for determining the bulk specific gravity and absorption of coarse and fine aggregates.

9-3.2A(7) Colorimetric Test for Organic Matter

See WSDOT Test Method 111 — Method of Test for Organic Impurities in Sands for Concrete.

If the color is as dark or is darker than the glass plate, the sand is open to suspicion. The organic matter may or may not be harmful. The effect can only be determined by testing the strength developed in mortar or concrete. The laboratory has records of certain pits in which the dark color is harmless. If the behavior of the sand in question is not known, the proper procedure is to reject for dark color until strength tests can be made. Notify the Materials Engineer at once when this situation arises.

9-3.2A(8) Particles of Specific Gravity Less Than 1.95

It may be necessary to make this test in the field on certain occasions. In this event, equipment and instructions will be furnished by the laboratory.

9-3.2B Test Methods for Portland Cement Concrete

9-3.2B(1) Test Cylinders

Use WSDOT Test Method 809 — Method of Making, Handling, and Storing Concrete Compressive Test Specimens in the Field.

9-3.2B(2) Slump Test

Use WSDOT Test Method 804 — Method of Test for Slump of Portland Cement Concrete.

9-3.2B(3) Entrained Air in Concrete

Use WSDOT Test Method 805 — Method of Test for Determination of Percent of Entrained Air in Portland Cement Concrete.

9-3.2B(4) Concrete Test Beams

Use WSDOT Test Method 808 — Method for Making Flexural Test Beams. Use WSDOT Test Method 802 — Method of Test for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading).

It will be the policy to make and test beams on all portland cement concrete paving jobs.

9-3.2B(5) Density and Cement Factor of Concrete Mix

Use WSDOT Test Method 806 — Portland Cement Concrete Mass per Cubic Meter (Foot) Cement Factor.

9-3.2C Sand Equivalent Test for Paving and Surfacing Materials

Use WSDOT Test Method 109 — Sand Equivalent Test for Surfacing Materials.

Frequency of Testing: The sand equivalent test will be made at the frequency outlined in Chapter 9-5.7 of this manual. There are conditions, however, when it should be made more frequently. These are: at the start of production when the quality of the product is not well established; in the production of gravel base when screen tests are not made frequently; whenever there is a question as to sufficient stripping of the pit; or, when rock quarries carry earthy matter in the joints and seams. Results of sand equivalent tests should be recorded in the Inspector's Record of Field Tests Form 422-020.

Action to be Taken by Project Engineer: When sand equivalents are found that are below the limit specified by the *Standard Specifications* or the contract special provisions, the Project Engineer should immediately send a complete sample to the Regional Materials Laboratory. The accompanying transmittal should include the sand equivalent, test results and request confirming tests. Without waiting for a report from the Region, the Project Engineer must take whatever steps are necessary toward obtaining cleaner material that will meet the specification requirements and shall have sand equivalent tests made at frequent intervals until a product that is satisfactory is being consistently obtained.

The point of acceptance for this test procedure is in the field. Olympia Service Center or Regional Materials Laboratory tests shall be a check on the field test procedures. Regional Materials Laboratory results do not supersede field test results. Should a discrepancy exceeding tolerance limits (±10 points) occur, the Assurance Sampler shall investigate the field procedures immediately to resolve such discrepancies, even to having field techniques standardized to the laboratory equipment.

Only Laboratory-trained and certified personnel will be assigned the task of performing the Sand Equivalent Test. Certification of an individual is made when that individual, using field equipment and like samples, can successively obtain test results equal to those obtained by the Laboratory, within the specified tolerance limits. At least one person from each Project Engineer's crew will normally be assigned to perform the Sand Equivalent Test, as well as the Assurance Samplers, and be trained in the Regional Materials Laboratory and their techniques be standardized to the Region Laboratory Equipment.

9-3.2D Density and Relative Compaction of Soils and Surfacing Materials Using the Nuclear Gauge*

Use WSDOT Test Method 613 — Method for Determining Inplace Densities and Relative Compaction of Soils and Surfacing Materials Using the Troxler Nuclear Moisture/Density Gauge.

9-3.2E Density Determination of Asphalt Concrete Pavements Using the Nuclear Gauge*

Use WSDOT Test Method 715 — Method of Test for Relative Compaction of Asphalt Concrete Pavements Using the Nuclear Gauge.

***Note:** See Chapter 9-6 of this manual for guidance for personnel using and administering the use of the Nuclear Gauge.

9-3.2F Vacant

9-3.2G Moisture Determination

9-3.2G(1) Moisture Determination, Oven Drying Method

Use WSDOT Test Method 106 — Method of determination of Moisture Content in Aggregates by Oven Drying.

9-3.2G(2) Moisture Determination, Field Stove Method

A gasoline or alcohol field stove can be used to furnish dry heat. However, caution must be used to avoid overheating the sample.

Accuracy: Similar to alcohol method.

Time: 10-30 minutes.

9-3.2H Field Sampling of Asphalt Mixtures

Use WSDOT Test Method 712 — Standard Method of Sampling Bituminous Paving Mixtures.

9-3.2I Degree of Particle Coating "Ross Count"

Use WSDOT Test Method 714 — Determining Degree of Particle Coating of Bituminous Aggregate Mixtures "Ross Count." Section 5-04.3(8) of the *Standard Specifications* requires that mixing time be sufficient to produce 95 percent coated particles as determined by WSDOT Test Method No. 714. The results of this test are also referred to as a "ross count" and the Inspector records the test results on Form 422-002.

9-3.2J Quick Extraction Method

Use WSDOT Test Method 723 — Quick Method for the Determination of Aggregate Gradation Using Alternate Solvent.

9-3.2K Determination of Asphalt Content

WSDOT Test Method 722 — Determination of Asphalt Content by the Nuclear Method.

9-3.2L Moisture in Bituminous Paving Mixtures

Use WSDOT Test Method 713 — Method for Determining Moisture in Bituminous Paving Mixtures.

9-3.2M Maximum Specific Gravity of Bituminous Paving Mixtures "Rice Density"

WSDOT Test Method 705 — Maximum Specific Gravity of Bituminous Paving Mixtures — "Rice Density."

9-3.2N Moisture Density Relations of Soil

Use WSDOT Test Method 609 — Method of Test for Moisture Density Relations of Soil.

9-3.2O Maximum Density Determination (Granular Soils)

Purpose of Test

The maximum density test is performed in order to provide the Engineer with a density standard for controlling compaction of predominantly granular soils and surfacing materials.

Types of Materials for Test

This test was developed for granular soils which are not suited to the standard moisture density test. With granular soils, especially free draining ones, the density is affected more by variations in grading than by variations in moisture content. A maximum density curve should be obtained for each type of granular embankment soil or surfacing material to be used on a project.

Test Samples

A 50-kilogram (100-pound) sample of material is required for each test. The sample should be from an approved source set up for the project and should be submitted to the Regional Materials Laboratory with a control sample letter.

Test Results

The test results are reported in the form of a curve where density is plotted against grading (percent passing the 4.75 mm (U.S. No. 4) sieve). The maximum density for any particular grading (percent passing the 4.75 mm (U.S. No. 4) sieve) may be determined from this curve by reading the ordinate of the intersection of the curve with the "Percent passing" value.

Equipment Required for Test

No field equipment is required for this test inasmuch as it is performed only at the Olympia Service Center Materials Laboratory or in the Regional Materials Laboratory. At least one week is required to process and report out a sample.

9-4 Specific Requirements for Each Material

9-4.1 Portland Cement or Blended Hydraulic Cement

1. Approval of Source: Request approval of the manufacturing plant and supplier of cement for each project.

2. Preliminary Samples: A preliminary sample for prequalification of a source will be required only if requested on the Request for Approval of Material Sources Form 350-071.

3. Acceptance:

   a. Bulk cement will be accepted upon receipt of a Manufacturer's Mill Test Report number which shall be reported on each certified concrete delivery ticket.

   b. Bagged cement will be accepted by "SATISFACTORY" test reports from the Olympia Service Center Materials Laboratory. Acquire a 5-kilogram (10-pound) sample from one of every 400 bags and ship to the Laboratory for testing. Allow a minimum of 10 days from receipt of the sample at the Laboratory for testing. DO NOT permit the use of bagged cement until an acceptance report has been received from the Laboratory.

4. Verification: Production mills will provide samples directly to the Olympia Service Center, Materials Laboratory on a quarterly basis to compare with the producers mill test report. The Engineer may take samples for testing as described in *Standard Specifications* Section 9-01.3.

Specification Requirements: See *Standard Specifications* Section 9-01. Review contract documents to determine if supplemental specifications apply.

9-4.2 Asphalt Road Materials

1. Approval of Source: Approval of source is required before use. In requesting approval, give name of company and point from which shipments are to be made.

2. Preliminary Samples: Preliminary samples will not be required.

3. Acceptance: Asphalt may be used after receipt of approval of source if the shipment is accompanied by Form 350-053, "Notice of Asphalt Shipment" or the asphalt shippers Bill of Lading with the information required by the *Standard Specifications*." Examine these certificates to make sure the material is of the grade required and that it comes from the approved source. If material is received which does not have this notice, a sample shall be taken from the load, and shipped to the Olympia Service Center Materials Laboratory at once, with a request for immediate testing.

4. Verification: Samples for verification of specification conformance will be taken based on shipments (truck and trailer) to the project. The samples will be taken in duplicate by the Project Engineer and both of them forwarded promptly to the Laboratory.

Liquid asphalts (emulsions and cutbacks) shall be sampled from every other shipment. Emulsion used for tack coat for ACP does not require sampling. Paving asphalts (AR4000W, AR and AC grades, PBA grades) shall be sampled from every third shipment.

Samples shall be taken as close as possible to the point where the material is to be used; i.e., pug mill, distributor, etc. In the case of cut-back asphalts, this may be from the distributor itself, by opening a valve or one of the nozzles. If a hand nozzle is available, the sample may be drawn off there. Paving asphalts for use in a plant should be sampled by drawing from the line to the pug by means of a valve from the line.

Specifications require the Contractor to install such a valve. In all cases where the sample is taken from a hose or valve, sufficient material must be drawn off before taking the sample to ensure that the sample is representative of the material being used.

If samples cannot be taken from the distributor or the supply line, as outlined above, they may be taken from the storage tank. Samples from large tanks must be taken with a "thief," so that they do not include surface material, but are from near the middle of the material in storage. They may be taken by the grab method — that is, the full amount of the sample will be taken at one time or at one spot in the car.

Samples of emulsified asphalts shall also be taken as close as possible to where the materials is used, but they must be taken before any dilution of the material on the job.

It may be difficult to relate the certificate number from the "Notice of Asphalt Shipment" to the sample under this procedure. It is requested, however, that, as closely as possible, the stations where the material was used be shown on the control sample letter accompanying the sample.

Because the entire sample may be used in testing, it is necessary to have a reserve sample in case the material is found not to comply with the specifications. Therefore, every sample is to be taken in duplicate and forwarded to the Olympia Service Center Materials Laboratory for testing.

The containers for all liquid products except emulsions will be approximately 1-liter (1-quart) cans with 44-mm ($1^3/_4$-inch) screw caps. Containers for emulsions will be plastic. While these may seem unnecessarily difficult to fill they are the only type that can be handled conveniently in the Laboratory. Always use new, clean containers that are free of rust, dents, or other weaknesses that may cause leaking or contamination. Containers previously used for any other purpose will not be satisfactory regardless of how well cleaned they are considered to be. The outside of the containers must not be cleaned by immersion in kerosene or other solvent because of the danger of contaminating the sample. Containers must not be cooled by immersion in water or other liquid as contraction may draw contaminants into sample. Solid asphalts may be shipped in the above cans or in any clean metal container found convenient. Enter complete data on gummed label Form 350-028 and attach to can. Complete a sample transmittal, Form 350-056, and attach it, in its envelope, to the can.

Also mail a letter of transmittal on Form 350-056.

5. Field Inspection: Check truck-tanks for separation into lighter and heavier components. Check temperature to which material is heated to make sure specified limits are not exceeded. Check truck-tanks after unloading to make sure they are empty.

6. Specification Requirements: See *Standard Specifications* Section 9-02. Review contract documents to determine if supplemental specifications apply. In addition, refer to project mix design.

9-4.3 Asphalt for Subsealing

1. Approval of Source: Approval of source is required before use.

2. Preliminary Samples: Preliminary samples are required as noted in (3) below.

3. Acceptance: Asphalt will not be used prior to test report from the Laboratory showing shipment to be satisfactory. This report will be based on sample taken at refinery.

4. Assurance: Samples are not required unless specifically requested by the Olympia Service Center Materials Laboratory.

5. Field Inspection: Check against damage by overheating.

6. Specification Requirements: See *Standard Specifications* Section 9-02. Review contract documents to determine if supplemental specifications apply.

9-4.4 Concrete Aggregates

1. Approval of Source: Approval of source is required for each pit. A preliminary sample must be submitted from all sources that have not had Steilacoom comparison tests run in the past 10 years, if not, approval will be limited to producer design mixes only.

2. Preliminary Samples: See chapter on Sampling for instructions on securing preliminary samples. Ship samples in tight canvas or burlap sacks. If material appears to be

reasonably uniform in composition and will wash clean, send 150 kilograms (300 pounds) of pit run material or 30 kilograms (60 pounds), if sand only. If material is found in the laboratory to be of doubtful quality, additional samples, up to 200 kilograms (500 pounds), may be requested.

3. Acceptance: After the source has been approved, concrete aggregates may be accepted upon satisfactory field tests for grading, cleanliness and freedom from excessive organic matter, silt, and soft or foreign pieces.

Acceptance samples shall be obtained, tested, and recorded in accordance with the *Standard Specifications*, the contract special provisions, and Chapters 9-5, and 10-3.14A of this manual.

4. Assurance: 25-kilogram (50-pound) samples of coarse aggregate and 3-kilogram (5-pound) samples of fine aggregate are required. The persons responsible for obtaining the samples and the number of samples required are shown in Chapter 9-5 of this manual.

Do not use heat to dry samples for submission to the laboratory. See chapters on Sampling Methods and Testing.

Assurance samples will not be required if total quantity of concrete in the contract is less than 80 cubic meters (100 cubic yards).

5. Field Inspection: Make tests enumerated above under "Acceptance" as required. See chapters on Sampling Methods and Testing. Discuss test results with the Contractor's representative. Enforce provisions of the *Standard Specifications*, regarding storing and draining of aggregates.

6. Specification Requirements: See *Standard Specifications* Section 9-03.1 and 3-02. Review contract documents to determine if supplemental specifications apply.

9-4.5 Surfacing Aggregates (Crushed Screening, Crushed Cover Stone, Ballast, Shoulder Ballast, Crushed Surfacing Base and Top Course)

1. Approval of Source: Approval of source is required for each type of aggregate for each pit used.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source, will be required only if requested on Request for Approval of Material Sources Form 350-071. A preliminary sample must be submitted for all sources that have not had qualifying tests run in the past 10 years. See Chapter 9-2 on Sampling Methods for instructions for taking samples.

3. Acceptance: See Chapter 9-5.7 of this manual for testing frequency and elements, such as gradation, sand equivalent for which acceptance testing must be preformed prior to use of the material.

4. Assurance: Samples are required at the frequency shown in Chapter 9-5.7 of this manual. See Chapter 9-2.5 of this manual for the size of sample required.

5. Field Inspection: See chapters on Sampling Methods and Testing. Discuss test results with the Contractor's representative. Enforce provisions of the *Standard Specifications* regarding stockpiling.

6. Specification Requirements: See *Standard Specifications* Sections 3-02, 9-03.4, and 9-03.9. Review contract documents to determine if supplemental specifications apply.

9-4.6 Aggregates for Asphalt Concrete and Asphalt Treated Base

1. Approval of Source: Approval of source is required for each pit or quarry. A preliminary sample must be submitted for all commercial pits that have not had quality tests run in the past 10 years. Blending sand used in asphalt mixtures, affects the quality of the mixture to an extent that is greatly out of proportion to its percentage in the total mixture. Approval of source of blending sand is as important as for the remaining aggregate. A minimum of 10 days is required in the laboratory for testing preliminary samples of aggregates for asphalt concrete and plant mix, including blending sand. Warn the contractor of the time required for testing.

(2-a) Preliminary Samples: See Chapter 9-2, Sampling Methods, for instruction for securing preliminary samples. Ship samples in tight canvas or burlap sacks. Send 100 kilograms (200 pounds) of rock or pit run gravel, or 10 kilograms (25 pounds) of sand only. Give full details of type of construction proposed.

(2-b) Job Mix Design Samples: See Chapter 9-2, Sampling Methods, for instructions in securing samples. Send 100 kilograms (200 pounds) of aggregate from each stockpile intended for use on the contract (i.e., 100 kilograms (200 pounds) of 16 mm to 6.3 mm ($^5/_8$ to $^1/_4$) and 50 kilograms (100 pounds) of 6.3-0 mm ($^1/_4$-0)). If blending sand is to be used, a 50-kilogram (100-pound) sample would be adequate. If RAP (Recycled Asphalt Pavement) is used, a 125-kilogram (300-pound) sample should be sent.

These aggregate samples must be accompanied by the following data, as supplied by the contractor: individual stockpile average gradations, proposed combining ratios of aggregate materials, proposed gradation of the completed mix, and the intended source of the asphalt cement.

3. Acceptance: Material may be accepted based on satisfactory field tests as follows: Aggregates produced for use on the same contract shall be sampled and tested for fracture and sand equivalent as the material is placed into stockpile. Acceptance of the aggregate for gradation shall be based on samples taken from the final mix. When material is used from a stockpile that has not been tested as provided above, the requirements for fracture and sand equivalent shall apply at the time of its introduction to the cold feed of the mixing plant.

If the aggregates are being produced for use on a future contract, they shall be sampled and tested for gradation as well as fracture and sand equivalent at the time the material is placed in stockpile.

During production of aggregates, the Inspector may take and test samples to inform the Engineer and the Contractor of the quality and gradation of the material being produced and to obtain mix design samples (see paragraph (5)). The Inspector shall check the box "Information Sample Only" at the top of Form 422-020, "Inspector's Record of Field Tests," and under remarks will not check either the "Satisfactory" or the "Rejected" box, but may add appropriate remarks.

4. Assurance: Samples are required for each 5,000 tonnes (tons) produced. See Chapter 9-2.4 of this manual for the size of sample required.

5. Field Inspection: See chapters on Sampling Methods and Testing. Discuss test results with the Contractor's representative. Enforce provisions of the *Standard Specifications* regarding stockpiling.

6. Specification Requirements: See *Standard Specifications* Sections 3-02, 9-03.6 and 9-03.8. Review contract documents to determine if supplemental specifications apply. AASHTO M 17 or ASTM D 242.

9-4.7 Asphalt Concrete and Asphalt Treated Base

1. Approval of Source: Approval of source as provided by Chapters 9-4.4 and 9-4.14 of this manual is required.

2. Preliminary Samples: Not required.

3. Acceptance: Material may be accepted on satisfactory field tests for gradation and asphalt content. Acceptance samples shall be obtained, tested and recorded in accordance with the *Standard Specifications*, contract documents and Chapters 9-5 and 10-3.5 of this manual.

4. Assurance: One sample is required for each day's production. Assurance samples are to be split three ways. One-third is tested by the field inspector, one-third is forwarded to the Regional Materials Laboratory and the final third is forwarded directly to the Olympia Service Center Materials Laboratory. The mass (weight) of each sample should be approximately 10 kilograms (25 pounds).

5. Field Inspection: The Project Engineer should perform a plant inspection prior to production. Forms for this purpose are available from the Olympia Service Center Materials Laboratory. The Inspector should see general section on Sampling Methods and Testing. Discuss test results with the Contractor's representative.

6. Specification Requirements: See *Standard Specifications* Sections 5-04, 9-03.6, and 9-03.8. Review contract documents to determine if supplemental specifications apply.

9-4.8 Mineral Filler

1. Approval of Source: Approval of source is required. A preliminary sample must be submitted for all commercially used pits that have not had quality tests run in the past 10 years.

2. Preliminary Sample: Ship 1.5 kilograms (3 pounds) in polyethylene bag.

3. Acceptance: Acceptance of commercial stone dust on satisfactory laboratory tests only for each lot of 50 tonnes (tons) or less. Portland cement may be accepted without test if it is furnished in original factory sacks and is not lumpy.

4. Assurance: Mineral filler must be stocked in identifiable units of not over 50 tonnes (tons) each. Carefully selected samples of 1.5 kilograms (3 pounds) must be shipped to the laboratory in polyethylene bag.

5. Field Inspection: See that the mineral filler does not contain foreign material or lumps.

6. Specification Requirements: See *Standard Specifications* Section 9-03.8(5). Review contract documents to determine if supplemental specifications apply. AASHTO M 17 or ASTM D 242.

9-4.9 Gravel Base and Bank Run Gravel for Trench Backfill

1. Approval of Source: Approval of source is required for each type of aggregate for each pit used.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source, will be required only if requested on Request for Approval of Material Sources Form 350-071. A preliminary sample must be submitted for all sources that have not had qualifying tests run in the past 10 years. See Chapter 9-2 on Sampling Methods for instructions for taking samples.

3. Acceptance: See Chapter 9-5.7 of this manual for testing frequency and elements, such as gradation, sand

equivalent for which acceptance testing must be preformed prior to use of the material.

4. Assurance: Samples are required at the frequency shown in Chapter 9-5.7 of this manual. See Chapter 9-2.5 of this manual for the size of sample required.

5. Field Inspection: See Chapters on Sampling Methods and Testing. Discuss test results with the Contractor's representative. Enforce provisions of the *Standard Specifications* regarding stockpiling.

6. Specification Requirements: See *Standard Specifications* Section 3-02, 9-03.4, and 9-03.9. Review contract documents to determine if supplemental specifications apply.

9-4.10 Pit Run Aggregates (Gravel Backfill for Foundation CL. B, Walls, Pipe Bedding; Backfill for Sand Drains, Sand Drainage Blanket, Gravel Borrow, Bedding Material for Rigid Pipe, Flexible Pipe; Foundation Material Class A, B, and C)

1. Approval of Source: Approval of source is required for each type of aggregate for each pit used.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source, will be required only if requested on Request for Approval of Material Sources Form 350-071. See Chapter 9-2 on Sampling Methods for instructions for taking samples.

3. Acceptance: See Chapter 9-5.7 of this manual for testing frequency and elements, such as gradation, sand equivalent for which acceptance testing must be preformed prior to use of the material.

4. Assurance: Samples are required at the frequency shown in Chapter 9-5.7 of this manual. See Chapter 9-2.5 of this manual for the size of sample required.

5. Field Inspection: See Chapters on Sampling Methods and Testing. Discuss test results with the Contractor's representative. Enforce provisions of the *Standard Specifications* regarding stockpiling.

6. Specification Requirements: See *Standard Specifications* Section 3-02, 9-03.4, and 9-03.9. Review contract documents to determine if supplemental specifications apply.

9-4.11 Gravel Backfill for Drains

1. Approval of Source: Approval of source is required. A preliminary sample may be required.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: See Chapter 9-5.7 of this manual for testing frequency. The gradation testing must be performed prior to use of the material. If commercially processed concrete aggregate grading number 5 is provided, the test frequency may be reduced from one test per 100 tonnes (tons) to one test per 1,000 tonnes (tons) or fraction thereof, with a minimum of one test per project.

4. Assurance: See Chapter 9-5.7 of this manual for testing frequency.

5. Field Inspection: See that voids are not filled with dirt, clay, etc., during or after placing. The material should not contain soft pieces that may crush or disintegrate. It is improbable that unwashed aggregate will meet the requirements of the specifications.

Do not accept without performing full washed gradation test as required by WSDOT Method 104 Part A.

6. Specification Requirements: See *Standard Specifications* Section 9-03.12(4). Review contract documents to determine if supplemental specifications apply.

9-4.12 Premolded Joint Filler

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Field sampling is not required.

4. Assurance: Samples are not required.

5. Field Inspection: Check for accuracy in cutting, stapling, and care in handling.

6. Specification Requirements: See *Standard Specifications* Section 9-04.1. Review contract documents to determine if supplemental specifications apply.

9-4.13 Expansion Joints and Compression Seals

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source, will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Material may be accepted on a satisfactory test report.

4. Assurance: Samples not required.

5. Field Inspection: Check material delivered to the project for conformance with the contract plan and specifications.

6. Specification Requirements: Review contract documents to determine if supplemental specifications apply.

9-4.14 Poured Rubber Joint Sealer

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: Material may be accepted on satisfactory test report or lot approval by the Olympia Service Center Materials Laboratory. Submit an unopened kit unless specifically exempted by the Olympia Service Center Materials Laboratory.

4. Assurance: Samples are not required.

5. Field Inspection: Make certain that application is in accordance with requirements of *Standard Specifications* and manufacturer's recommendations. In order to obtain satisfactory adhesion of the sealer, joints must be thoroughly cleaned before the sealer is applied. This is particularly true where joints wider than 30 millimeters ($1^1/_4$ inches) are to be sealed. These joints should be sandblasted just prior to applying the sealer unless the Project Engineer is ABSOLUTELY CERTAIN that the joint surfaces have no trace of curing compound, dirt, oil, grease, or other contaminants.

6. Specification Requirements: See *Standard Specifications* Section 9-04.2(1) and (2). Review contract documents to determine if supplemental specifications apply.

9-4.15 Rubberized Crack Pouring Asphalt (AASHTO M 173) (ASTM D 1190)

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: Acceptance Sample testing required prior to use. Submit one box sample to the Olympia Service Center Materials Laboratory and hold use until results are received. If the lot can be identified and proven to have prior satisfactory acceptance test results, it may be used without testing on current projects.

4. Assurance: Samples not required.

5. Field Inspection: Ensure that application is in accordance with requirements of the *Standard Specifications* and the manufacturer's recommendation.

9-4.16 Concrete Culvert, Sewer, Drain, and Underdrain Pipe

1. Approval of Source: Approval of manufacturer is required.

2. Preliminary Samples: Not required.

3. Acceptance:

   a. Concrete pipe less than 750 millimeters (30 inches) in diameter will be accepted based on "Concrete Pipe Acceptance Reports" which shall accompany the pipe to the job. Individual pipe are not stamped.

   b. Concrete pipe 750 millimeters (30 inches) in diameter and larger are individually inspected at the plant prior to shipment. Accepted pipe will be stamped "Approved for Shipment."

4. Assurance: No assurance sampling required.

5. Field Inspection:

   a. Concrete pipe less than 750 millimeters (30 inches) in diameter:

      1) Verify that the "Concrete Pipe Acceptance Report" is current and covers the diameter quantity and class of pipe delivered.

      2) Inspect the manufacture date marked in each pipe to verify that it was made within the period covered by the Inspection Report. Also verify that shipment was made after the required retention time. *Standard Specifications* require 28 days for pipe using Type II cement and seven days for pipe using Type III cement. If tested and accepted at an earlier age these requirements may be modified.

      3) Verify that the pipe is free from damage from handling and shipping.

      4) Complete the upper portion of the "Concrete Pipe Acceptance Report" and forward to the Olympia Service Center Materials Laboratory, Attn: Contract Documentation.

   b. Concrete pipe 750 millimeters (30 inches) in diameter and larger:

      1) Verify that each pipe in the shipment is stamped "Approved for Shipment." Unless properly stamped, pipe should not be accepted.

      2) Verify that pipe is free from damage from shipping and handling.

Concrete sewer pipe requires hydrostatic testing after installation in conformance with the *Standard Specifications*.

6. Specification Requirements: See *Standard Specifications* Section 9-05. Review contract documents to determine if supplemental specifications apply.

7. Final Documentation:

a. Concrete pipe less than 750 millimeters (30 inches) in diameter: "Concrete Pipe Acceptance Reports" must be accumulated to cover the job quantities used. Copies of all such reports must be forwarded to the Contract Documentation Section.

b. Concrete pipe 750 millimeters (30 inches) in diameter and larger: For all pipe inspected and stamped prior to delivery, the Fabrication Inspector will prepare and provide a Concrete Pipe Acceptance Report.

9-4.17 Galvanized Steel, Aluminized Steel and Aluminum Corrugated Metal Culvert, Drain Pipe and Perforated Underdrain Pipe

1. Approval of Source: Approval of the fabrication facility as well as the base metal must be obtained.

2. Preliminary Samples: Not required.

3. Acceptance:

a. Untreated and treated metal culvert and drain pipe under 750 millimeters (30 inches) in diameter and less may be accepted when accompanied at the job site by a Manufacturer's Certificate of Compliance which certifies that the pipe meets all applicable specifications and identifies the base metal heat number. The Certificate of Compliance and the shipping Bill of Lading should be forwarded to the Olympia Service Center Materials Laboratory for approval. If there is any doubt concerning the quality of the pipe, the Fabrication Inspection Office should be contacted to arrange for an on-site inspection prior to installation. If the pipe shipment does not include the Manufacturer's Certificate of Compliance and the shipping Bill of Lading or is damaged in any way, the pipe should not be accepted until corrective action is taken. Contact the Olympia Service Center Materials Laboratory.

b. Untreated and treated metal culvert, 750 millimeters (30 inches) in diameter or more, will be inspected at the point of fabrication by the Fabrication Inspection Office. A representative number of pipes in each shipment will display "WSDOT Approved for Shipment" tags. The pipe may then be accepted in the same manner as previously outlined. If none of the pipe bears the "WSDOT Approved for Shipment" tag, contact the Fabrication Inspection Office to arrange for an on-site inspection prior to installation.

4. Assurance: Samples are not required.

5. Field Inspection: Check each delivery for fabrication details and quality of workmanship. Check for shipping damage and ensure that the spelter coating is intact. Check treated pipe for damage to coating.

Obtain the necessary documents on every shipment and forward to the Olympia Service Center Materials Laboratory for approval.

6. Specification Requirements: See *Standard Specifications* Section 9-05. Review contract documents to determine if supplemental specifications apply.

9-4.18 Perforated Underdrain Pipe

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required unless requested on Request for Approval of Material Sources Form 350-71.

3. Acceptance: After the source has been approved, pipe may be accepted on manufacturer's certification and field inspection.

4. Assurance: Samples are not required.

5. Field Inspection: Check for compliance with specifications, particularly the size and spacing of holes, and for shipment and handling damage.

6. Specification Requirements: See *Standard Specifications* Section 9-05.2(3). Review contract documents to determine if supplemental specifications apply.

9-4.19 Structural Plate Pipes and Arches

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: Acceptance may be on the basis of Manufacturer's Certificate of Compliance, with accompanying mill test reports.

4. Assurance: Samples are not required, unless samples of the nuts and bolts are requested on the approval of source.

5. Field Inspection: Check for breaks in spelter or asphalt coating and for damage from shipment.

Material in the shipment must be properly identified as to heat number. The certification discussed above must

accompany the shipment and must contain the information which is listed hereinafter.

a. Chemical analysis of the base metal of each heat number in the shipment.

b. The mass (weight) of spelter coating for each heat number in the shipment.

c. A statement that all materials conform to requirements of the specifications.

d. The certification must be on company letterhead and signed by a responsible company official whose title shall be indicated.

All suppliers of structural plate pipe and arches are to transmit four copies of the certification to the Project Engineer. At least one copy must accompany the shipment; the others may be forwarded through the Contractor. Two copies of the certification are to be retained in the Project Engineer's files; two are to be forwarded by the Project Engineer to the Olympia Service Center Materials Laboratory, together with a description of the material and the quantities involved.

6. Specification Requirements: See *Standard Specifications* Section 9-05.6. Review contract documents to determine if supplemental specifications apply.

9-4.20 Gray-Iron Castings, Steel Castings, Ductile-Iron Castings

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: Acceptance will be based on Inspected Items Tag. All castings will be stamped or tagged "APPROVED FOR SHIPMENT" by the shop Inspector.

4. Assurance: Samples are not required.

5. Field Inspection: Check for defects listed in the *Standard Specifications*. Check for the Inspector's approved stamp or tag.

6. Specification Requirements: See *Standard Specifications* Sections 9-05.15, 9-06, and 9-22.1. Review contract documents to determine if supplemental specifications apply.

9-4.21 Sanitary Sewers

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: Material may be accepted in lieu of sampling upon receipt of an "APPROVED" document as shown below:

a. Ductile Iron Sewer Pipe — Manufacturer's Certificate of Compliance.

b. Plain Concrete Storm Sewer Pipe — Concrete Pipe Acceptance Report.

c. Reinforced Concrete Storm Sewer Pipe — Concrete Pipe Acceptance Report.

d. Vitrified Clay Sewer Pipe — Manufacturer's Certificate of Compliance.

e. PVC Sewer Pipe — Manufacturer's Certificate of Compliance.

f. Ductile Iron Sewer Pipe — Manufacturer's Certificate of Compliance.

g. ABS Composite Sewer Pipe — Manufacturer's Certificate of Compliance.

4. Assurance: Samples are not required from the job.

5. Field Inspection: Check material delivered to the project for damage, and conformance to the contract documents.

6. Specification Requirements: See *Standard Specifications* Section 7-17. Review contract documents to determine if supplemental specifications apply.

9-4.22 Steel for Bridges

1. Approval of Source: Approval of the fabricator as well as the manufacturer of the steel is required.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Materials and fabrication will be accepted on Inspected Items Tags except in the case of minor parts. As soon as the fabricator receives the materials, the shop Inspector will check the accompanying mill test certificates to ensure the materials meet contract requirements. He will also provide weekly written shop inspection reports to the Project Engineer while major steel structures are being fabricated.

4. Assurance: Samples will not be required. The fabrication Inspector will be in contact with the mill producing the materials and will make arrangements to witness physical tests, including Charpy V-Notch tests when required.

5. Field Inspection: Check for "Approved for Shipment" tags or stamps and shipping and handling damage.

6. Specification Requirements: See *Standard Specifications* Sections 6-03 and 9-06. Review contract

documents to determine if supplemental specifications apply.

7. Plant Inspection: Upon receipt of the "Approval of Source," the Olympia Service Center Materials Laboratory will inspect the fabrication shop to ensure it meets all contract requirements. A copy of the Approval of Source will be sent to the fabrication Inspector.

9-4.23 Unfinished Bolts, Nuts, and Washers

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source, will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Unfinished bolts, nuts, and washers may be accepted on receipt of Manufacturer's Certificate of Compliance.

4. Assurance: Samples are not required from the job.

5. Field Inspection: Check each lot of material delivered to the project for damage, and that accompanying Manufacturer's Certificate of Compliance is present.

6. Specification Requirements: See *Standard Specifications* Section 9-06.5(1). Review contract documents to determine if supplemental specifications apply.

	Specification Reference
Bolts	ASTM A 307
Nuts	ASTM A 563 AASHTO M 291

9-4.24 High Strength Bolts

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not Required.

3. Acceptance: Material may be accepted on receipt of satisfactory test report from the Olympia Service Center Materials Laboratory. When the material is received on the job site, sample each shipment of the bolts in accordance with the table in Section 9-06.5(3) of the *Standard Specifications*.

4. Assurance: Samples not required.

5. Field Inspection: Make certain that material to be used is from a lot represented by acceptance samples.

6. Specification Requirements: See *Standard Specifications* Section 9-06.5(3). Review contract documents to determine if supplemental specifications apply.

	Specification Reference	
Bolts	AASHTO M 164M	ASTM A 325
	AASHTO M 253M	ASTM A 490
Nuts	AASHTO M 291M	ASTM A 563
	AASHTO M 292M	ASTM A 194
Washers	AASHTO M 293M	ASTM F 436

9-4.25 Anchor Bolts for Luminaires, Signal Poles, and Sign Structures

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: A preliminary sample for pre-qualification of a source will be required only if requested on the Request for Approval of Material Sources Form 350-071.

3. Acceptance: Acceptance may be based on "Approval for Shipment" tags.

4. Assurance: Samples are not required.

5. Field Inspection: Check for "Approved for Shipment" tags. Check for damage due to shipping and handling.

Note: Special attention shall be placed on the proper installation of bolts. No adjustments (bending) of bolts will be allowed after placement in concrete.

6. Specification Requirements: See *Standard Specifications* Section 9-06.5(4). Review contract documents to determine if supplemental specifications apply.

9-4.26 Reinforcing Bars for Concrete

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: May be required if requested on Request for Approval of Material Sources Form 350-71.

3. Acceptance: Acceptance will be by the Certification of Compliance and Certified Mill Test reports that will accompany each shipment.

Note: If Mill Test reports are not available, do not incorporate steel into the project and contact the Olympia Service Center Materials Laboratory for guidance.

4. Assurance: Representative of the Olympia Service Center Materials Laboratory will take random samples at the point of fabrication.

5. Field Inspection: Check for Certification of Compliance and Certified Mill Test Reports for sizes and heats of rebar. Remove excess rust and mill scale before

using. Check steel fabrication and bends for compliance with plans and specifications.

6. Specification Requirements: See *Standard Specifications* Section 9-07. Review contract documents to determine if supplemental specifications apply. AASHTO M 31M or ASTM A 615.

9-4.27 Epoxy Coated Reinforcing Steel Bars for Concrete

1. Approval of Source: Approval of source is required for both the steel supplier and the epoxy coating applicator.

2. Preliminary Samples: A preliminary sample for pre-qualification of a source will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Material may be accepted on "APPROVED FOR SHIPMENT" stamp or tag.

Note: If bar is not tagged "APPROVED FOR SHIPMENT" do not incorporate steel into the project and contact the Olympia Service Center Materials Laboratory for guidance.

4. Assurance: Representatives of the Olympia Service Center Materials Laboratory will take random samples at the point of fabrication and at the coating facility.

5. Field Inspection: Check shipment for "APPROVED FOR SHIPMENT" stamp or tag. Check coating for shipping damage, check steel fabrication, and bends for compliance with plans and specifications.

6. Specifications Requirements: See *Standard Specifications* Section 9-07. Review contract document to determine if supplemental specifications apply.

9-4.28 Rebar Splices

1. Approval of Source: Approval of source is required.

2. Preliminary Sample: A preliminary sample for pre-qualifying a source, will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Material may be accepted on receipt of a "SATISFACTORY" Test Report from the Olympia Service Center Materials Laboratory from samples taken from the project. A Manufacturer's Certificate of Compliance and other technical data MUST be submitted with the samples.

4. Verification: Sample per Section 6-02.3(24)G of the *Standard Specifications*.

5. Field Inspection: Check material delivered to the project for conformance with the contract plan and specifications.

6. Specification Requirements: See *Standard Specifications* Section 6-02.3(24)F and G. Review contract documents to determine if supplemental specifications apply.

9-4.29 Rebar Chairs, Dobies, and Spacers

1. Approval of Source: Approval of source is required.

2. Preliminary Sample: A preliminary sample for pre-qualifying a source, will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Material may be accepted on receipt of Manufacturer's Certificate of Compliance. Dobie blocks shall be accepted based upon tests reports for two 50-mm × 100-mm (2-inch × 4-inch) concrete cylinders for each production run of 2,500 blocks or fraction thereof. Cylinders are to be made from the same concrete as the mortar blocks and cured with the mortar blocks.

4. Assurance: Samples not required.

5. Field Inspection: Check material delivered to the project for conformance with the contract plan and specifications.

6. Specification Requirements: See *Standard Specifications* Section 6-02.3(24)C. Review contract documents to determine if supplemental specifications apply.

9-4.30 Dowels for Concrete Pavement

1. Approval of Source: Approval of source is required.

2. Preliminary Sample: A preliminary sample of two dowels will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Acceptance may be on Manufacturer's Certificate of Compliance with accompanying Mill Test Reports.

4. Assurance: Samples are not required.

5. Field Inspection: Check for dimensional conformance and if proper mill test certificates have been provided.

6. Specification Requirements: See *Standard Specifications* Section 9-07. Review contract documents to determine if supplemental specifications apply.

9-4.31 Wire Mesh for Concrete Reinforcement

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: May be required if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Acceptance will be by the Certification of Compliance and Certified Mill Test Reports that accompany each shipment.

4. Assurance: Samples are not required.

5. Field Inspection: Check for excessive rust, and for spacing of wires and mass (weight) per square meter (yard) if covered in the special provisions.

6. Specification Requirements: See *Standard Specifications* Section 9-07.7. Review contract documents to determine if supplemental specifications apply.

9-4.32 Bridge Approach Slab Anchors

1. Approval of Source: Approval of source is required.

2. Preliminary Sample: A preliminary sample for pre-qualifying a source, will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Material may be accepted on receipt of Manufacturer's Certificate of Compliance.

4. Assurance: Samples are not required.

5. Field Inspection: Check material delivered to the project for conformance with the contract plan and specifications.

6. Specification Requirements: See *Standard Plans*. Review contract documents to determine if supplemental specifications apply.

9-4.33 Prestressing/Post Tensioning Reinforcement — Strand

1. Approval of Source: Approval of manufacturer is required.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Acceptance will be on satisfactory laboratory test report only. Submit one sample (minimum of 2 meters (5 feet) in length) from each reel or pack. A copy of a Manufacturer's Certificate of Compliance with supporting test report and stress/strain curve is to accompany each sample submitted for testing.

4. Assurance: Samples are not required.

5. Field Inspection: Check for dirt, grease or rust.

6. Specification Requirements: See *Standard Specifications* Section 9-07.10. Review contract documents to determine if supplemental specifications apply.

9-4.34 Prestressing/Post Tensioning Reinforcement — Bar

1. Approval of Source: Approval of manufacturer is required.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Acceptance will be on satisfactory laboratory test report only. Send two samples from each heat. The samples must be a minimum of 2 meters (5 feet) in length. A copy of the Manufacturer's Certificate of Compliance shall accompany each heat of reinforcing bar. Additional samples of two bars from each heat if supplement requirements apply.

4. Assurance: Samples are not required from the job.

5. Field Inspection: Check material delivered to the project for damage, and conformance to the contract documents.

6. Specification Requirements: Review contract documents to determine specification requirements.

9-4.35 Paints for Structures

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Preliminary Samples will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Paint will be sampled at the point of production and tested by the Olympia Service Center Materials Laboratory prior to its receipt on the project. The lot number on the containers must be checked against the Laboratory test reports. Except as indicated, paint which has not been tested and accepted by the Laboratory will not be used. When less than 80 liters (20 gallons) of one kind of paint are involved, its use without laboratory tests may be approved upon the manufacturer's certificate that the material meets the specification. The certificate shall include a list of materials and the quantities used. One copy of the certificate shall be submitted to the Olympia Service Center Materials Laboratory.

4. Field Samples: Only paint from standard specification formulas C-6-90 and C-9-90 shall be field sampled. Other paints shall be accepted on the basis of a certified lot if applicable. Paint will be sampled on a random basis of one

sample per 400 liters (100 gallons). All paint samples should be taken from the painters buckets. The sample container must be nearly filled and sealed airtight. All paints bearing dates of manufacture over one year old shall be sampled on a basis of one sample per 200 liters (50 gallons).

5. Field Inspection: Determine the mass (weight) per liter (gallon) and compare with the Laboratory test report. Laboratory test reports show the mass (weight) per liter (gallon) at time of acceptance. Appreciable variation from this mass (weight) after arrival on the job is an indication of contamination.

The mass (weight) per liter (gallon) of the paint shall be determined on a random sampling basis by filling a 4-liter (1-gallon) pail to the point where the paint touches the bottom of the inner lip, with paint taken from the top of a container of thoroughly mixed paint, and weighing it to the nearest gram (tenths of a pound) on a market-type scale.

See that paint is not caked in the container, that it is free from skins and is well stirred before withdrawing portions for use.

Paint that has become lumpy during use should be strained through cheesecloth. During cold weather the paint can be made thinner by placing the container in warm water.

After application the paint should dry to a uniform film without running, streaking or sagging.

6. Specification Requirements: See *Standard Specifications* Section 9-08. Review contract documents to determine if supplemental specifications apply.

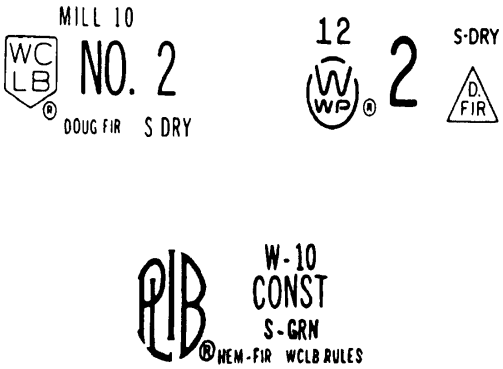
9-4.36 Structural Timber and Lumber — Untreated

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance:

   a. Permanent structures and sign posts 6 x 6 and larger require a Manufacturer's Certificate of Compliance (i.e., Lumber Grading Certificate) conforming to the requirements of the *Standard Specifications*. The Manufacturer's Certificate of Compliance will be issued by the grading bureau whose authorized stamp is being used, or by the mill grading the timber or lumber under the supervision of one of the following lumber grading agencies: West Coast Lumber Inspection Bureau (WCLIB), Western Wood Products Association (WWPA), or the Pacific Lumber Inspection Bureau (PLIB). A typical lumber grade stamp as used by the various inspection agencies are shown below:



   b. Sign posts less than 6 × 6, mileposts, sawed fence posts, and mailbox posts will be accepted by visual determination in the field that each post is stamped with the correct lumber grade.

The PLIB graded lumber will be graded under the grading rules of one of the other two listed agencies and will be grade stamped accordingly.

All timber and lumber is subject to reinspection upon delivery to the project.

4. Assurance: Samples not required.

5. Field Inspection: Check for compliance with specifications.

6. Specification Requirements: See *Standard Specifications* Section 9-09. Review contract documents to determine if supplemental specifications apply.

9-4.37 Treated Timber and Piling

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance:

   a. Permanent structures, sign posts 6 × 6 and larger. Check for inspector's stamp or tag. Acceptance for shipment stamp consists of a circled "WSDOT," or "WHD." Accepted for shipment tags will be stapled to the ends of the pilings or timber. All piling will be stamped or tagged on the butt end. Only about one-third of the approved timber pieces will be stamped or tagged for acceptance. All rejected timber pieces will always be marked with a circled "X."

   b. Sign posts less than 6 × 6, mileposts, sawed fence posts, and mailbox posts except as listed under 9-4.36.

4. Assurance: Samples not required.

5. Field Inspection: Check primarily for damage caused by handling. Check pieces for inspector's stamp or tag.

6. Specification Requirements: See *Standard Specifications* Sections 9-09 and 9-10. Review contract documents to determine if supplemental specifications apply.

9-4.38 Piling — Untreated

1. Approval of Source: Approval of source is not required.

2. Preliminary Samples: Not required.

3. Acceptance: Field inspection.

4. Assurance: Samples not required.

5. Field Inspection: Check for compliance with specifications.

6. Specification Requirements: See *Standard Specifications* Section 9-10.1(1). Review contract documents to determine if supplemental specifications apply.

9-4.39 Steel H-Piling

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Samples are not required unless requested on Approval of Source Form 350-071. Submit a 300 mm (1-foot) section of the piling if requested.

3. Acceptance: Material may be accepted on satisfactory Manufacturer's Certificate of Compliance including mill certificates showing heat number, physical properties and chemical composition.

4. Assurance: Samples are not required.

5. Field Inspection: Check material in each shipment against heat numbers shown on Mill Test Certificates. Check for damage due to shipping and handling.

6. Specification Requirements: See *Standard Specifications* Section 9-10.5. Review contract documents to determine if supplemental specifications apply.

9-4.40 Hollow Steel Piling and Jack Casing

1. Approval of Source: Approval of source is required.

2. Preliminary Sample: Samples are not required unless requested on Approval of Source Form 350-071.

3. Acceptance: Material may be accepted on satisfactory Manufacturer's Certificate of Compliance showing heat number, physical properties, and chemical composition.

4. Assurance: Samples are not required.

5. Field Inspection: Check material in each shipment against heat numbers shown on Mill Test Certificates. Check for damage due to shipping and handling.

6. Specification Requirements: See *Standard Specifications* Section 9-10.5. Review contract documents to determine if supplemental specifications apply.

9-4.41 Precast Concrete Catch Basins, Manholes, and Inlets

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: After the source has been approved, field acceptance will be based on "WSDOT Inspected" stamp or tag provided by the in-plant Materials Inspector.

4. Assurance: Samples not required.

5. Field Inspection: Check for shipping and handling damage and "WSDOT Inspected" stamp or tag.

6. Specification Requirements: See *Standard Specifications* Section 9-12. Review contract documents to determine if supplemental specifications apply.

9-4.42 Stone or Broken Concrete Rubble for Quarry Spalls and Riprap

1. Approval of Source: Approval of source is required for stone.

2. Preliminary Samples: Samples not required unless requested on Approval of Source Form 350-071.

   a. Quality testing for stone shall consist of a 35-kilogram (80-pound) minimum sample (quarry spall sized rock) of unprocessed material from the same area and deposit within the pit as the proposed material. This material shall meet the requirements of Section 9-13 of the *Standard Specifications*.

   Submittal of this sample will not be required if the source has satisfactorily passed the quality test within the preceding 12 months. The Request for Approval of Material Sources, DOT Form 350-071 will reflect the current status of the quarry.

   b. Quality testing for broken concrete rubble shall be as described for stone but may be omitted based on visual examination and discretion of the Project Engineer.

3. Acceptance:

   a. When project quantities for Quarry Spalls are less than 75 cubic meters (100 cubic yards) 200 tonnes (tons) or project quantities for Rip Rap are less than 40 cubic meters (50 cubic yards) (100 tonnes (tons)),

the Project Engineer is delegated acceptance authority for visual determination of Quality of Source

b. When project quantities for Quarry Spalls are between 75 and 400 cubic meters (100 and 500 c.y.) (200 to 1,000 tonnes (tons)) or project quantities for Rip Rap are between 40 and 400 cubic meters (50 and 500 c.y.) (100 to 1,000 tonnes (tons)), the source must have had a satisfactory quality test within the preceding 24 months. The Project Engineer shall determine that the grading is in conformance with the *Standard Specifications* Section 9-13.

c. When project quantities for Rip Rap or Quarry Spalls exceed 400 cubic meters (500 c.y.) (1,000 tonnes (tons)), the source must have had a satisfactory quality test within the preceding 12 months. The Project Engineer shall determine that the grading is in conformance with the *Standard Specifications* Section 9-13.

4. Assurance: Samples are not required.

5. Field Inspection: See that the gradation remains constant.

6. Specification Requirements: See *Standard Specifications* Section 9-13.

9-4.43 Semi-Open Slope Protection

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source, will be required only if requested on the Request for Approval of Material Sources Form 350-071.

3. Acceptance: Material may be accepted on receipt of Manufacturer's Certificate of Compliance.

4. Assurance: Samples not required.

5. Field Inspection: Check material delivered to the project for conformance with the contract plan and specifications.

6. Specification Requirements: See *Standard Plans*. Review contract documents to determine if supplemental specifications apply.

9-4.44 Plant Material

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: A preliminary sample will be required for all plant material except for trees. Color photographs showing a full view and close-ups and/or cuttings off an individual limb, may be substituted in lieu of the trees if the detail is such that the variety and form can be identified from the photographs and materials furnished.

3. Acceptance: After the approval of the source, the plants may be accepted based on field inspection on the job site. Sample lots as provided in (5), Field Inspection. Field Inspection will be the inspection of the acceptance samples. Acceptable samples will be incorporated into the project.

4. Assurance: Samples not required.

5. Field Inspection: Check for uniformity of plants within each lot and for representative sample lot based on the following:

(N = total number of plants in lot)

(n = number of plants in sample lot)

Total Number of Plants (N)	Minimum No. of Plants required to make sample lot (n)
0 — 20	N
21 — 100	20
101 — 1,000	20 +0.04 (N — 100)
1,001 — 5,000	50 +0.02 (N — 1,000)
5,001 — 30,000	130+0.01 (N — 5,000)
Over 30,000	380+0.005 (N — 30,000)

Should less than 5 percent of the sample lot fail, the entire lot may be accepted. Should over 5 percent of the acceptance sample lot fail to meet nominal specifications requirements, the entire lot shall be rejected and removed from the job, except that, if in the opinion of the Engineer, the lot appears to be exceptionally hearty and vigorous and a large percent might be acceptable after reviewing and sorting by the Contractor. If done immediately, the Contractor shall be allowed to sort and remove the substandard portion of the plants.

After the contractor has completed sorting, a new sample lot based on the above schedule of the remaining stock will again be selected and inspected. Should less than 5 percent of this sample lot fail, the sorted lot may be accepted.

6. Specification Requirements: See *Standard Specifications* Section 9-14. Review contract documents to determine if supplemental specifications apply.

9-4.45 Topsoil Type A

1. Approval of Source: Approval of source is required for Topsoil Type A prior to use.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Material may be accepted upon receipt of a Manufacturer's Certificate of Compliance with accompanying test reports verifying conformance with the Contract Specifications.

4. Assurance: Samples not required.

5. Field Inspection: The material shall be inspected for roots, weeds, subsoil, rocks, and other debris.

6. Specification Requirements: See *Standard Specifications* Section 9-14.1. Review contract documents to determine if supplemental specifications apply.

9-4.46 Seed

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: Material may be accepted on analysis shown on the label. Submit a copy of the label with the Erosion Control Report.

4. Assurance: Samples not required.

5. Field Inspection: Each individual sack of seed must contain a label (tag) as to the contents and be unopened prior to use on the project. At least one label should be retained in the project records in the event that subsequent questions or claims may arise.

6. Specification Requirements: See *Standard Specifications* Section 9-14.2. Review contract documents to determine if supplemental specifications apply.

9-4.47 Fertilizer

1. Approval of Source: Approval of sources is required.

2. Preliminary Samples: Not required.

3. Acceptance:

a. Fertilizer Acceptance: General

Fertilizer may be accepted based on approval of source and chemical content based on container labels. No fertilizer shall be used from unidentified or unlabeled containers.

b. Fertilizer for Erosion Control

The application of fertilizer for erosion control will be in accordance with an erosion control plan which shall be reviewed by and approved by the Project Engineer prior to application. The required elements for the erosion control plan are set forth in the format of the erosion control report.

For Erosion Control on projects with total quantities less than 2 hectares (5 acres), acceptance of fertilizer may be made by verification of the components based on stamped or printed bag analysis. Projects involving 2 hectares (5 acres) or more shall require a certified analysis of each component furnished meeting the requirements of a Manufacturer's Certificate of Compliance.

Upon completion of erosion control work, the Project Engineer will provide a summary erosion control report reflecting the materials and amounts applied. A sample format is shown in Figure 9-3.

c. Fertilizer for Landscaping

Fertilizer for landscaping projects may be accepted on the basis of examination of the labelled contents for conformance to the project specifications.

4. Assurance: Samples not required.

5. Field Inspection: Each individual sack must be labeled as to its contents which must meet the requirements specified in the special provisions. All bags must be unopened prior to use on the project. Most fertilizers specified contain ureaform (38-0-0) which is blue-green in color which makes that component's presence easy to identify.

6. Specification Requirements: See *Standard Specifications* Section 9-14.3. Review contract documents to determine if supplemental specifications apply.

9-4.48 Mulch

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: Material may be accepted as described below for the different types of mulch:

a. Straw — Visual inspection.

b. Wood Cellulose Fiber — Manufacturer's Certificate of Compliance.

c. Bark — Field gradation test.

d. Sawdust — Visual inspection.

e. Tackifier — Manufacturer's Certification of Compliance.

4. Assurance: Samples not required.

5. Field Inspection: A visual inspection shall be made to ensure uniformity of the mulch. Also check for detrimental contamination.

6. Specification Requirements: See *Standard Specifications* Section 9-14.4. Review contract documents to determine if supplemental specifications apply.

Erosion Control Report

Contract Number: _____

Date: _____

Contractor: _____

Subcontractor: _____

Inspector: _____

The following materials and rates per hectare (acre) were applied in conformance with the project provisions. Page(s) ____

la) Fertilizer: _____
(Bag analysis is attached)
Application Rate: _____ per hectare (acre)

lb) Fertilizer: _____
(Bag analysis is attached)
Application Rate: _____ per hectare (acre)

lc) Fertilizer: _____
(Bag analysis is attached)
Application Rate: _____ per hectare (acre)

ld) Fertilizer: _____
(Bag analysis is attached)
Application Rate: _____ per hectare (acre)

2) Seed: _____
(Certified analysis is attached)
Application Rate: _____ per hectare (acre)

3) Mulch: _____
Type: _____
Application Rate: _____ per hectare (acre)

4) Tackifier: _____
Type: _____
Application Rate: _____ per hectare (acre)

The above application calculates to be:

Pounds Nitrogen per hectare (acre): _____

Percentage ureaform or ureaformaldehyde: _____

Pounds Phosphorus per hectare (acre): _____

Pounds Potassium per hectare (acre): _____

Pounds Sulfur per hectare (acre): _____

Contractors Signature: _____

Date: _____

Figure 9-3

9-4.49 Irrigation System

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: Material may be accepted in lieu of sampling upon receipt of an approved document as shown:

a. PVC Water Pipe — Manufacturer's Certificate of Compliance.

b. Polyethylene Pipe — Manufacturer's Certificate of Compliance.

c. Galvanized Iron Water Pipe — Manufacturer's Certificate of Compliance.

d. Drip Tubing — APPROVED Catalog Cut.

e. Automatic Controllers — APPROVED Catalog Cut.

f. Sprinkler Head — APPROVED Catalog Cut.

g. Valve Boxes and Protective Sleeves — APPROVED Catalog Cut.

h. Gate Valves — APPROVED Catalog Cut.

i. Manual Control Valves — APPROVED Catalog Cut.

j. Automatic Control Valves — APPROVED Catalog Cut.

k. Automatic Control Valves with Pressure Regulator — APPROVED Catalog Cut.

l. Quick Coupling Equipment — APPROVED Catalog Cut.

m. Drain Valves — APPROVED Catalog Cut.

n. Hose Bibs — APPROVED Catalog Cut.

o. Cross-Connection Control Devices — APPROVED Catalog Cut.

p. Check Valves — APPROVED Catalog Cut.

q. Pressure Reducing Valves — APPROVED Catalog Cut.

r. Three-way Valves — APPROVED Catalog Cut.

s. Flow Control Valves — APPROVED Catalog Cut.

t. Air Relief Valve — APPROVED Catalog Cut.

u. Electrical Wire and Splices — APPROVED Catalog Cut.

v. Detectable Marking Tape — APPROVED Catalog Cut.

w. Wye Strainers — APPROVED Catalog Cut.

4. Assurance: Samples not required.

5. Field Inspector: Check for damage to coatings in shipping and handling. See that damaged areas and field cut threads are protected with an approved coating.

6. Specification Requirements: See *Standard Specifications* Section 9-15. Review contract documents to determine if supplemental specifications apply.

9-4.50 Fencing

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: Material may be accepted on receipt of satisfactory test report from the Olympia Service Center or Regional Materials Laboratory. Send acceptance samples as follows:

a. Chain Link Fabric — One sample consisting of three wires across full width of fabric from one of each 50 rolls.

b. Wire Mesh — One 300-mm (12-inch) sample across full width of roll, from one of each 50 rolls.

c. Barbed Wire — One 1-meter (3-foot) piece from one of each 50 spools.

d. Rails and Posts for Chain Link Fence — Sample to consist of one rail or post selected for sampling. Sample one rail or post for each 500.

e. Metal Posts for Wire Fence Line Posts — One complete post with plate for each 500 posts. Corner Posts or brace pots — one complete post per 10 corner or brace posts.

Above samples are to be taken from properly identified lots of material stored at job site. Be sure samples are numbered and properly identified as to Lot when sent to the Laboratory. If first sample fails, two additional samples are to be submitted from same lot. Resamples are to be properly identified as to Lot and referenced to previous Lab No. for first sample.

4. Assurance: Samples not required.

5. Field Inspection: Check for damage to spelter coating on posts, rails, hardware, etc. Weigh an occasional post or column to check against specification requirements.

6. Specification Requirements: See *Standard Specifications* Section 9-16. Review contract documents to determine if supplemental specifications apply.

9-4.51 Beam Guardrail, Guardrail Anchors, and Glare Screen

1. Approval of Source: Approval of source is required. May be approved through Subcontractor Qualification.

2. Preliminary Samples: Not required.

3. Acceptance: Steel rail elements, fittings, terminal sections, hardware, and bolts may be accepted by Qualified Subcontractor's Certification.

4. Assurance: Samples are not required from the job.

5. Field Inspection: Check material delivered to the project for damage to galvanizing. Verify quantities against Subcontractor's Certification.

6. Specification Requirements: See *Standard Specifications* Section 9-16.3. Review contract documents to determine if supplemental specifications apply.

7. Procedural letter and typical request for approval are shown in Figures 9-4 and 9-5, following.

9-4.52 Guardrail Posts and Blocks

1. Approval of Source: Approval of source is required through Subcontractor's Qualification.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source, will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Material may be accepted on qualified Subcontractor's Certification of completed installation.

4. Assurance: Samples not required.

5. Field Inspection: Check material delivered to the project for conformance with the contract plan and specifications. Verify quantities against Subcontractor's Certification.

6. Specification Requirements: See Standard Plans. Review contract documents to determine if supplemental specifications apply.

9-4.53 Miscellaneous Precast Concrete Products (Including Posts, Markers, and Cribbing)

1. Approval of Source: Approval of source is required unless made on job.

2. Preliminary Samples: Not required.

3. Acceptance: Acceptance on field inspection. In general, the Olympia Service Center Materials Laboratory will not undertake inspection of these products. When large quantities are involved, the Regional Administrator should arrange for inspection during manufacture, including the sampling of materials and the making of test cylinders.

4. Assurance: Samples not required.

5. Field Inspection: Check mix and quality of concrete during manufacture. Check placement of reinforcing. Check the finish. Check the curing. Make test cylinders.

6. Specification Requirements: See *Standard Specifications* Sections 9-18. Review contract documents to determine if supplemental specifications apply.

9-4.54 Prestressed Concrete Products

1. Approval of Source: Approval of manufacturer is required.

2. Preliminary Samples: Not required.

3. Acceptance: Acceptance will be based on "APPROVED FOR SHIPMENT" tags from plant inspection and on field inspection for damage due to shipping and handling.

4. Assurance: Assurance samples are not required from the Project Engineer. Sampling is performed during fabrication by the plant Inspector under the Regional Materials Engineer.

5. Field Inspection: Check for damage due to shipping and handling.

6. Specification Requirements: See *Standard Specifications* Section 6-02.3(25) and Section 9-19. Review contract documents to determine if supplemental specifications apply.

9-4.55 Raised Pavement Markers, Types 1, 2, and 3

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: Type 1 markers shall be from tested and approved lots identified with an "APPROVED FOR SHIPMENT" stamp or tag. After use, all emptied, marked boxes shall be destroyed.

Type 2 markers accept on verification of "Stimsonite" or "Ray O Lite" brand.

Type 3 markers accept on approval of source. No acceptance samples required unless directed by source approval.

4. Assurance: Samples not required.

5. Field Inspection: A visual inspection shall be made to ensure that cracked or damaged lane markers are not incorporated in the work.

Washington State
Department of Transportation
Sid Morrison
Secretary of Transportation

Transportation Building
P.O. Box 47300
Olympia, WA 98504-7300

Dear

Following up on the initial, informal discussions, the Washington State Department of Transportation (WSDOT) is prepared to move toward the acceptance of guardrail based on contractor/subcontractor certification. The details of the operational system from the WSDOT viewpoint is set forth in the enclosed copy of memorandum.

From the standpoint of the contract operations, we see these as the key points:

1. Guardrail contractors/subcontractors will be identified on a prequalified materials list, based on their individual request.

2. For a specific contract, the Prime Contractor will identify the proposed use of an approved guardrail contractor/subcontractor by the submittal of a Request for Approval of Materials Source (RAMS) to the Project Engineer.

3. Guardrail materials utilized by the contractor/subcontractor will be certified by the original suppliers and these records will be maintained by the guardrail contractor/subcontractor, traceable to project utilization for a period of five (5) years after the completion of any affected contract. The certifications on file will meet the requirements of a manufacturers' Certificate of Compliance.

4. Following approval by the Project Engineer under the delegated authority, no further materials documentation will be required during the course of the work concerning steel guardrail and components and timber posts and blocks.

5. At the conclusion of the work, the guardrail contractor/subcontractor will furnish the Project Engineer a certification enumerating the items and quantities furnished for the guardrail installation and attesting as to the materials conformance to the WSDOT contract provision. This must also include documentation of steel materials as to their conformance to the "Buy American" Special Provision included in federal aid projects.

In order to proceed with this process, we have prepared an agreement letter for your consideration and execution if you wish to be established as an Approved Guardrail contractor/subcontractor for materials documentation purposes. Please complete this form and include a RAMS for the materials sources which you contemplate utilizing.

If you have further questions, please contact the Olympia Service Center Materials Laboratory.

Sincerely

Figure 9-4

Guardrail Contractor/Subcontractor Approval Request

WSDOT
Materials Engineer
P.O. Box 167
Olympia, WA 98507-0167

Dear Sir:

We request approval as a Qualified Guardrail Contractor/Subcontractor for the purpose of Materials Acceptance Documentation. Guardrail materials will be furnished from only those sources indicated on the enclosed Request for Approval of Materials Sources or as amended during the calendar year. Materials furnished and installed on WSDOT Construction Contracts will be fully documented pior to final acceptance of the work as to quantities of components provided. All materials furnished will be documented in the subcontractor's files by means of Manufacturer's Certificates of Compliance as to their conformance to the contract specifications. Such records will be maintained for a period of five (5) years after installation.

_____
(Company)

_____
(Signature)

_____
(Address)

Figure 9-5

6. Specification Requirements: See *Standard Specifications* Section 9-21. Review contract documents to determine if supplemental specifications apply.

9-4.56 Signing Materials

1. Approval of Source: Approval of Sign Fabricator is required.

> **Note**: Sources for the signing materials are approved on an annual basis for each sign fabricator. The sign fabrication inspector will arrange for the annual source approval and for new sources of signing materials as necessary.

2. Preliminary Samples: A preliminary sample for pre-qualification of a source will be required only if requested on the Request for Approval of Material Sources Form 350-071.

3. Acceptance: The finished sign will be accepted based on a "FABRICATION APPROVED" decal attached to the back of each sign. A Sign Acceptance Report (SAR) will be issued by the sign fabrication inspector which will confirm that all materials incorporated in the signs are accepted.

> **Note**: Reflective sheeting, legend, and prismatic reflectors shall be tested and accepted based on a "lot" of material. A "lot" is defined as the amount of sheeting or legend received by a fabricator in a single shipment. All rolls or individual shipping units within a lot shall be sampled and tested.

4. Assurance: Samples not required.

5. Field Inspection: Check "Fabrication Approved" decal. Check for damage due to shipping, handling, and installation.

6. Specification Requirements: See *Standard Specifications* Sections 9-18. Review contract documents to determine if supplemental specifications apply.

9-4.57 Concrete Curing Compounds

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: A preliminary sample of 1 liter (1 quart) for pre-qualifying a source will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Submit 1 liter (1 quart) for each lot of curing compound delivered to each project. Material will be accepted based on satisfactory test results from the Olympia Service Center Materials Laboratory on samples taken from the project. No curing compound shall be used on WSDOT work prior to testing of each lot. Samples must be submitted for testing 10 days prior to use of curing compound.

4. Assurance: Samples are not required.

5. Field Inspection: Check different lots for similarity in appearance and working properties.

6. Specification Requirements: Are covered in general in the *Standard Specifications* Section 9-23, but additional requirements may be specified in giving approval. Review contract documents to determine if supplemental specifications apply.

9-4.58 Air Entraining Admixtures and Water Reducing Admixtures

1. Approval of Source: Approval of source is required before use.

2. Preliminary Samples: A preliminary sample of 1 liter (1 quart) for pre-qualifying will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Acceptance will be on the basis of Manufacturer's Certificate of Compliance.

4. Assurance: Samples are not required.

5. Field Inspection: Check for thorough mixing of containers before use. Check dispensing equipment for correct discharge.

6. Specification Requirements: See *Standard Specifications* Section 9-23.6. Review contract documents to determine if supplemental specifications apply.

9-4.59 Plastic Waterstop

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Material may be accepted on basis of Manufacturer's Certificate of Compliance.

4. Assurance: Samples not required.

5. Field Inspection: Check for uniformity of product in lot, and for damage in shipment or handling.

6. Specification Requirements: See *Standard Specifications* Section 9-24. Review contract documents to determine if supplemental specifications apply.

9-4.60 Epoxy Resins

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: A preliminary sample of 1 liter (1 quart) for pre-qualifying a source will be required only

if equested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Material may be accepted on receipt of satisfactory test report from the Olympia Service Center Materials Laboratory. Submit mix ratios, intended use, and sufficient component materials to produce 1 liter (1 quart) of the mixture for each batch or lot number. Lane Marker adhesive does not require field sampling.

4. Assurance: Samples are not required.

5. Field Inspection: Check for uniformity of color and conformance to required mix proportions. Streaking is an indication of inadequate mixing. Check for set and hardness with your thumbnail. You should not be able to dent the properly mixed and cured material.

Synthetic binders shall be mixed and applied in conformance to manufacturer's written instructions unless otherwise modified in writing by the manufacturer's agent.

6. Specification Requirements: See *Standard Specifications* Section 9-26. Review contract documents to determine if supplemental specifications apply.

9-4.61 Gabion Baskets

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source will be required only if requested on Request for Approval of Material Sources Form 350-071. The sample shall be as shown in 3a to 3d below.

3. Acceptance: Acceptance is based on receipt of a Manufacturer's Certificate of Compliance with accompanying Mill Test Report. Acceptance sample may be requested by the Project Engineer or the Olympia Service Center Materials Laboratory and shall consist of the following:

   a. One square meter (yard) of mesh including selvage and body wire.

   b. One meter (3 feet) of tie wire.

   c. One meter (3 feet) of lacing wire.

   d. Six each, wire clips, fasteners.

4. Assurance: Samples not required.

5. Field Inspection: Check for damage.

6. Specification Requirements: See *Standard Specifications* Section 9-27.3. Review control documents to determine if supplemental specifications apply.

9-4.62 Sign Structures

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: The fabricated sign structure will be accepted on the basis of an "APPROVED FOR SHIPMENT" stamp or tag. When the structures are fabricated out-of-state and are shipped directly to the job site, arrangements must be made with the Materials Fabrication Inspection Office to have the structures inspected prior to erection.

4. Assurance: Samples are not required.

5. Field Inspection: Check for "APPROVED FOR SHIPMENT" tags or stamps and damage due to shipping, handling and erection.

6. Specification Requirements: See design standards and *Standard Specifications* Section 9-28.15. Review contract documents to determine if supplemental specifications apply.

9-4.63 Conduit

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance:

   a. Galvanized conduit shall be accepted on receipt of satisfactory test reports. Each sample requires two 300-mm (12-inch) sections, one from each end of a standard length of conduit. Resampling, when directed, requires twice the number of pieces specified. Be sure that matching end pieces are identified.

   b. Fiber reinforced plastic, flexible, and plastic conduit shall be accepted on Manufacturer's Certificate of Compliance or on catalog cuts.

4. Assurance: Samples not required.

5. Field Inspection: Check for Underwriters approval labels. Check for damage to coatings in shipping and handling, and see that damaged areas and field cut threads are protected with an approved coating.

6. Specification Requirements: See *Standard Specifications* Section 9-29.1. Review contract documents to determine if supplemental specifications apply.

9-4.64 Electrical Conductors

1. Approval of Source: Approval of Source is required.

2. Preliminary Samples: Not required.

3. Acceptance: Conductors are accepted on receipt of satisfactory test results from the Olympia Service Center Materials Laboratory.

a. Single Conductors: (electrical conductor for power feed or distribution, loop detector, or building and control wiring are typical applications). A sample is required for each manufacturer, insulation type, and wire size as described below from at least one unit (roll, carton, or reel) of each group of five units or less. An additional sample shall be taken from each five units or fraction thereof. Ensure that sample taken contains the complete printed/stamped designation: manufacturer, size, insulation type.

i. For conductors, size #2 and larger, a 600-mm (2-foot) sample is required.

ii. For conductors, size #4 and smaller, a 5-meter (15-foot) sample for each manufacturer type and size of conductor. The 5-meter (15-foot) sample will suffice for the required sample for up to the first five units of that size, type, and manufacturer. For additional conductor of the same size, type, and manufacturer, a 600-mm (2-foot) sample from each five units or fraction thereof is required.

b. Multiple Conductors: (traffic signal wiring, pole and bracket cable, opticom control, loop detector lead-in, or coaxial cables) A sample is required for each manufacturer, type, size, and brand. One 600-mm (2-foot) sample as described above for each five units or fraction thereof.

c. Fiber Optic Systems. No sampling of Fiber Optic cables or systems is required.

4. Assurance Samples: No Assurance Samples are required.

5. Field Inspection: A visual inspection shall be made to ensure that no conductors with damaged insulation are incorporated into the project.

6. Specification Requirements: See *Standard Specifications* Section 9-29.3. Review Contract Documents to determine if supplemental requirements apply.

9-4.65 Signal, Luminaire, and Strain Poles

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: If poles were inspected prior to shipment to job site, they will be stamped or tagged “APPROVED FOR SHIPMENT.” If not, poles must be inspected on job site by the Olympia Service Center Materials Inspection staff prior to installation. Acceptance will be based on approved shop drawings per Chapter 8-20.2B of this manual, Mill Test Certificates supplied by the manufacturer, and Material Acceptance Reports.

4. Assurance: Samples not required.

5. Field Inspection: Check for shipping and handling damage. Arrange for inspection if not tagged.

6. Specification Requirements: See *Standard Specifications* Section 9-29.6. Review contract documents to determine if supplemental specifications apply.

9-4.66 Luminaires and Lamps

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: Projects with up to four luminaires may be field inspected based on an approved catalog cut and concurrence of the Olympia Service Center Materials Laboratory. On projects installing five or more luminaires, the Field Inspector will submit a sample of each type of luminaire. On projects of 50 or more luminaires, the Laboratory will retain the sample unless otherwise stated in the special provisions.

4. Assurance: Samples not required.

5. Field Inspection: A visual inspection shall be made to ensure damaged equipment is not installed and that luminaires are mounted level. Confirm the socket position is the same as that noted on the catalog cut.

6. Specification Requirements: See *Standard Specifications* Section 9-29.10. Review contract documents to determine if supplemental specifications apply.

9-4.67 Water Distribution System

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: Material may be accepted in lieu of sampling upon receipt of an “APPROVED” document as shown below:

a. Ductile Iron Pipe — Manufacturer’s Certificate of Compliance.

b. Concrete Cylinder Pipe — Shop Drawings and “APPROVED FOR SHIPMENT” stamp or tag.

c. Steel Pipe (less than 150 mm (6 inches)) — Manufacturer’s Certificate of Compliance.

d. Steel Pipe (150 mm (6 inches) and larger) — Manufacturer’s Certificate of Compliance.

e. Transition Reducing and Flexible Couplings — Catalog Cut.

f. Restrained Joint Coupling — Catalog Cut.

g. Gate Valves (400 mm (16 inches) and larger) — Catalog Cut.

h. Butterfly Valves — Manufacturer's Certificate of Compliance.

i. Valve Boxes — Catalog Cut.

j. Combination Air Release/Air Vacuum Valves — Catalog Cut.

k. Hydrants — Catalog Cut.

l. Service Connection — Saddles — Catalog Cut.

m. Service Connection — Corporation Stops — Catalog Cut.

n. Service Connection — Service Pipe (Copper) — Catalog Cut.

o. Service Connection — Service Pipe (Polyethylene) — Catalog Cut.

p. Service Connection — Service Pipe (Polybutalene) — Catalog Cut.

q. Service Connection — Compression Couplings — Catalog Cut.

r. Service Connection — Insulating Couplings — Catalog Cut.

4. Assurance: Samples are not required from the job.

5. Field Inspection: Check material delivered to the project for damage, and conformance to the contract documents.

6. Specification Requirements: See *Standard Specifications* Section 9-30. Review contract documents to determine if supplemental specifications apply.

9-4.68 Elastomeric Bearing Pads

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: Material may be accepted on a Manufacturer's Certificate of Compliance accompanied by a certified test report identifying the specific batch of material and conforming to AASHTO M251.

4. Assurance: Samples not required.

5. Field Inspection: Make certain that material to be used is from the certified batch.

6. Specification Requirements: See *Standard Specifications* Section 9-31. Review contract documents to determine if supplemental specifications apply.

9-4.69 Fabric Pad Bearings

1. Approval of Source: Approval of source is required for the fabricator and all material components of the bearings.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Material may be accepted on receipt of the following "APPROVED" documentation and "SATISFACTORY" Test Reports for the various material items used in the Fabric Pad Bearing Manufacturer:

a. Polytetrafluorethylene (TFE) sheeting, fabric, and elastomer — Manufacturer's Certificate of Compliance.

b. Steel Plates and shapes including stainless steel — Manufacturer's Certificate of Compliance.

c. TFE and stainless steel coefficient of friction requirements — Certified Test Reports from independent testing laboratory.

d. Proof load testing reports for preformed fabric pads — Certified Test Reports from independent testing laboratory.

e. Sample of preformed fabric pad — "SATISFACTORY" Test Report from the Olympia Service Center Materials Laboratory.

f. Field Inspection of bearing assemblies — Contact the Seattle Inspection Office for field inspection and receipt of field inspection results.

4. Assurance: None required.

5. Field Inspection: A representative of the Material Fabrication Inspection Office will inspect the bearings for defects in workmanship and issue a report prior to the installation of any bearing assemblies.

6. Specification Requirements: Review the contract documents to determine the specification requirements.

9-4.70 Precast Concrete Barrier

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: If items were inspected prior to shipment to job site, they will be stamped or tagged "APPROVED FOR SHIPMENT."

4. Assurance: Samples not required.

5. Field Inspection: Check for shipping and handling damage and "APPROVED FOR SHIPMENT" stamp or tag.

6. Specification Requirements: See *Standard Specifications* Section 6-10. Review contract documents to determine if supplemental specifications apply.

9-4.71 Safety Bars, Cattle Guards, Sign Mounting Brackets, Steel and Special Guardrail Posts, Steel Sign Posts

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source will be required only if requested on Request for Approval of Material Sources Form 350-071.

3. Acceptance: Materials may be accepted on receipt of Manufacturer's Certificate of Compliance.

4. Assurance: Samples are not required from the job.

5. Field Inspection: Check each lot of material delivered to the project for damage, and that accompanying Manufacturer's Certificate of Compliance is present.

6. Specification Requirements: See *Standard Specifications* Section 9-05.18, 9-16.3(2), 9-28.15(1) and Standard Plans. Review contract documents to determine if supplemental specifications apply.

7. Field Inspection: Identify lots with test reports. Check for handling or shipping damage.

9-4.72 Metal Bridge Rail

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: Not required.

3. Acceptance: If rails were inspected prior to shipment to job site, they will be stamped or tagged "APPROVED FOR SHIPMENT." If not, rails must be inspected on job site by the Olympia Service Center Materials Inspection staff prior to installation. Acceptance will be based on approved shop drawings per Chapter 8-20.2B of this manual, Mill Test Certificates supplied by the manufacturer, and Material Acceptance Reports.

4. Assurance: Samples will not be required.

5. Field Inspection: Check for "APPROVED FOR SHIPMENT" tags or stamp. Check for damage caused by shipping and handling. Unless aluminum parts have been adequately wrapped, there may be damage to anodic and lacquer coating. Damaged parts shall be rejected.

6. Specification Requirements: See *Standard Specifications* Section 6-06.3(2). Review contract documents to determine if supplemental specifications apply.

9-4.73 Construction Geotextiles

1. Approval of Source: Approval of source is required.

2. Preliminary Samples: A preliminary sample for pre-qualifying a source will be required if requested on the Request for Approval of Material Sources Form 350-071.

3. Acceptance: Acceptance will be on Manufacturer's Certification of Compliance for quantities within the limits stated in the contract provisions. Satisfactory test reports from the Olympia Service Center Materials Laboratory for quantities which exceed the limits of the contract provisions. Sample per WSDOT Test Method 914.

4. Assurance: Assurance samples not required.

5. Field Inspection: Check each roll of geotextile fabric for proper identification as shown on either the Manufacturer's Certification of Compliance or on the Olympia Service Center Materials Laboratory test report.

6. Specification Requirements: Review contract provisions for current specifications.

9-5 Guidelines for Job Site Control of Materials

9-5.1 General

When in doubt as to sampling requirements, refer to Record of Materials, Form 350-029; Request for Approval of Material Sources Form 350-071; and Chapter 9-4 of this manual.

In some instances, to avoid delays and unnecessary expense to the Contractor, certain items usually sampled by project personnel may be sampled and tested by the Olympia Service Center Materials Laboratory at the warehouse or at the point of shipment. Such items, when properly identified with an "Approved for Shipment" tag, may be accepted for use by the Project Engineer without any further sampling or testing; however, a visual check for damages due to shipment and handling should be made before incorporating the materials into the work. Arrangements for such warehouse or point-of-shipment inspection and testing should be made with the Laboratory by project personnel to ensure common basis for acceptance and preclude unnecessary duplication of sampling and testing.

9-5.2 Sampling and Testing Schedule

9-5.2A General

The intent of sampling and testing is to ensure that the material provided to the project conforms to the specifications. The frequency schedule in Chapter 9-5.7 covers the minimum requirements for sampling and testing at the project level. The Project Engineer is responsible for obtaining the number of samples necessary to effect adequate control of the material being produced under the circumstances and conditions involved with the particular project. In some instances, good construction practice will necessitate more frequent tests to ensure adequate control of the quality of production. This will be the case where production is just getting under way, where source material is heterogeneous, or where production is variable or marginal in quality. Also operations from commercial sources when small lots of material are being sampled (as for barge loads of aggregate) or when stockpiles are built and depleted may require more frequent sampling and testing.

The instructions listed in Chapter 9-5.7 will be followed in the production of those surfacing materials covered therein. A minimum of one acceptance and one assurance test is required except for small quantities as shown in Paragraph 9-5.2C.

9-5.2B Reducing Frequency of Testing

In instances of uniform production where the material is running well within specification limits, deviations from the schedule may be effected by the Project Engineer. Deviations exceeding a 10 percent reduction will require approval from the Olympia Service Center Materials Laboratory and must be properly documented in the project records, and fully explained by the Project Engineer. Lack of personnel, equipment, and facilities will not be considered sufficient reasons for such deviation. When a reduction in the number of acceptance and assurance samples is approved, it shall also apply to a proportional reduction in the number of independent assurance samples.

Authority for approval of frequency reduction may be delegated to the Regional Materials Engineer upon request. This authority may permit overall reduction of sampling frequency or selective relief of selected test properties. Examples of selective relief would be reduction/elimination of fracture determinations for production from quarry sources or reduction of frequency for sand equivalent determination. As a general principle, frequency reduction may be considered whenever five consecutive samples taken at the normal frequency indicate full conformance with the specifications. For other reduction application, the Olympia Service Center Materials Laboratory may be consulted.

9-5.2C Sampling and Testing for Small Quantities of Material

Small quantities of material, except structurally critical concrete and pavement mixes placed on mainlines, ramps, and their shoulders, may be accepted from approved sources on the basis of one of the two following methods:

1. Acceptance on the basis of visual examination provided the source has been approved and has recently furnished similar material found to be satisfactory under WSDOT's normal sampling and testing procedures.

2. Acceptance on the basis of certification by the producer or supplier stating that the material complies with the specification requirements.

Acceptance of minor quantity materials by these methods must be fully documented and one copy of such documentation forwarded to the Olympia Service Center Materials Laboratory.

The primary documentation of acceptance of material under either of these two methods should be provided by the Project Engineer or Inspector accepting the material. The documentation may consist of a daily inspector's report with a statement as to the basis of acceptance of the material and the approximate quantity of material covered by the acceptance.

Amended acceptance procedures may be used when the total project quantities are less than one-half the minimum required sample frequency. This definition of minor quantities as well as considerations for other items without prescribed frequencies are accounted for in the preparation of the Record of Materials for the project. The minor quantities established at the time of preparing the Record of Materials are identified by <*> preceding the required acceptance criteria.

The principle involved, is to reduce the degree of inspection and testing by one degree whenever minor quantities (as defined above) are involved. The normal and relieved standards are as shown in the following table:

Standard Acceptance	Minor Quantity Acceptance
Acceptance Sample	
Aggregates	Visual Inspection
All Other Items	Certificate of Compliance
Certificate of Compliance	Visual Inspection
Approved Shipment Tags (MAR)	No Change
Pipe Acceptance Report	Visual Inspection
Proprietary Items (QPL in Specs)	No Change
Mill Test Reports	Visual Inspections
Catalog Cuts	No Change
Visual Inspection	
Landscape Materials	No Change

In applying this factor to the contract items, quantities representing a threshold cost value based on average bid prices are used. The same procedure may be used by the Project Engineer for components of bid items or for breakdown of lump sum items. For these items, and considering items which do not have critical structural importance, the Project Engineer may accept on the basis of visual inspection, materials having an estimated value of $200 or less. Fasteners (bolts and anchors) should be considered for structural importance especially. Whenever the inspector has reason to question the acceptability of material following visual inspection, normal sampling and testing should proceed before the material is accepted.

Quite often materials are supplied to projects from lots which have been tested and meet our specifications. Whenever this is the case, the producer or supplier could furnish a certificate stating the test results and that the material meets the requirements of the specifications; or he may refer to the project on which the lot was tested. In these cases, it would only be necessary for the Inspector to check the materials for storage or shipping damage. In case of doubt, confirmation of past approval can be secured by contacting the Olympia Service Center Materials Laboratory.

This acceptance procedure may be used for nonstructural miscellaneous areas of construction such as follows:

1. Auxiliary construction outside the shoulder line of the main roadways and ramps.

2. Safety improvement projects.

3. Rest areas.

4. Temporary construction work on larger projects (work that will be removed or abandoned before completion of the project).

Portland cement concrete from approved sources may be accepted for the following items on the basis of visual examination and occasional conventional field sampling and testing for characteristics such as slump and air, where specified, and occasional test beams or test cylinders, with only intermittent or random plant inspection as deemed necessary for control by the Project Engineer.

1. Finished, unfinished and temporary pavements not a part of a mainline, a ramp, or their shoulders; driveways; sidewalks; floors; slope paving: not exceeding 400 square meters (500 square yards) per day.

2. Curbs, gutters, ditch lining and similar items measured by linear measurement not exceeding 150 meters (500 linear feet) per day.

3. Miscellaneous usage such as building foundations, headers, anchors, metal pile shells, posts, catch basins, inlets, manhole bases, sign, signal and light bases, and similar work not to exceed 20 cubic meters (25 cubic yards) per day.

Under this system, arrangements should be made for the producer to state on the delivery ticket accompanying each load of concrete the class of concrete being furnished, the mass (weight) of cement, aggregates and water used in the batch and the time of batching. Only state-tested aggregates and supplier-certified cement, may be used.

Asphalt concrete from approved sources may be accepted for the following items on the basis of visual examination with only intermittent or random plant inspection as deemed necessary for control by the Project Engineer.

1. Pre-leveling course and patching including mainlines.

2. Driveways, sidewalks, road approaches, and parking areas.

3. Curbs and gutters.

4. Paved ditches and slopes.

Under this system, arrangements should be made for the producer to state on the delivery ticket accompanying each load of mix, the mass (weight) of the material and the percent of asphalt in the mix. Only state-tested aggregates and certified asphalt may be used. If payment for the item of the construction is by tonnes (tons), the amount of material accepted without providing a scaleperson on this basis shall be limited to 100 tonnes (tons) per day and 500 tonnes (tons) per project unless it is weighed by the Contractor's weighperson or on a commercial scale.

Asphalt concrete pavement placed on mainlines, intersections, ramps and their shoulders may be accepted without testing by the following procedure:

Total quantities of asphalt concrete, for quality assurance projects under Acceptance Plan C with quantities under 400 tonnes (tons) or other projects where job quantities are under 500 tonnes (tons) for placement as mainline, intersections, ramps, and shoulder paving may be accepted without acceptance testing on the day of production provided that all the following conditions have been met:

1. Materials Sources approved.

2. Aggregate tested and approved (Fracture and SE); Certified Asphalt Cement.

3. Previous production samples of the same class of mix from the proposed plant, produced within ten days prior to the paving operation have been tested by the Engineer and determined to be in full compliance with the specifications. Production for the small quantity shall be under the same plant operation and controls (bin masses (weights), plant rate, or feeder setting) as previously used.

Where the preceding conditions are not fulfilled, materials of minor quantities may be accepted on the basis of a single lot acceptance on an end product basis. Acceptability to be determined by a single representative sample. Test results shall be determined for at least two analyses of the same sample by different laboratory facilities. If the averaged results are not within the applicable tolerance bands, a price adjustment will apply to all material within the lot.

9-5.3 Point of Acceptance

STATE OWNED SOURCE: Material produced from State owned source may be accepted either as it is placed into stockpile or as it is placed in hauling vehicles for delivery to the roadway. The sampling and testing frequency during stockpiling shall be in conformance with Chapter 9-5.7 of this manual.

If the material is to be accepted as it is placed into stockpile, an occasional sample to confirm continued compliance with specification requirements shall be taken as the material is being removed from the stockpile for delivery to the roadway.

In the event sample testing during stockpiling shows the material to be marginal in any specification requirement, acceptance at this point shall be conditional and dependent on adherence to specifications at the time of removal from stockpile.

CONTRACTOR'S SOURCE: If stockpiled material is set aside exclusively for use on WSDOT projects it may be accepted the same as that for a state-owned source. If stockpiles are constructed for general use, then materials for WSDOT projects shall be sampled and tested for acceptance only when placed in vehicles for delivery to the roadway. If an existing stockpile was built without acceptance testing during material production, and later set aside exclusively for use on state projects, the material may be accepted in stockpile with appropriate test results from samples taken by the Engineer. The sampling and testing frequency shall conform to Chapter 9-5.7 of this manual.

9-5.4 Basis for Acceptance

The basis for acceptance of manufactured surfacing materials is compliance with existing specifications and is made by one of two methods:

1. Acceptance by Quality Assurance

For materials being accepted by quality assurance procedures, random samples will be statistically evaluated to determine quality level within a defined tolerance band. Acceptance, bonus, and disincentive procedures are defined in the Specifications.

The accuracy and reliability of testing is paramount under this process since significant monetary incentives may be affected. Accordingly, confirmation testing is required whenever widely varying test results are encountered.

Procedures for confirmation may be established by varying approaches dependent upon the material. These approaches will be defined by the department to ensure uniform application. They are intended to be applied by the field inspector or technician at the time the initial sample results are determined. They are to be applied only when the testing technician can not identify any errors or deviation occurring during the test procedure. Test results which are questioned due to acknowledged errors or equipment deficiencies are to be immediately discarded without recourse to the confirmation process.

Asphalt Concrete Pavement

Confirmation Test Procedure: Asphalt concrete test results shall be reviewed for aberrations in determination of asphalt content and of gradation passing the 6.30-mm (1/4-inch), 2.00-mm (#10), and 0.075-mm (#200) screens. Other test properties will not be subject to confirmation testing. A confirmation test shall consist of a retest of gradation on another portion of the original asphalt concrete sample and reevaluation of asphalt content by the same operator, test equipment, and procedures. Testing shall be conducted as soon as practical after completion of the initial test. Confirmation testing may be waived by the contractor's representative, if present, at the time for retest.

The retest for percent asphalt and all gradations 6.3-mm (1/4-inch), 2.00-mm (#10), and 0.075-mm (#200) will be performed under the following conditions:

Sublots	**Retest if:**
1 to 2 or until avg. and std. dev. are established	The test result falls outside the tolerance bands based on the applicable job mix formula.
3 or more	The test results fall outside the tolerance bands based on the applicable job mix formula and the test result is beyond 1½ standard deviations from the established average.

The original test results shall be considered as confirmed whenever the confirmation results fall within the limits of:

6.30 mm (1/4 inch)	±	4%
2.00 mm (#10)	±	2%
0.075 mm (#200)	±	0.4%
AC%	±	0.3%

Contractor's quality control results may be used to either confirm or establish the need for retest if they are available and based on a split of the sample or from independent sampling within one hour of the original sample. To be considered, the results must be based on the specified WSDOT test procedure.

When the results are confirmed, either by WSDOT testing or by comparison with the contractor's test results, the evaluation of the sublot shall be based on the original test results.

Whenever the results of the retest or comparison fall outside the above limits, the following procedure shall apply:

For Gradation:

A third set of test results shall be obtained from one of the following:

1. The contractor's quality control results. To be considered, they must be based on the specified WSDOT test procedures.

2. An additional set of WSDOT test results made on a portion of the material taken from the Nuclear Gage sample pan or other remnant of the original acceptance sample.

The three sets of test results so obtained shall be evaluated to determine which results from WSDOT testing are to be used to represent the sublot in question. The WSDOT test results taken initially are hereafter referred to as "**original**" test results. The WSDOT retest results, taken for confirmation are hereafter referred to as "**confirmation**" test results. The third set of test results whether taken by WSDOT or the contractor, are hereafter referred to as "**referee**" test results.

The following procedure will be utilized to determine the test of record for the sublot in question:

1. When contractor Q/C test results are used initially to confirm the original test results and it cannot be confirmed, the contractor's test results shall become the "referee" test. WSDOT will then run a retest from a portion of the original sample to establish the "confirmation" test results.

2. When WSDOT test results are used initially to confirm the original test results and it cannot be confirmed, Q/C test results may be used as the "referee" test.

3. The test results to be utilized as representing the sublot will be either the "original" or "confirmation" values as determined by the closest comparison to the "referee" test.

4. Contractor's Q/C test results will not be utilized to represent the test results of record for any sublot.

For Asphalt Content:

1. The source of asphalt shall be confirmed from the most recent Certificate of Asphalt Shipment. If the source does not match the calibration in use, the asphalt content determination is not valid and must be reevaluated using the specific calibration for the asphalt source.

2. If the source matches the calibration in use, the background reading shall be determined and reentered.

3. The mix design reference pan shall be rerun.

4. The test mass (weight) of the asphalt sample in question shall be verified against the calibration data and must be within 2 grams plus or minus.

5. The asphalt content shall be retested.

Unless the reference pan sample reading deviates by more then 0.2 percent from the reference reading obtained on arrival at the project, the asphalt content shall be entered as the average of the two determinations. When a deviation greater than 0.2 percent is noted a single-point calibration shall be run using aggregate sampled from the cold-feed and asphalt sampled on the project.

2. Acceptance by Non-Quality Assurance

Individual samples taken for acceptance determination may be subject to certain tolerances allowed outside the established value stated in the *Standard Specifications*. The tolerance acceptance procedures shall be followed in these cases.

The basis for acceptance of manufactured surfacing materials is compliance with existing specifications as modified to include the following tolerances. The application of these tolerances and the procedure to be used in material acceptance shall be conformity with the following guidelines:

The following shall be cause for immediate material rejection:

1. When a sample falls outside of the applicable tolerance bands.

2. When any two out of three consecutive samples are within tolerance bands, but outside specification limits.

3. When any sample has a gradation that falls within both the high and low tolerance bands as given for the stated point of acceptance.

4. Any sample where the material is outside the specification limits, but within the tolerance bands, in any two of the following properties:

Gradation (includes sand/silt ratio)
Fracture
Sand Equivalent

At any time a sample falls outside the specification limits, but within the tolerance bands, two additional samples representing current production shall immediately be taken in accordance with Chapter 5-4.2B of this manual. The Contractor may have the option of making plant adjustments prior to taking these samples. Production will be accepted until the second sample is checked in those properties shown to be out of specification in the first sample. If the second sample is also out of specification, acceptance of the material will halt immediately. If the second sample is within specification, the third sample will be checked immediately. If the third sample is out of specification, acceptance will cease. No further material will be accepted after the time of rejection until corrections are made in the operations and tests show the material to be within specification limits. Basis for acceptance after this correction will be in conformity with the procedure outlined above. All tests reflecting material outside the specification limits must be listed and justified on the Project Engineer's certification as required by Chapter 9-1.5 of this manual.

Material that has been produced prior to rejection (i.e., ACP in storage silo) may be incorporated into the project provided the Contractor is made fully aware that the material may be subject to a price adjustment or, in extreme cases, to total removal. Every effort shall be made to place this material in structurally noncritical areas such as shoulders or gore areas.

All material produced between the time of rejection and the time an acceptable material is produced, as defined by WSDOT tests, shall not be incorporated in the work in any manner until it meets specifications.

The tolerances shown hereinafter apply exclusively to the appropriate material specifications as listed in the *Standard Specifications*. These tolerances do not apply to those "special" materials having requirements differing from those listed in the *Standard Specifications*. For these "special" materials usually described in the special provisions, tolerances will be provided by the Olympia Service Center Materials Engineer upon request from the Regional Administrator.

All items for acceptance, except for sampling and testing PCC cores, testing concrete cylinder and cement and as shown in Chapter 9-5.5B will be sampled and tested by the Field Inspector.

9-5.5 Assurance Sampling and Testing

9-5.5A Independent Assurance Sampler

The Regional Administrator should assign a sufficient number of persons in each Region to handle the program for independent assurance sampling, testing and inspection review. These persons should be under the general direction of the Regional Materials Engineer.

It will be the duty of the Independent Assurance Sampler to conduct the independent assurance sampling program in accordance with the requirements of WSDOT.

It is essential that the Independent Assurance Sampler visit all projects, obtain the proper number of samples independently and observe the techniques of running the field test. A complete record should be kept of the sampling and testing performed during this inspection, the personnel whom contacted during the visit, and the suggestions or instructions that were left with the job personnel. Monthly reports of the Independent Assurance Sampler activities shall be submitted on Form 350-054.

The Assurance Samplers should be well trained and experienced in all phases of the work.

9-5.5B Assurance Sampling

The requirements for assurance sampling and testing are shown in Section 9-5.7. Note that if acceptance samples are taken more frequently than shown, the number of assurance samples will increase as one assurance sample and test is required for each five acceptance samples and tests for all aggregates.

Assurance sampling and testing will be done by the Field Inspector or the Independent Assurance Sampler as follows unless otherwise noted in Chapter 9-4 of this manual.

Three of every four assurance samples of aggregate may be taken by the field inspector and split two ways. One split will be tested by the inspector in the field as an acceptance sample and the other split will be submitted to the Regional Materials Laboratory as an assurance sample for immediate testing and comparison with field results. Assurance samples of asphalt mix will be split three ways and the final third sent directly to the Olympia Service Center Materials Laboratory.

The other one of four assurance samples of aggregate and asphalt mix will be taken by an independent sampler and will be split three ways. One split will be run in the field as an acceptance sample, the second split will be tested in the Regional Materials Laboratory and the third split will be sent to the Olympia Service Center Materials Laboratory for testing and comparison with the other two splits.

The results of the field and Regional Materials Laboratory tests should be submitted to the Olympia Service Center Materials Laboratory with their split of the sample.

It is the intent of this section that the independent assurance samples be taken totally random in manner. One of every four assurance samples on a project will be taken by the Independent Assurance Sampler. The Independent Assurance Sampler may be required to deviate from the "Every 4th" rule in order to accomplish this goal.

All assurance sampling and testing of portland cement concrete, including test beams, cylinder fabrication, slump, air and cement factor will be performed by the Independent Assurance Sampler. These assurance tests shall be done side by side with acceptance tests, and shall be performed with a separate set of testing equipment.

Compaction assurance testing of asphalt concrete will be witnessed and documented by the Independent Assurance Sampler at the frequency shown in Chapter 9-5.7 of this manual.

Assurance sample testing does not reflect on the acceptability of the material involved. Acceptance under the contract is determined by the acceptance testing process. Assurance testing is performed to obtain an independent verification of proper testing procedure and equipment. To achieve this goal, assurance samples and tests should employ another operator and separate set of testing equipment than that used for the acceptance tests. The operator may be the Assurance Inspector in person, the Regional Laboratory Foreman, or another qualified technician operating under their direction. The witnessing of procedures and tests as performed by the Acceptance Inspector does not constitute a valid assurance confirmation with the exception of nuclear density gauge testing that is specifically designed for witness testing.

When acceptance testing is done at the Regional Materials Laboratory, assurance samples will be required in the same manner as for acceptance sampling performed in the field. The assurance samples shall be tested by an individual other than the one performing the acceptance sample testing. Separate equipment should be used if available. It is recommended in this case that either the Region Laboratory Foreman or the Assurance Sampler perform the testing on the assurance samples. Transmittal of Independent Assurance Samples for testing in the Olympia Service Center Materials Laboratory shall follow the usual procedure.

9-5.5C Comparison of Assurance and Acceptance Test Results

Assurance sample results will be compared with the acceptance test results of the companion samples. Independent Assurance results will be compared with both the Assurance and Acceptance results.

Reports of the comparison of results will be provided to the Project Engineer and the Region Independent Assurance Sampler. Comments reflecting the degree of conformance will be entered in the remarks section of the report by the individual responsible for the test, either the Region Materials Engineer or Olympia Service Center Materials Engineer. The degree of conformance will be determined according to the deviation ranges noted below. Gradation test results will be compared only on specification screens.

Test	Normal Range of Deviation	Maximum Range of Deviation
Sand Equivalent	±8 points	±15 points
Fracture	±5 percent	±10 percent
Asphalt Content (ACP & ATB)	±0.3 percent	±0.6 percent
Air Content of Concrete	±1 percent	±2 percent
Slump of Concrete:		
19.0 mm (3/4 inch) Max. Aggregate and Specified Slump 75 mm (3 inches) or less	±0.5	±1
Specified Slump greater than 75 mm (3 inches) and 37.5 mm (1 1/2 inch) Max. Aggregate	±1	±1.5
Sieve Analysis — All Items:		
4.75 mm (No. 4) sieve and larger	±5 percent	±8 percent
3.35 mm (No. 6) sieve to 0.180 mm (No. 80) sieve	±3 percent	±6 percent
0.150 mm (No. 100) and 0.075 mm (No. 200) sieve	±2 percent	±4 percent

In the table above, "Normal Range" indicates an acceptable range of variation between test results and no action is required. Test results which fall in this category will be so indicated by the wording "*normal deviation*" on the assurance and independent assurance test reports.

Test results falling outside of the "Normal Range" but within the "Maximum Range," will be indicated by the wording "*questionable deviation*" on the assurance and independent assurance test reports. For deviations falling into this category, the Project Engineer or a representative shall review the original test report form, advise the responsible test operator of the deviation, and review the test procedure at the next opportunity.

Test results exceeding the maximum range will be indicated by the wording "*excessive deviation*." For deviations falling in the excessive category, the Project Engineer or a representative will notify the Independent Assurance Sampler and/or Region Trainer for their services in corrective action. Corrective action will include review of sampling procedures, sample splitting procedures, testing procedures, and testing equipment.

Actions and results of these investigations will be documented by the Project Engineer by a notation or attachment to the assurance sample test report and by the Independent Assurance Inspector in the monthly periodic activity report. These may include comments or findings by the Region Trainer. Extracts or references to these results shall be included in the Project Engineer's Project Certification.

Independent assurance comparisons are by their nature delayed in reaching the Project Engineer. The comparisons may reflect a more severe degree of nonconformance than was noted in the assurance sample comparison. The Project Engineer's actions should be as appropriate to the situation. If the operator and test equipment are still available the follow-up action should be complete. If not, that information should be noted and provided to the Independent Assurance Inspector and to the Olympia Service Center Materials Laboratory Contract Documentation Section.

9-5.6 Tolerance Limits — Metric

Crushed Surfacing Top Course

	Specification Limits	Tolerance Limits
% Passing 16.0 mm	100	95-100
% Passing 6.30 mm	55-75	50-80
% Passing 0.425 mm	8-24	5-27
% Passing 0.075 mm	10.0 Max.	11.0 Max.
Sand Equivalent	40 Min.	35 Min.
Fracture	75% Min.	70% Min.

Crushed Surfacing Base Course

	Specification Limits	Tolerance Limits
% Passing 31.5 mm	100	95-100
% Passing 16.0 mm	50-80	45-85
% Passing 6.30 mm	30-50	25-55
% Passing 0.475 mm	3-18	3-20
% Passing 0.075 mm	7.5 Max.	9.0 Max.
Sand Equivalent	40 Min.	35 Min.
Fracture	75% Min.	70% Min.

Ballast

	Specification Limits	Tolerance Limits
% Passing 63 mm	100	100
% Passing 50 mm	65-100	60-100
% Passing 25.0 mm	50-85	45-90
% Passing 6.30 mm	30-50	25-60
% Passing 0.425 mm	16 Max.	20 Max.
% Passing 0.075 mm	9.0 Max.	10.0 Max.
Sand Equivalent	35 Min.	30 Min.

Shoulder Ballast

	Specification Limits	Tolerance Limits
% Passing 63 mm	100	100
% Passing 19.0 mm	40-80	35-85
% Passing 6.30 mm	5 Max.	6 Max.
% Passing 0.150 mm (wet sieving)	0-2.0	0-2.9
Fracture	75% Min.	70% Min.

Maintenance Rock

	Specification Limits	Tolerance Limits
% Passing 12.5 mm	100	95 Min.
% Passing 6.30 mm	55-70	50-75
% Passing 0.425 mm	10-25	8-30
% Passing 0.075 mm	7.0 Max.	8.0 Max.
Sand Equivalent	40 Min.	35 Min.
Fracture	75% Min.	70% Min.

Gravel Base

	Specification Limits	Tolerance Limits
% Passing 6.30 mm	25 Min.	20 Min.
% Passing 0.075 mm	10.0 Max.	11.0 Max.
Dust Ratio	2/3 Max.	
Sand Equivalent	30 Min.	25 Min.

Sand Drainage Blanket

	Specification Limits	Tolerance Limits
% Passing 63 mm	90-100	85-100
% Passing 6.30 mm	30-100	25-100
The portion passing 6.30 mm shall meet the following requirements for grading:		
% Passing 2.00 mm	50-100	45-100
% Passing 0.30 mm	0-30	0-35
% Passing 0.150 mm	0-7	0-8
% Passing 0.075 mm	0-3.0	0-3.9

Gravel Backfill for Walls

	Specification Limits	Tolerance Limits
% Passing 100 mm	100	100
% Passing 6.30 mm	25-70	20-75
% Passing 0.075 mm	5.0 Max.	6.0 Max.
Max. Dust Ratio	2/3 Max.	
Sand Equivalent	60 Min.	55 Min.

Gravel Backfill for Pipe Bedding

	Specification Limits	Tolerance Limits
% Passing 25.0 mm	100	100
% Passing 6.30 mm	25-80	20-85
% Passing 0.075 mm	15.0 Max.	16.0 Max.
Sand Equivalent	35 Min.	30 Min.

Gravel Backfill for Drains

	Specification Limits	Tolerance Limits
% Passing 25.0 mm	100	95-100
% Passing 19.0 mm	80-100	75-100
% Passing 9.50 mm	10-40	8-45
% Passing 4.75 mm	0-4	0-5
% Passing 0.075 mm	0-2	0-2.5

Backfill for Sand Drains

	Specification Limits	Tolerance Limits
% Passing 12.5 mm	90-100	85-100
% Passing 6.30 mm	65-100	60-100
% Passing 2.00 mm	40-100	35-100
% Passing 0.30 mm	3-30	2-35
% Passing 0.150 mm	0-4	0-5
% Passing 0.075 mm	0-3.0	0-3.9

Gravel Borrow

	Specification Limits	Tolerance Limits
% Passing 31.5 mm	100*	95-100
% Passing 6.30 mm	25 Min.	20 Min.
% Passing 0.425 mm	40 Max.	43 Max.
% Passing 0.075 mm	7.0 Max.	9.0 Max
Sand Equivalent	50 Min.	45 Min.

*Maximum size may be increased by Engineer's approval.

Crushed Coverstone

	Specification Limits	Tolerance Limits
% Passing 19.0 mm	100	95-100
% Passing 16.0 mm	95-100	90-100
% Passing 6.30 mm	30-50	26-54
% Passing 0.075 mm	0-7.5	0-9.0
Fracture	75% Min.	70% Min.
Sand Equivalent	40 Min.	35 Min.

Crushed Screenings 16.0 mm — 6.30 mm or B.S.T.

	Specification Limits	Tolerance Limits
% Passing 19.0 mm	100	95-100
% Passing 16.0 mm	95-100	90-100
% Passing 6.30 mm	0-10	0-15
% Passing 2.00 mm	0-3	0-7
% Passing 0.075 mm	0-1.0	0-2.0
Fracture	75% Min.	70% min.

Crushed Screenings 12.5 mm — 6.30 mm or B.S.T.

	Specification Limits	Tolerance Limits
% Passing 16.0 mm	100	95-100
% Passing 12.5 mm	95-100	90-100
% Passing 6.30 mm	0-15	0-20
% Passing 2.00 mm	0-3	0-7
% Passing 0.075 mm	0-1.0	0-2.0
Fracture	75% Min.	70% Min

Crushed Screenings 6.30 mm — 0 mm for B.S.T.

	Specification Limits	Tolerance Limits
% Passing 9.50 mm	100	95-100
% Passing 6.30 mm	90-100	85-100
% Passing 2.00 mm	30-60	26-64
% Passing 0.075 mm	0-10.0	0-11.0
Fracture	75% Min.	70% Min.

Crushed Screenings 19.0 mm — 12.5 mm for B.S.T.

	Specification Limits	Tolerance Limits
% Passing 25.0 mm	100	95-100
% Passing 19.0 mm	95-100	90-100
% Passing 12.5 mm	0-20	0-25
% Passing 9.50 mm	0-5	0-10
% Passing 0.075 mm	0-1.0	0-2.0

Crushed Screenings 16.0 mm — 2.00 mm

	Specification Limits	Tolerance Limits
% Passing 19.0 mm	100	95-100
% Passing 16.0 mm	95-100	90-100
% Passing 6.30 mm	30-50	26-54
% Passing 2.00 mm	0-10	0-12
% Passing 0.075 mm	0-1.0	0-2.0
Fracture	75% Min.	70% Min.

Crushed Screening 9. 50 mm — 2.00 mm

	Specification Limits	Tolerance Limits
% Passing 12.5 mm	100	95-100
% Passing 9.50 mm	90-100	85-100
% Passing 6.30 mm	50-75	45-80
% Passing 2.00 mm	0-10	0-12
% Passing 0.075 mm	0-1.0	0-2.0
Fracture	75% Min.	70% Min.

Aggregate in Asphalt Concrete Mix

Class B	Specification Limits	Tolerance Limits
% Passing 19.0 mm≤		100
% Passing 16.0 mm≤	100	95-100
% Passing 12.5 mm≤	90-100	85-100
% Passing 9.50 mm≤	75-90	70-95
% Passing 6.30 mm≤	55-75	50-80
% Passing 2.00 mm	32-48	28-52
% Passing 0.425 mm	11-24	9-27
% Passing 0.080 mm	6-15	5-18
% Passing 0.075 mm	3.0-7.0	2.0-9.0
Sand/Silt Ratio	5.5-10.5	4.5-16.0
Class D		
% Passing 16.0 mm≤		100
% Passing 12.5 mm≤	100	97-100
% Passing 9.50 mm≤	97-100	94-100
% Passing 4.75 mm	30-50	26-54
% Passing 2.36 mm	5-15	3-17
% Passing 0.075 mm	2.0-5.0	0-7.0
Class E		
% Passing 37.5 mm≤		100
% Passing 31.5 mm≤	100	95-100
% Passing 25.0 mm≤	90-100	85-100
% Passing 16.0 mm≤	67-86	63-90
% Passing 12.5 mm≤	60-80	56-84
% Passing 6.30 mm≤	40-62	36-6640-75
% Passing 2.00 mm	25-40	21-44
% Passing 0.425 mm	10-23	7-26
% Passing 0.180 mm	6-14	5-15
% Passing 0.075 mm	2.0-9.0	2.0-10.0
Class F		
% Passing 25.0 mm≤		100
% Passing 19.0 mm≤	100	95-100
% Passing 12.5 mm≤	80-100	75-100
% Passing 6.30 mm≤	45-78	40-83
% Passing 2.00 mm	30-50	26-54
% Passing 0.075 mm	2.0-8.0	2.0-10.0

Aggregate for Asphalt Concrete

Class G		
% Passing 16.0 mm≤		100
% Passing 12.5 mm≤	100	97-100
% Passing 9.50 mm≤	97-100	94-100
% Passing 6.30 mm≤	60-88	55-92
% Passing 2.00 mm	32-53	28-57
% Passing 0.425 mm	11-24	9-27
% Passing 0.180 mm	6-15	5-18
% Passing 0.075 mm	3.0-7.0	2.0-9.0
Sand/Silt Ratio	5.5-10.5	4.5-16.0
Fracture:		
Classes B & G	75% Min.	70% Min.
Class D		
1 Fractured Face	90% Min.	85% Min.
2 Fractured Faces	75% Min.	70% Min.
Classes E & F		
Sand Equivalent: Min.	70% Min.	
Classes B, D, E & G	45 Min.	35 Min.
Class F	35 Min.	30 Min.

Asphalt Treated Base

% Passing 50 mm≤	100	100
% Passing 12.5 mm≤	56-100	54-100
% Passing 6.30 mm≤	40-78	35-83
% Passing 2.00 mm	22-57	18-61
% Passing 0.425 mm	8-32	5-35
% Passing 0.075 mm	2.0-9.0	2.0-11.0

Aggregate for Asphalt Concrete Stockpiled for Future Use

Class F Coarse		
% Passing 19.0 mm≤	100	100
% Passing 12.5 mm≤	40-100	35-100
% Passing 6.30 mm≤	0-30	0-35
Class F Fine		
% Passing 12.5 mm≤	100	100
% Passing 6.30 mm≤	70-100	65-100
% Passing 2.00 mm	45-80	40-85
% Passing 0.075 mm	3.0-12.0	2.0-13.0

Class G		
% Passing 16.0 mm≤		100
% Passing 12.5 mm≤	100	97-100
% Passing 9.50 mm≤	97-100	94-100
% Passing 6.30 mm≤	60-88	55-92
% Passing 2.00 mm	32-53	28-57
% Passing 0.425 mm	11-24	9-27
% Passing 0.180 mm	6-15	5-16
% Passing 0.075 mm	3.0-7.0	2.0-9.0
Fracture:		
Classes B & G	75% Min.	70% Min.
Class D		
1 Fractured Face	90% Min.	85% Min.
2 Fractured Faces	75% Min.	70% Min.
Classes E & F	50% Min.	45% Min.
Sand Equivalent:		
Classes B, D, E & G	45 Min.	35 Min.
Class F	35 Min.	30 Min.

9-5.6 Tolerance Limits — English

Crushed Surfacing Top Course

	Specification Limits	Tolerance Limits
% Passing ⅝″	100	95-100
% Passing ¼″	55-75	50-80
% Passing No. 40	8-24	5-27
% Passing No. 200	10.0 Max.	11.0 Max.
Sand Equivalent	40 Min.	35 Min.
Fracture	75% Min.	70% Min.

Crushed Surfacing Base Course

	Specification Limits	Tolerance Limits
% Passing 1¼″	100	95-100
% Passing ⅝″	50-80	45-85
% Passing ¼″	30-50	25-55
% Passing No. 40	3-18	3-20
% Passing No. 200	7.5 Max.	9.0 Max.
Sand Equivalent	40 Min.	35 Min.
Fracture	75% Min.	70% Min.

Ballast

	Specification Limits	Tolerance Limits
% Passing 2½″	100	100
% Passing 2″	65-100	60-100
% Passing 1″	50-85	45-90
% Passing ¼″	30-50	25-60
% Passing No. 40	16 Max.	20 Max.
% Passing No. 200	9.0 Max.	10.0 Max.
Sand Equivalent	35 Min.	30 Min.

Shoulder Ballast

	Specification Limits	Tolerance Limits
% Passing 2½″	100	100
% Passing ¾″	40-80	35-85
% Passing ¼″	5 Max.	6 Max.
% Passing No. 100 (wet sieving)	0-2.0	0-2.9
Fracture	75% Min.	70% Min.

Maintenance Rock

	Specification Limits	Tolerance Limits
% Passing ½″	100	95 Min.
% Passing ¼″	55-70	50-75
% Passing No. 40	10-25	8-30
% Passing No. 200	7.0 Max.	8.0 Max.
Sand Equivalent	40 Min.	35 Min.
Fracture	75% Min.	70% Min.

Gravel Base

	Specification Limits	Tolerance Limits
% Passing ¼″	25 Min.	20 Min.
% Passing No. 200	10.0 Max.	11.0 Max.
Dust Ratio	⅔ Max.	
Sand Equivalent	30 Min.	25 Min.

Sand Drainage Blanket

	Specification Limits	Tolerance Limits
% Passing 2½″	90-100	85-100
% Passing ¼″	30-100	25-100
The portion passing ¼″ shall meet the following requirements for grading:		
% Passing No. 10	50-100	45-100
% Passing No. 50	0-30	0-35
% Passing No. 100	0-7	0-8
% Passing No. 200	0-3.0	0-3.9

Gravel Backfill for Walls

	Specification Limits	Tolerance Limits
% Passing 4″	100	100
% Passing ¼″	25-70	20-75
% Passing No. 200	5.0 Max.	6.0 Max.
Max. Dust Ratio	⅔ Max.	
Sand Equivalent	60 Min.	55 Min.

Gravel Backfill for Pipe Bedding

	Specification Limits	Tolerance Limits
% Passing 1″	100	100
% Passing ¼″	25-80	20-85
% Passing No. 200	15.0 Max.	16.0 Max.
Sand Equivalent	35 Min.	30 Min.

Gravel Backfill for Drains

	Specification Limits	Tolerance Limits
% Passing 1″	100	95-100
% Passing ¾″	80-100	75-100
% Passing ⅜″	10-40	8-45
% Passing No. 4	0-4	0-5
% Passing No. 200	0-2	0-2.5

Backfill for Sand Drains

	Specification Limits	Tolerance Limits
% Passing ½″	90-100	85-100
% Passing ¼″	65-100	60-100
% Passing No. 10	40-100	35-100
% Passing No. 50	3-30	2-35
% Passing No. 100	0-4	0-5
% Passing No. 200	0-3.0	0-3.9

Gravel Borrow

	Specification Limits	Tolerance Limits
% Passing 1¼″	100*	95-100
% Passing ¼″	25 Min.	20 Min.
% Passing No. 40	40 Max.	43 Max.
% Passing No. 200	7.0 Max.	9.0 Max
Sand Equivalent	50 Min.	45 Min.

*Maximum size may be increased by Engineer's approval.

Crushed Coverstone

	Specification Limits	Tolerance Limits
% Passing ¾″	100	95-100
% Passing ⅝″	95-100	90-100
% Passing ¼″	30-50	26-54
% Passing No. 200	0-7.5	0-9.0
Fracture	75% Min.	70% Min.
Sand Equivalent	40 Min.	35 Min.

Crushed Screenings ⅝″ — ¼″ or B.S.T.

	Specification Limits	Tolerance Limits
% Passing ¾″	100	95-100
% Passing ⅝″	95-100	90-100
% Passing ¼″	0-10	0-15
% Passing No. 10	0-3	0-7
% Passing No. 200	0-1.0	0-2.0
Fracture	75% Min.	70% min.

Crushed Screenings ½″ — ¼″ or B.S.T.

	Specification Limits	Tolerance Limits
% Passing ⅝″	100	95-100
% Passing ½″	95-100	90-100
% Passing ¼″	0-15	0-20
% Passing No. 10	0-3	0-7
% Passing No. 200	0-1.0	0-2.0
Fracture	75% Min.	70% Min

Crushed Screenings ¼″ — 0″ for B.S.T.

	Specification Limits	Tolerance Limits
% Passing ⅜″	100	95-100
% Passing ¼″	90-100	85-100
% Passing No. 10	30-60	26-64
% Passing No. 200	0-10.0	0-11.0
Fracture	75% Min.	70% Min.

Crushed Screenings ¾″ — ½″ for B.S.T.

	Specification Limits	Tolerance Limits
% Passing 1″	100	95-100
% Passing ¾″	95-100	90-100
% Passing ½″	0-20	0-25
% Passing ⅜″	0-5	0-10
% Passing No. 200	0-1.0	0-2.0

Crushed Screenings ⅝″ — #10

	Specification Limits	Tolerance Limits
% Passing ¾″	100	95-100
% Passing ⅝″	95-100	90-100
% Passing ¼″	30-50	26-54
% Passing No. 10	0-10	0-12
% Passing No. 200	0-1.0	0-2.0
Fracture	75% Min.	70% Min.

Crushed Screening ⅜″ — #10

	Specification Limits	Tolerance Limits
% Passing ½″	100	95-100
% Passing ⅜″	90-100	85-100
% Passing ¼″	50-75	45-80
% Passing No. 10	0-10	0-12
% Passing No. 200	0-1.0	0-2.0
Fracture	75% Min.	70% Min.

Aggregate in Asphalt Concrete Mix

	Specification Limits	Tolerance Limits
Class B		
% Passing ¾≤		100
% Passing ⅝≤	100	95-100
% Passing ½≤	90-100	85-100
% Passing ⅜≤	75-90	70-95
% Passing ¼≤	55-75	50-80
% Passing No. 10	32-48	28-52
% Passing No. 40	11-24	9-27
% Passing No. 80	6-15	5-18
% Passing No. 200	3.0-7.0	2.0-9.0
Sand/Silt Ratio	5.5-10.5	4.5-16.0
Class D		
% Passing ⅝≤		100
% Passing ½≤	100	97-100
% Passing ⅜≤	97-100	94-100
% Passing No. 4	30-50	26-54
% Passing No. 8	5-15	3-17
% Passing No. 200	2.0-5.0	0-7.0
Class E		
% Passing 1½≤		100
% Passing 1¼≤	100	95-100
% Passing 1≤	90-100	85-100
% Passing ⅝≤	67-86	63-90
% Passing ½≤	60-80	56-84
% Passing ¼≤	40-62	36-6640-75
% Passing No. 10	25-40	21-44
% Passing No. 40	10-23	7-26
% Passing No. 80	6-14	5-15
% Passing No. 200	2.0-9.0	2.0-10.0
Class F		
% Passing 1≤		100
% Passing ¾≤	100	95-100
% Passing ½≤	80-100	75-100
% Passing ¼≤	45-78	40-83
% Passing No. 10	30-50	26-54
% Passing No. 200	2.0-8.0	2.0-10.0

Aggregate for Asphalt Concrete

Class G		
% Passing ⅝≤		100
% Passing ½≤	100	97-100
% Passing ⅜≤	97-100	94-100
% Passing ¼≤	60-88	55-92
% Passing No. 10	32-53	28-57
% Passing No. 40	11-24	9-27
% Passing No. 80	6-15	5-18
% Passing No. 200	3.0-7.0	2.0-9.0
Sand/Silt Ratio	5.5-10.5	4.5-16.0
Fracture:		
Classes B & G	75% Min.	70% Min.
Class D		
1 Fractured Face	90% Min.	85% Min.
2 Fractured Faces	75% Min.	70% Min.
Classes E & F		
Sand Equivalent: Min.	70% Min.	
Classes B, D, E & G	45 Min.	35 Min.
Class F	35 Min.	30 Min.

Asphalt Treated Base

% Passing 2≤	100	100
% Passing ½≤	56-100	54-100
% Passing ¼≤	40-78	35-83
% Passing No. 10	22-57	18-61
% Passing No. 40	8-32	5-35
% Passing No. 200	2.0-9.0	2.0-11.0

Aggregate for Asphalt Concrete Stockpiled for Future Use

Class F Coarse		
% Passing ¾≤	100	100
% Passing ½≤	40-100	35-100
% Passing ¼≤	0-30	0-35
Class F Fine		
% Passing ½≤	100	100
% Passing ¼≤	70-100	65-100
% Passing No. 10	45-80	40-85
% Passing No. 200	3.0-12.0	2.0-13.0

Class G		
% Passing 5/8≤		100
% Passing 1/2≤	100	97-100
% Passing 3/8≤	97-100	94-100
% Passing 1/4≤	60-88	55-92
% Passing No. 10	32-53	28-57
% Passing No. 40	11-24	9-27
% Passing No. 80	6-15	5-16
% Passing No. 200	3.0-7.0	2.0-9.0
Fracture:		
Classes B & G	75% Min.	70% Min.
Class D		
1 Fractured Face	90% Min.	85% Min.
2 Fractured Faces	75% Min.	70% Min.
Classes E & F	50% Min.	45% Min.
Sand Equivalent:		
Classes B, D, E & G	45 Min.	35 Min.
Class F	35 Min.	30 Min.

9-5.7 Sampling and Testing Frequency Guide — Metric

Item	Test	Acceptance Sample	Assurance Sample
Gravel Borrow	Grading & SE	1 – 4000 Tonnes	1 – 20,000 Tonnes
Sand Drainage Blanket	Grading	1 – 4000 Tonnes	1 – 20,000 Tonnes
Gravel Base	Grading, SE & Dust Ratio	1 – 4000 Tonnes	1 – 20,000 Tonnes
CSTC	Grading, SE & Fracture	1 – 2000 Tonnes	1 – 10,000 Tonnes
CSBC	Grading, SE & Fracture	1 – 2000 Tonnes	1 – 10,000 Tonnes
Maintenance Rock	Grading, SE & Fracture	1 – 2000 Tonnes	1 – 10,000 Tonnes
Ballast	Grading, SE & Dust Ratio	1 – 2000 Tonnes	1 – 10,000 Tonnes
Shoulder Ballast	Grading & Fracture	1 – 2000 Tonnes	1 – 10,000 Tonnes
Backfill for Sand Drains	Grading	1 – 2000 Tonnes	1 – 10,000 Tonnes
Crushed CoversTonnese	Grading, SE & Fracture	1 – 1000 Tonnes	1 – 5,000 Tonnes
Crushed Screening			
⅝ – ¼	Grading & Fracture	1 – 1000 Tonnes	1 – 5,000 Tonnes
½ – ¼	Grading & Fracture	1 – 1000 Tonnes	1 – 5,000 Tonnes
¼ – 0	Grading & Fracture	1 – 1000 Tonnes	1 – 5,000 Tonnes
Gravel Backfill For			
Foundations	Grading, SE & Dust Ratio	1 – 1000 Tonnes	1 – 5,000 Tonnes
Walls	Grading, SE & Dust Ratio	1 – 1000 Tonnes	1 – 5,000 Tonnes
Pipe Bedding	Grading, SE & Dust Ratio	1 – 1000 Tonnes	1 – 5,000 Tonnes
Drains	Grading	1 – 100 Tonnes	1 – 500 Tonnes
PCC Paving			
Coarse Aggregate	Grading	1 – 2000 Tonnes	1 – 10,000 Tonnes
Fine Aggregate	Grading	1 – 1000 Tonnes	1 – 5,000 Tonnes
Core	Density	1 – 2000 m^2	
	Thickness	1 – 2000 m^2	
Completed Mix			
Consistency	Slump	1 – 2000 m^2	1 – 20,000 m^2
Air Content	Air	1 – 2000 m^2	1 – 20,000 m^2
Yield	Cement Factor	1 – 2000 m^2	1 – 20,000 m^2
Test Beam	Flexural Strength	1 – 2000 m^2	1 – 20,000 m^2
PCC Structures			
Coarse Aggregate	Grading	1 – 1,000 Tonnes	1 – 5,000 Tonnes
Fine Aggregate	Grading	1 – 500 Tonnes	1 – 2,500 Tonnes
Consistency	Slump	1 – 40 m^3	1 – 800 m^3
Air Content	Air	1 – 40 m^3	1 – 800 m^3
Cylinders (28-day)	Compressive Strength	1 – 40 m^3	1 – 800 m^3
Yield	Cement Factor	1 – 80 m^3	1 – 800 m^3
Cement	Chemical & Physical	Certification	(Verification Sample) 1 – 1,000 Tonnes

Note that if acceptance samples are taken more frequently than shown, the number of assurance samples will increase as one assurance sample and test is required for each five acceptance samples and tests for all aggregates.

Item	*Test*	*Acceptance Sample*	*Assurance Sample*
Asphalt Cement Concrete			
Completed Mix	Grading & Asphalt Content	1 – 800 Tonne***	1 – Per Day***
	Compaction	5 – 400 Tonne (Min 1/Project)	
Open Graded, Class D and D Mod.	Grading (Agg. from cold feed)	1 – 800 Tonne***	1 – Per Day ***
Asphalt Concrete Aggregate			
Aggregate (from cold feed)	SE & Fracture	1 – 1,600 Tonne (every other mix sample)***	1 – 8,000 Tonne
Coarse Aggregate (in stockpile)*	Grading, SE, & Fracture	1 – 1,000 Tonne	1 – 5,000 Tonne
Fine Aggregate (in stockpile)*	Grading, SE, & Fracture	1 – 1,000 Tonne	1 – 5,000 Tonne
Blend Sand (in stockpile)	SE	1 – 1,000 Tonne	1 – 5,000 Tonne
Mineral Filler	Sp. G & Pl	Certificate	1 – Per Type Used
Asphalt Treated Base			
Aggregate	Grading* & SE	1 – 1,000 Tonne	1 – 5,000 Tonne
Completed Mix	Grading & Asphalt	1 – 1,000 Tonne	1 – Per Day
	Compaction	5 – Control Lot**	
Asphalt Materials		Certification	Verification
Paving Asphalt (AR, AC, PBA)			1 L every 3rd shipment
Liquid Asphalt (Cutback, Emulsion)			1 L every other shipment
Emulsion for ACP Tack Coat			None required
Rubberized Asphalt		Certification	
Compaction			
Embankment		1 – 2000 M^3	
Cut Section		1 – 150 M	
Surfacing		1 – 300 M (per layer)	
Backfill		1 – 400 M^3	

* Tests for grading will be performed only when aggregates are being produced and stockpiled for use on a future project.

** A control lot shall be a normal days production. For minor quantities of 200 tonnes or less per day, a minimum of two gauge readings shall be taken.

*** For projects under statistical acceptance, the sample frequency shall be as prescribed in the contract, and the sublot size may vary from 500 to 800 tonnes depending on the project quantities. For projects under nonstatistical acceptance, the sublot size may vary from 400 to 800 tonnes with a minimum of one sublot per day when the daily production is less than 400 tonnes. The assurance sampling shall be one per day only on the days when an acceptance sample(s) is required.

Note that if acceptance samples are taken more frequently than shown, the number of assurance samples will increase as one assurance sample and test is required for each five acceptance samples and tests for all aggregates.

9-5.7 Sampling and Testing Frequency Guide — English

Item	Test	Acceptance Sample	Assurance Sample
Gravel Borrow	Grading & SE	1 – 4000 Ton	1 – 20,000 Ton
Sand Drainage Blanket	Grading	1 – 4000 Ton	1 – 20,000 Ton
Gravel Base	Grading, SE & Dust Ratio	1 – 4000 Ton	1 – 20,000 Ton
CSTC	Grading, SE & Fracture	1 – 2000 Ton	1 – 10,000 Ton
CSBC	Grading, SE & Fracture	1 – 2000 Ton	1 – 10,000 Ton
Maintenance Rock	Grading, SE & Fracture	1 – 2000 Ton	1 – 10,000 Ton
Ballast	Grading, SE & Dust Ratio	1 – 2000 Ton	1 – 10,000 Ton
Shoulder Ballast	Grading & Fracture	1 – 2000 Ton	1 – 10,000 Ton
Backfill for Sand Drains	Grading	1 – 2000 Ton	1 – 10,000 Ton
Crushed Coverstone	Grading, SE & Fracture	1 – 1000 Ton	1 – 5,000 Ton
Crushed Screening			
⅝ – ¼	Grading & Fracture	1 – 1000 Ton	1 – 5,000 Ton
½ – ¼	Grading & Fracture	1 – 1000 Ton	1 – 5,000 Ton
¼ – 0	Grading & Fracture	1 – 1000 Ton	1 – 5,000 Ton
Gravel Backfill For			
Foundations	Grading, SE & Dust Ratio	1 – 1000 Ton	1 – 5,000 Ton
Walls	Grading, SE & Dust Ratio	1 – 1000 Ton	1 – 5,000 Ton
Pipe Bedding	Grading, SE & Dust Ratio	1 – 1000 Ton	1 – 5,000 Ton
Drains	Grading	1 – 100 Ton	1 – 500 Ton
PCC Paving			
Coarse Aggregate	Grading	1 – 2000 Ton	1 – 10,000 Ton
Fine Aggregate	Grading	1 – 1000 Ton	1 – 5,000 Ton
Core	Density	1 – 2500 SY	
	Thickness	1 – 2500 SY	
Completed Mix			
Consistency	Slump	1 – 2500 SY	1 – 25,000 SY
Air Content	Air	1 – 2500 SY	1 – 25,000 SY
Yield	Cement Factor	1 – 2500 SY	1 – 25,000 SY
Test Beam	Flexural Strength	1 – 2500 SY	1 – 25,000 SY
PCC Structures			
Coarse Aggregate	Grading	1 – 1,000 Ton	1 – 5,000 Ton
Fine Aggregate	Grading	1 – 500 Ton	1 – 2,500 Ton
Consistency	Slump	1 – 50 CY	1 – 1,000 CY
Air Content	Air	1 – 50 CY	1 – 1,000 CY
Cylinders (28-day)	Compressive Strength	1 – 50 CY	1 – 1,000 CY
Yield	Cement Factor	1 – 100 CY	1 – 1,000 CY
Cement	Chemical & Physical	Certification	(Verification Sample) 1 – 1,000 Ton

Note that if acceptance samples are taken more frequently than shown, the number of assurance samples will increase as one assurance sample and test is required for each five acceptance samples and tests for all aggregates.

Item	*Test*	*Acceptance Sample*	*Assurance Sample*
Asphalt Cement Concrete			
Completed Mix	Grading & Asphalt Content	1 – 800 Ton***	1 – Per Day***
	Compaction	5 – 400 Ton (Min 1/Project)	
Open Graded, Class D and D Mod.	Grading (Agg. from cold feed)	1 – 800 Ton***	1 – Per Day ***
Asphalt Concrete Aggregate			
Aggregate (from cold feed)	SE & Fracture	1 – 1,600 Ton (every other mix sample)***	1 – 8,000 Ton
Coarse Aggregate (in stockpile)*	Grading, SE, & Fracture	1 – 1,000 Ton	1 – 5,000 Ton
Fine Aggregate (in stockpile)*	Grading, SE, & Fracture	1 – 1,000 Ton	1 – 5,000 Ton
Blend Sand (in stockpile)	SE	1 – 1,000 Ton	1 – 5,000 Ton
Mineral Filler	Sp. G & Pl	Certificate	1 – Per Type Used
Asphalt Treated Base			
Aggregate	Grading* & SE	1 – 1,000 Ton	1 – 5,000 Ton
Completed Mix	Grading & Asphalt	1 – 1,000 Ton	1 – Per Day
	Compaction	5 – Control Lot**	
Asphalt Materials		Certification	Verification
Paving Asphalt (AR, AC, PBA)			1 qt. every 3rd shipment
Liquid Asphalt (Cutback, Emulsion)			1 qt. every other shipment
Emulsion for ACP Tack Coat			None required
Rubberized Asphalt		Certification	
Compaction			
Embankment		1 – 2,500 CY	
Cut Section		1 – 500 LF	
Surfacing		1 – 1,000 LF (per layer)	
Backfill		1 – 500 CY	

* Tests for grading will be performed only when aggregates are being produced and stockpiled for use on a future project.

** A control lot shall be a normal days production. For minor quantities of 200 tons or less per day, a minimum of two gauge readings shall be taken.

*** For projects under statistical acceptance, the sample frequency shall be as prescribed in the contract, and the sublot size may vary from 500 to 800 tons depending on the project quantities. For projects under nonstatistical acceptance, the sublot size may vary from 400 to 800 tons with a minimum of one sublot per day when the daily production is less than 400 tons. The assurance sampling shall be one per day only on the days when an acceptance sample(s) is required.

Note that if acceptance samples are taken more frequently than shown, the number of assurance samples will increase as one assurance sample and test is required for each five acceptance samples and tests for all aggregates.

9-5.7A Sampling and Testing Frequency Guide for Independent Assurance Samples — Metric

Item	*Test*	*Frequency of Sampling and Testing*
Gravel Borrow Gravel Base Sand Drainage Blanket	Grading & SE Grading, SE & Dust Ratio Grading	1 sample per 80,000 tonnes with 1 sample on each project requiring 30,000 tonnes or more and/or 2 or more assurance samples.
Crushed Surfacing Base Course Top Course Ballast Shoulder Ballast Maintenance Rock Backfill for Sand Drains	Grading & SE Grading & SE Grading & SE Grading & SE Grading & SE Grading & SE Grading & SE	1 sample per 40,000 tonnes with 1 sample on each project requiring 15,000 tonnes or more and/or 2 or more assurance samples.
Crushed Coverstone	Grading, SE & Fracture	1 sample per 20,000 tonnes with 1 sample on each project requiring 7,500 tonnes or more and/or 2 or more assurance samples.
Crushed Screenings 5/8 — 1/4 1/2 — 1/4 1/4 — 0	Grading, SE & Fracture	1 sample per 20,000 tonnes with 1 sample on each project requiring 7,500 tonnes or more and/or 2 or more assurance samples.
Gravel Backfill for Foundations Walls Pipe Bedding	 Grading, SE & Dust Ratio Grading, SE & Dust Ratio Grading, SE & Dust Ratio	1 sample per 20,000 tonnes with 1 sample on each project requiring 7,500 tonnes or more and/or 2 or more assurance samples.
Drains	Grading	1 sample per 2,000 tonnes with 1 sample on each project requiring 750 tonnes or more and/or 2 or more assurance samples.
PCC Paving Coarse Aggregate	 Grading	1 sample per 40,000 tonnes with 1 sample on each project requiring 15,000 tonnes or more and/or 2 or more assurance samples.
Fine Aggregate	Grading	1 sample per 20,000 tonnes with 1 sample on each project requiring 7,500 tonnes or more and/or 2 or more assurance samples.

Item	*Test*	*Frequency of Sampling and Testing*
PCC Structure		
Coarse Aggregate	Grading	1 sample per 20,000 tonnes with 1 sample on each project requiring 7,500 tonnes or more and/or 2 or more assurance samples.
Fine Aggregate	Grading	1 sample per 10,000 tonnes with 1 sample on each project requiring 3,750 tonnes or more and/or 2 or more assurance samples.
Asphalt Cement Concrete		
Coarse Aggregate Fine Aggregate	SE, Fracture & Physical	1 sample per 20,000 tonnes with 1 sample on each project requiring 7,500 tonnes or more and/or 2 or more assurance samples.
Blend Sand		None required.
Mineral Filler		None required.
Asphalt Treated Base		
Coarse Aggregate Fine Aggregate	Grading, SE	1 sample per 20,000 tonnes with 1 sample on each project requiring 7,500 tonnes or more and/or 2 more assurance samples.
Completed Mix		
ACP and ATB	Grading & Asphalt Content	1 sample per 20,000 tonnes with 1 sample on each project requiring 2,000 tonnes or more and/or 2 or more assurance samples.

9-5.7A Sampling and Testing Frequency Guide for Independent Assurance Samples — English

Item	*Test*	*Frequency of Sampling and Testing*
Gravel Borrow Gravel Base Sand Drainage Blanket	Grading & SE Grading, SE & Dust Ratio Grading	1 sample per 80,000 tons with 1 sample on each project requiring 30,000 tons or more and/or 2 or more assurance samples.
Crushed Surfacing Base Course Top Course Ballast Shoulder Ballast Maintenance Rock Backfill for Sand Drains	Grading & SE Grading & SE Grading & SE Grading & SE Grading & SE Grading & SE Grading & SE	1 sample per 40,000 tons with 1 sample on each project requiring 15,000 tons or more and/or 2 or more assurance samples.
Crushed Coverstone	Grading, SE & Fracture	1 sample per 20,000 tons with 1 sample on each project requiring 7,500 tons or more and/or 2 or more assurance samples.
Crushed Screenings 5/8 — 1/4 1/2 — 1/4 1/4 — 0	Grading, SE & Fracture	1 sample per 20,000 tons with 1 sample on each project requiring 7,500 tons or more and/or 2 or more assurance samples.
Gravel Backfill for Foundations Walls Pipe Bedding	 Grading, SE & Dust Ratio Grading, SE & Dust Ratio Grading, SE & Dust Ratio	1 sample per 20,000 tons with 1 sample on each project requiring 7,500 tons or more and/or 2 or more assurance samples.
Drains	Grading	1 sample per 2,000 tons with 1 sample on each project requiring 750 tons or more and/or 2 or more assurance samples.
PCC Paving Coarse Aggregate	 Grading	1 sample per 40,000 tons with 1 sample on each project requiring 15,000 tons or more and/or 2 or more assurance samples.
Fine Aggregate	Grading	1 sample per 20,000 tons with 1 sample on each project requiring 7,500 tons or more and/or 2 or more assurance samples.

Item	*Test*	*Frequency of Sampling and Testing*
PCC Structure		
Coarse Aggregate	Grading	1 sample per 20,000 tons with 1 sample on each project requiring 7,500 tons or more and/or 2 or more assurance samples.
Fine Aggregate	Grading	1 sample per 10,000 tons with 1 sample on each project requiring 3,750 tons or more and/or 2 or more assurance samples.
Asphalt Cement Concrete		
Coarse Aggregate Fine Aggregate	SE, Fracture & Physical	1 sample per 20,000 tons with 1 sample on each project requiring 7,500 tons or more and/or 2 or more assurance samples.
Blend Sand		None required.
Mineral Filler		None required.
Asphalt Treated Base		
Coarse Aggregate Fine Aggregate	Grading, SE	1 sample per 20,000 tons with 1 sample on each project requiring 7,500 tons or more and/or 2 more assurance samples.
Completed Mix		
ACP and ATB	Grading & Asphalt Content	1 sample per 20,000 tons with 1 sample on each project requiring 2,000 tons or more and/or 2 or more assurance samples.

9-5.7B Sampling and Testing Frequency Guide for Tests to be Witnessed by the Independent Assurance Sampler

Subgrade Compaction: (Includes Cut Sections and Backfill Zones.)	One test per 40,000 cubic meters (50,000 cubic yards) with one test on each project requiring 20,000 cubic meters (25,000 cubic yards) or more of embankment compaction.
Surfacing Compaction: (Includes Gravel Base.)	One test per 40,000 tonnes (50,000 tons) with one test on each project requiring 20,000 tonnes (25,000 tons) or more surfacing.
Asphalt Pavement Compaction:	One lot of compaction test for each Independent Assurance sample of completed mix.
Asphalt Materials Paving Asphalt (inc. emulsified asphalt used in Open Graded Asphalt) Emulsified Asphalt for BST Cut-back Asphalt for BST	Witness Project Inspector taking verification sample.

9-5.7C Sampling and Testing Frequency Guide for Tests to be Taken by the Independent Assurance Sampler

PCC PAVING: Slump Air Content Cement Factor Compressive Strength (Cylinders)	1 of each test using independent equipment, to be made along side of acceptance tests. 1 set of tests per 20,000 cubic meters (25,000 cubic yards) with 1 set of tests on each project requiring 1,000 cubic meters (1,250 cubic yards) or more.
PCC STRUCTURES: Slump Air Content Cement Factor Compressive Strength (Cylinders)	1 of each test using independent equipment, to be made along side of acceptance tests. 1 set of tests per 800 cubic meters (1,000 cubic yards) with 1 set of tests on each project requiring 40 cubic meters (50 cubic yards) or more.

9-6 Radioactive Testing Devices

9-6.1 Administration and Safety

The purpose of this chapter is to provide a guide for personnel using, and administering the use of, testing devices containing radioactive materials. The instructions included in this Chapter will be used throughout the Washington State Department of Transportation for the express purpose of regulating the use of radioactive testing devices containing radioactive materials.

Each Region shall have a Region Radiation Administration Officer and a Region Radiation Safety Officer whose duties are described in Chapter 9-6.2 and 9-6.3. Only licensed operators shall operate radioactive testing devices. A licensed operator, whose responsibilities are described in Chapter 9-6.4 must complete a certified training course to be eligible for a license.

All personnel using or responsible for radioactive testing devices shall be:

1. Thoroughly familiar with the safe handling techniques for using radioactive materials.

2. Fully informed of the hazards to health that exist near radioactive materials.

3. Completely familiar and in compliance with the following rules and regulations:

   a. Rules and Regulations for Radiation Protection by the State Department of Health, Division of Radiation Protection, Title 246, WAC.

   b. Radiation Emergency Handbook by the State Department of Health.

Copies of the above publications will be kept by the Region Radiation Safety Officer. A copy of the *Radiation Emergency Handbook* will also be supplied with each radioactive testing device. The Licensed Operator will read this handbook before using the radioactive testing device for testing.

If an emergency as outlined in the *Radiation Emergency Handbook* occurs, the following people or agencies should be notified by the individual in charge of the testing device:

1. Radiation Control Program; Health Services Division; State Department of Health; Olympia, Washington 98504 (Phone 206/NUCLEAR).

2. Washington State Patrol, if a public hazard exists.

3. Radiation Administration Officer.

4. Radiation Safety Officer.

5. Olympia Service Center Radiation Administration Officer or Radiation Safety Officer.

The telephone numbers of these agencies or individuals will be posted at all storage sites and a copy of these numbers shall be kept with each device.

Personal monitoring of radiation received from the radioactive testing device is one of the major items in the Health Safety Program. Anyone handling radioactive sources must wear a radiation exposure badge which records any exposure that the body may receive. Radiation exposure badges are assigned to individuals. They are not to be used by any other person.

The acquisition of radiation exposure badges as needed by each Region shall be the responsibility of the Region Radiation Safety Officer. These badges can be obtained from U.S. Dosimetry Technology Inc., 660-A George Washington Way, Richland, Washington 99352, Telephone (509) 946-8738, or from a firm recognized by the Department of Health to perform this service. Three month TLD (Thermo Luminescent Dosimeter) badges indicating exposure to gamma, beta, x-ray, and neutron radiation will be used.

Each radioactive testing device will be supplied in a shipping container with an adequate latch. For transporting purposes, this latch and the lock on the testing device must be secured. At all times, the key for the lock will be in the possession of the individual responsible for the radioactive testing device.

When a passenger vehicle is used for transporting, the box containing the testing device shall be kept in the trunk. When a station wagon or panel truck is used, the testing device shall be placed at the back of the vehicle in such a manner as to prevent it from sliding around. When carried in a six passenger pickup with a service body, the testing device shall be carried in the back, with the storage lid locked. Don't carry the testing device in the back seat. When a pickup is used, the box containing the testing device will be secured to the bed of the vehicle to prevent movement and in such a way as not to be removed by a passerby.

For en route overnight storage at a motel, hotel, or other lodging place, the locked testing device may be left in the locked vehicle. In case of a pickup truck, the testing device must be locked in the cab of the truck.

9-6.2 Radiation Administration Officer (Region Materials Engineer)

The Radiation Administration Officer (RAO) will be responsible for administering the use of radioactive material within the Region.

The RAO will obtain, revise, and renew the Region's Radioactive Material License issued by the Washington State Department of Health. A license indicates the strength and type of sources that a Region may possess.

Licenses are issued subject to all the requirements of the Washington Rules and Regulations for Radiation Protection and to the conditions specified in the license. Licenses are also subject to any additional requirements of the Department of Health as stated in letters issued by DOH. Where a letter containing a license condition requirement differs from the Regulations, the letter will supersede the regulations insofar as the license is concerned.

When a change occurs in the radiation program which would make untrue a statement in the current Radioactive Material License, the Licensee will notify the Department of Health and request an appropriate amendment.

The Radiation Administration and Safety Officers must be listed on the license. Individual operators are not required to be on the license, but the Radiation Administration Officer must maintain a list of licensed or qualified operators. This list of qualified operators should include the operator's name, type of training, and final test score.

The RAO will be responsible for the storage of the radioactive testing devices when not in field use, and the assignment of testing devices to the individual project offices. The RAO will be responsible for maintaining the following records:

1. List of qualified operators within the Region.
2. Radioactive testing device location records.
3. Radioactive testing device shipping records.

Prior to shipping (or transferring) the testing device from one licensed organization to another, the shipper shall check, and be assured, that the receiver has a valid license; and that the shipped (or transferred) sources do not exceed the limitations of the receiver's license. Shipment to authorized personnel within the Region is covered by the Region's license. Any radioactive testing device requiring repairs or calibration will be shipped to the Olympia Service Center Materials Laboratory. They will make the arrangement to have the testing device repaired.

The RAO is responsible to arrange for the training of licensed operators. The RAO will arrange for the training classes to be conducted and maintain the training records for the region.

When the testing devices are not in field use, the normal storage will be at the Region office. This should be an area designated for this purpose with the following information posted on the walls of the room to notify personnel of the existence of radiation:

1. "CAUTION — RADIOACTIVE MATERIALS" sign.

2. DOH Form RHF-3 "Notice to Employees."

3. Chapters 246-220, 246-221, and 246-222 of the *Rules and Regulations for Radiation Protection*.

4. DOH Form "Notification of a Radiation Emergency."

9-6.3 Radiation Safety Officer (Assurance Inspector or Equal)

The Radiation Safety Officer (RSO) will have the responsibility for the Region radiation protection program. The RSO will be responsible for maintaining the following records:

1. Wipe test records.

2. Medical records.

3. Radiation Exposure Report.

4. Minor testing device maintenance as outlined in the Radioactive Materials License.

Wipe tests or leak testing is required by law and is simply a swabbing of the sealed source to ascertain that no radioactive contamination has occurred from the nuclear source. The Region RSO shall be responsible for having each source wiped every six months. The analysis of wipe tests is done by a commercial firm licensed to do this work. The service contract will be obtained by individual regions. Records of leak tests results shall be kept in units of microcuries and maintained for inspection. Any leak test revealing the presence of 0.005 microcuries or more of removable radioactive material shall be reported to the Department of Health, Radiation Control Division, LD-11 Olympia, Washington 98504, within five days of the test. This report should include a description of the defective source or device, the results of the test, and the corrective action taken.

Leak test kits can be obtained from Troxler Electronic Laboratory, Inc. When returning the sample for testing, place the sample in a plastic envelope. Place the plastic envelope(s) in another envelope and write your company name, address, and other pertinent details on the outside. This envelope must be marked "RADIOACTIVE MATERIALS — NO LABEL REQUIRED."

Place this envelope into another envelope addressed to the approved facility for processing. Prior to being mailed, the contents and packing must be checked with a survey instrument and the radiation at any point on the surface must not exceed a dose rate greater than 0.5 millirem per hour in order to comply with U.S. Postal Regulations.

The radiation Safety Officer will be responsible for radiation exposure reports for the personnel in that Region. Exposure records shall be kept on Department of Health Form RFH-5 or in a manner which includes all information required on said form. Each entry shall be for a period of time not exceeding one calendar quarter.

9-6.4 Licensed Operators

The Licensed Operators will be directly responsible to the Radiation Administration Officer for the use and storage of the radioactive testing device in the field and to the Radiation Safety Officer for all safety in regard to the radioactive testing device.

The Licensed Operators shall be responsible for posting the following information at all field storage areas:

1. "CAUTION — RADIOACTIVE MATERIALS" Sign.

2. DOH Form RHF-3 "Notice to Employees."

3. Chapters 246-220, 246-221, and 246-222 of the *Rules and Regulations for Radiation Protection*.

4. DOH Form "Notification of a Radiation Emergency."

The Licensed Operator must keep the Radiation Administration Officer informed of the location of the radioactive sources at all times. (The State Radiation Control Unit inspectors will want the sources produced or the exact locations given during their periodic inspections.) If the exact location where the testing device will be used is known in advance, it should be noted before leaving the Region office, and if unknown, shall be forwarded to the Radiation Administrative Officer as soon as it is known.

The Licensed Operator on a project must know (for the nuclear density gauge) how the shutter operating device for shielding the radioactive materials works as the source index handle is moved. The operation of the shutter operating device should be continuously checked and any malfunction reported to the Radiation Administration Officer immediately. When not in use, the source index handle will be locked and the nuclear density gauge locked in an adequate storage facility. When operating the nuclear gauge (i.e., when the handle is in the "USE" position), unauthorized personnel are not to be within 2 meters (5 feet) of the gauge.

9-7 Final Record Measurements

9-7.1 Record Sampling

The Project Engineer or representative shall obtain and record thickness measurements that are required on construction projects.

Thickness measurements on flexible and rigid pavements and bases will be performed by the Project Engineer or representative thereof, on each project.

Portland cement concrete under Section 5-05.5, requires depth cores to determine compliance with specification depth. These determinations will suffice for project record depth measurements. Asphalt concrete pavements will require cores or depth measurements to be taken during construction or prior to completion of the contract.

Whenever measurements are taken that do not meet project requirements, additional measurements shall be taken to determine if the original location was an isolated case and to determine the area involved.

The following procedure is to be used to delineate areas where thickness record measurements fail to meet project requirements. This procedure is applicable for surfacing depth and flexible pavement measurements.

Obtain additional measurements at 30-meter (100-foot) intervals in both directions from the original measurement until measurements indicate adequate thickness. When required thickness is obtained, take an additional measurement 15 meters (50 feet) toward the original measurement from the last measurement on each end of the section. The delineation measurements need not be taken at the same offset as the original measurement but should remain within the suspect lane unless placement width was greater than 3.7 meters (12 feet).

9-7.2 Frequency for Project Record Measurements

Item	*Measurement*	*Frequency*
Crushed Surfacing and/or Base Ballast Gravel Base	Thickness	One depth measurement whenever a density test is taken on the finished lift, or one every 600 meters (2,000 lineal feet) of 2 lane roadway.
Portland Cement Concrete Unfinished Portland Cement Concrete	Thickness	Report cores required by 5-05.5
Asphalt Concrete Asphalt Treated Base	Thickness	Mainline — One depth measurement per 3 lane kilometers (2 lane mile) per lift Ramps — One depth measurement per ramp Shoulders — One depth measurement per 3 kilometers (2 miles) of shoulder.
Roadway	Paving Width & Shoulder Width	One measurement for each 800 meters (2,500 lineal feet) of roadway with one measurement for each roadway section. To be recorded in the inspector's diary or Daily Paving Report.

9-7.3 Project Record Documents

Project record measurements and materials certification must be completed before the project will be considered acceptable by the Assistant Secretary for Field Operations Support Service Center. Materials which are questionable, or measured thicknesses which are deficient beyond tolerance, must be explained by the Project Engineer. An explanation must be supported by copies of field tests, with comments pertaining to corrective action and disposition of substandard materials. Copies of field measurements taken at the time material is placed, as required in Chapter 4-4.4 of this manual, will be required to support explanation of thickness deficiencies. The explanations and data provided by the Project Engineer may become part of the certification to the Federal Highway Administration.

9-8 WSDOT Test Methods

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103 — Method for Determining % of Fracture in Aggregates

104 — Method of Test for Sieve Analysis of Coarse Aggregates

106 — Method of Determination of Moisture Content in Aggregate by Oven Drying

107 — Method of Test for Determination of Specific Gravity and Absorption of Coarse Aggregate

108 — Method of Test for Determination of Specific Gravity and Absorption of Fine Aggregate

109 — Sand Equivalent Test for Surfacing Materials

115 — Method of Drying Materials to a Constant Mass

116 — Method for Reducing Field Samples of Construction Materials to Testing Size

117 — Method for Determination of Moisture Content of Fine Aggregates —Pycnometer Procedure

118 — Method of Test for Field Determination of Specific Gravity of Fine Aggregate (Saturated — Surface Dry Basis)

119 — Method of Test for Fineness Modulus

609 — Method of Test for Moisture Density Relations of Soil

613 — Method for Determining Inplace Densities and Relative Compaction of Soils and Surfacing Materials Using the Troxler Nuclear Moisture/Density Gauge

705 — Method of Test for Maximum Specific Gravity of Bituminous Paving Mixtures — “Rice Density”

711 — Quick Method for the Determination of Aggregate Gradation and Asphalt Content of Mixtures

712 — Standard Method of Sampling Bituminous Paving Mixtures

713 — Method of Test for Moisture or in Bituminous Paving Mixtures

714 — Method of Test for Determining Degree of Particle Coating of Bituminous — Aggregate Mixtures —“Ross Count”

715 — Method of Test for Relative Compaction of Asphalt Concrete Pavement

716 — Method of Random Sampling for Location of Testing and Sampling Sites

720 — Method of Test for Thickness Measurement of Asphalt Concrete Cores

722 — Method of Test for Determination of Asphalt Content by Nuclear Method

722 Appendix 1 — Method of Test for Calibration of the Troxler 3241C Nuclear Asphalt Content Gauge for Job Mix

723 — Method of Test for Quick Determination of Aggregate Gradation Using Alternate Solvent

724 — Method of Preparation of Aggregate for ACP Job Mix Design

725 — Method of Test for Field Verification of a Job Mix Calibration for the Nuclear Asphalt Content Gauge

801 — Method of Test for Compressive Strength of Molded Concrete Cylinders

802 — Method of Test for Flexural Strength of Concrete (Using Simple Beam with Center—Point Loading)

803 — Method of Sampling Fresh Concrete

804 — Method of Test for Slump of Portland Cement Concrete

805 — Method of Test for Determination of Percent of Entrained Air in Portland Cement Concrete

806 — Portland Cement Concrete Mass per Cubic Meter Cement Factor

807 — Method of Operation of California Profilograph and Evaluation of Profiles

808 — Method for Making Flexural Test Beams

809 — Method of Making, Handling, and Storing Concrete Compressive Test Specimens in the Field

811 — Method of Capping Cylindrical Concrete Specimens

813 — Field Method of Fabrication of 50-millimeter (2-inch) Cube Specimens for Compressive Strength Testing of Grouts and Mortars

914 — Practice for Sampling of Geotextiles for Testing

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10-1 General

10-1.1 Introduction

The Project Engineer and Project Field Office personnel are required to maintain accurate and complete records of construction project work.

It is of prime importance in the administration of a contract that measurements and calculations of contract quantities are accurate, that records of such quantities are complete and detailed enough to sustain audit, and that records of all other activities pertaining to the contract contain sufficient details and are clear enough to be read and understood by anyone unfamiliar with the project.

It is the intent of this Chapter to provide a ready reference and guide for keeping records to establish an adequate and uniform method throughout the State. If the method of keeping records for a project is established at the beginning of the project, original field notes and records can be prepared which will require a minimum amount of time and organization to produce the final contract records. Uniformity in the methods of keeping records facilitates the review of records and promotes greater efficiency when engineering personnel are transferred and reassigned to different projects.

Original field notes must be kept in a form that can be filed and retained as basic documentation. Field notes taken on scratch paper and then passed to the office are not acceptable. Transcription of field notes to final record form is to be avoided due to the obvious possibilities of error and the unwarranted expense through duplication.

Project personnel are charged with the responsibility to see that notes are made correctly and complete with all pertinent information. This Chapter will furnish sample notes to be used as a guide in preparing final record notes.

Fax machines are becoming normal fixtures in many state and private offices, which significantly reduce the time required to transport paper documents. It is acceptable to take action on a fax document; however, follow up mail copies of originals are necessary for any item requiring commitment by either the Contractor or WSDOT to fulfill conditions of the contract. Follow up mail copies are also required for all items involving signatures or multiple part forms. If a fax document is going to be used as a permanent record, it must be copied, because most fax paper will quickly deteriorate.

It is recognized that as work assignments, types of material, construction and design techniques change, so also will documentation and record keeping procedures vary. New procedures will be added to this Chapter as they occur.

10-1.2 Requirements for Notes

Contract items not specifically covered by sample notes in this Chapter can, in most instances, be kept similarly to some like item shown as a sample. The following notations are to be carefully observed for correct procedure:

1. A complete breakdown of stationing for each project by payment groups is to be made available to the project personnel. Quantities must be kept within these divisions as the project is staked or measured.

2. Each set of notes must carry the date when made and the initials of the persons making the notes.

3. Each set of notes, except staking notes, must carry the date when phases of work are accomplished, and the initials of the persons who compute and check the quantities along with the date when the quantities were computed and checked.

4. When field notes are the basic source document supporting a payment to the Contractor, they must also contain the date and initials of the person entering and the person verifying entry into the electronic Project Ledger, along with the six-digit ledger entry number.

5. Particular care must be exercised in referring to contract items exactly as shown in the contract. A notation such as “300-mm (12-inch) Concrete Pipe” is not acceptable.

6. Each pay quantity in the notes will be designated with the item number listed in the contract, and shown thus: 1-Mobilization.

7. Always use the correct field book or loose leaf sheet for the particular kind of work being staked or measured.

8. The degree of accuracy required for computing unit quantities should be consistent with established standards. See Chapter 10-2.1B.

9. Sets of field notes should be field numbered and titled to prevent loss, and then book numbered in the field office.

10-1.3 Source Documents

Preferably all field notes, base line, center line, and grade books should be recorded in bound books. When loose-leaf books are used, care must be exercised to prevent lost pages.

Notes shall be recorded neatly, clearly, uncrowded, and in sufficient detail to be easily understood.

Original entries later determined to be in error, must not be obliterated by erasing, correction fluid, or tape. A line is to be drawn through them and corrections entered directly above with the initials of the person making the change. This is very important as erasures will destroy the legal standing of notes. When revisions require abandonment of a considerable portion of notes, they will be crossed out and a cross-reference made of the book and page number where the revised notes may be found.

Each book shall have the pages numbered, and a title sheet with the route, project name, contract number, and Federal Aid number (if applicable) in the front of the book with a table of contents on the first page following the title sheet.

It is essential that original field notes and documents be carefully kept, recorded, and maintained in safe filing facilities during the active stage of a project. They are transferred to safe, adequate, and recoverable storage after the contract is completed. At all times, when not in use, all source documents, reports, survey notes, etc., are to be kept in fire resistant files where possible.

10-1.3A Daily Report of Force Account Worked

A completed sample of Form 422-008, Daily Report of Force Account Worked, is shown in Figures 10-2 and 10-3. In calculating the amount to be paid for work performed by force account (see Chapter 1-2.4D), it is acceptable to round off individual line extensions to the nearest whole dollar. This should provide some saving in time for most project offices who fill out Force Account sheets by hand. For the few project offices that use a computer program to perform the calculations and print out the completed form, rounding will not be of any significance. It is not intended that computer programs be changed to reflect this rounding.

10-2 Measurement of Items of Work

10-2.1 General

10-2.1A Introduction

It is essential that proper controls are exercised when measuring items of work. At any stage of the work, payment will not be made for any item which cannot be substantiated by the project records. Items that are paid on the basis of mass or truck volume measurement require measurement of the quantities, receipt of the materials, and documentation of both of these operations by the use of item quantity tickets or other delivery records.

10-2.1B Quantity Details

The number of significant decimal places to which quantities should be measured and/or computed varies with the value or bid price of the respective items. Unless specifically advised otherwise, the Project Engineer may use the following guidelines.

Bid Price		Significant Decimal per Unit
Less than $10 per unit	-	1.
From $10 to $100 per unit	-	0.1
Over $100 per unit	-	0.01

Quite often, good practice would dictate that the isolated parts of the quantities be calculated to a higher significant decimal or in some other unit than the payment unit and converted to the payment unit in the summation. Good judgment is required in selecting when to round the quantity. In general, rounding at the first summation of each isolated part is proper. For example, the summation of a day's item quantity tickets should be rounded to the proper significant decimal before entry into the project ledger.

10-2.1C Item Quantity Ticket

This three part ticket has been designed as a means of documenting the many items which are paid on the basis of the quantities received on the project. WSDOT personnel shall fill out applicable portions of the ticket and shall issue to the carrier for each load of material the original (white) and Contractor's copy (canary) and retain the Engineer's copy (pink) in the ticket book. In lieu of using Form 422-021, tickets furnished by the Contractor, by certified public weighmasters, or by suppliers at commercial plants, may be used for materials that are weighed providing that the ticket includes the essential information.

The following information should be recorded on each item quantity ticket:

1. Date.

2. Station, kilometer (mile), and/or group.

3. Legal gross mass (weight) in remarks section, and/or pertinent information.

4. Time received and initials of the person accepting the item.

5. Time weighed and initials of the person issuing the ticket. (May leave blank or put N/A if measurement for the item requires only a person to accept the item.)

6. Unit of measure.

7. Identification number of truck/truck trailer if appropriate.

8. Record the Gross, Tare and Net Masses (Weights). If the scale has a tare beam so the net mass (weight) can be read directly, only the net mass (weight) need be recorded on the ticket. If the unit of measurement is cubic meters (yards), hours, etc., record only the net.

9. Item number.

10. Contract number.

11. Contractor and subcontractor, if applicable.

12. Type of material.

13. Ticket serial number. (This is already imprinted on Form 422-021.)

A representative of WSDOT shall be assigned as a receiver at the delivery site or at the site where the item is performed, and shall collect the tickets from the carrier upon delivery of the load of materials. The receiver shall record any necessary additional information on the ticket and retain the original copy. The Contractor's representative may receive the copy marked "Contractor" upon delivery or at the end of each day's operation. The receiver shall verify the net mass (weight) of each ticket and make periodic computations of yield where applicable.

For materials that are not paid by mass (weight), the receiver will make out the ticket at the point of delivery of the materials. The appropriate items required to completely identify the material, the quantity, and its placement shall be filled in.

As soon as time permits, the original tickets shall be checked against the goldenrod tickets in the books to see if all the material weighed was received on the project. Payment shall be based on the original tickets received on the project but any missing tickets shall be reconciled immediately with the Contractor so they will not be in contention for payment at a later date. As soon as these tickets are reconciled and approved by the Project Engineer, the pink copy may be discarded.

These tickets shall be separated into payment groups and the quantity for each day's operation totaled and checked with the adding machine tapes attached. A cover sheet shall be attached to the tickets separating the daily runs and stating the quantity for each group, total quantity, location placed, and other pertinent information. All tickets are to be accounted for, voided tickets shall be marked "void," and the original included with the completed tickets. The quantities from this cover sheet shall be posted in CAPS.

The tickets shall be placed in two-prong binders or fastened with metal fasteners, string or other permanent material. Rubber bands shall not be used for bundling tickets. Each binder shall be clearly marked to show the contents including quantities, contract number, etc., and be cross-referenced to the CAPS System.

Figure 10-1 is an example of the Item Quantity Ticket. The ticket shown has the contract number, Contractor, item number, and description imprinted on it with an addressograph imprinter. Many Regions have these imprinters available to save time in recording this repetitious information. This information shall be filled in by hand if an imprinter is not available.

10-2.1D Conversion Factors

Conversion factors for liquid asphalt are found in Section 1-09.1 of the *Standard Specifications*. A conversion factor of 1.48 tonnes per cubic meter (1.25 tons per cubic yard) is found in Section 1-09.2(5) of the *Standard Specifications* for use when "minor incidental" quantities are involved. A minor incidental quantity is defined as a total project quantity which is less than one-half of the quantity shown in the control sample (acceptance sample) frequency for a given material.

When it becomes necessary to use an unpublished conversion factor such as tonnes to cubic meters (tons to cubic yards) or vice versa for a contract pay item, the Engineer must make adequate tests and submit supporting data to the Olympia Service Center Construction Office for approval of the conversion factor or new price quotation. A letter of agreement or change order for the conversion factor or price quotation must be obtained from the Contractor and included with the submission for approval. Conversion factors approved for the Contractor's convenience must reflect an appropriate credit to WSDOT. For example, if a Contractor requests a change in measuring an item from a mass (weight) basis to a volume basis, this eliminates the expense of providing a scale facility which was included in the contract bid. This changes the contract and a credit must be given to WSDOT for the reduction in work. Additional items that may be changed are length of haul, method of loading, number of truck loads, and time per trip.

10-2.2 Items Measured by Mass (Weight)

10-2.2A General Instructions

All materials paid on the basis of mass (weight) shall be weighed in accordance with the provisions of the *Standard Specifications* by a representative of WSDOT, or at commercial scales with a WSDOT representative

periodically observing and checking the weighing operation on a nonscheduled basis but not less than twice a week. The weigher shall record the mass (weight) and information on an Item Quantity Ticket in accordance with the instructions in Chapter 10-2.1C of this manual.

When platform scales are used, the tare mass (weight) of each truck shall be taken at least twice daily and recorded on a tare sheet, scaleperson's diary, or shown on the Scaleman's Daily Report Form 422-027. The tare mass (weight) is the mass (weight) of the truck without a load. When using a tare beam scale, the tare for each truck shall be set on the beam at the time of weighing, not the average for all trucks. This requirement also applies to commercial weighers.

For most materials, the loads and the tare masses (weights) will be weighed to the nearest 50 kilograms (100 pounds). Item Quantity Tickets will only be issued for masses (weights) up to the maximum legal amount for each hauling vehicle. Maximum legal gross vehicle masses (weights) are determined by either the individual vehicle's license, the maximum allowed on the haul route if on a public road, or by a current overlegal mass (weight) permit. If the gross load is over the legal limit, WSDOT's weighperson or material receiver shall promptly advise the Contractor and/or supplier. The Contractor or supplier should be given the opportunity to unload the surplus material and then reweigh. If the Contractor elects not to decrease the load, the actual mass (weight) of the load will be recorded on the ticket. This mass (weight) will then be crossed out and the maximum gross legal mass (weight) shown for determination of the pay mass (weight). A mass ticket shall not be issued for any material over the maximum gross legal mass (weight) for the hauling vehicle.

Occasionally a mass (weight) ticket showing an overlegal load will escape the notice of both the weigher at the scales and the material receiver on the grade. The mass (weight) ticket arrives at the project office to be processed for payment showing the overlegal masses (weights). When this happens, it is not intended that office staff go back and make the over legal corrections to the ticket. In other words, if both the weigher and the material receiver have not noticed the overlegal amount and the material has been placed, WSDOT will not retroactively correct the office copy of the ticket. Although this appears to be in direct conflict with Section 1-09.2(6) of the *Standard Specifications*, once the material is in place without the mass (weight) ticket being corrected, it is WSDOT policy to pay for the overlegal amount.

In the determination of quantities of materials produced from batch-type mixing plants, where individual components of each batch of materials are weighed before mixing, the batch masses (weights) will be acceptable for measurement and payment provided that a WSDOT representative is assigned to observe and check on the weighing operations and periodic checks are made and recorded in the checker's diary of the batch masses (weights). This checker shall also observe and periodically record the number of batches placed in each truck and shall issue Item Quantity Tickets for all truck loads dispatched.

When surfacing materials, gravel backfill, riprap, and similar materials are involved on a project and it is reasonably certain that no diversion or substitution of materials can occur, the issuance of individual truck load tickets will not be required, provided that the procedure is approved. The information normally required for the Item Quantity Tickets shall be recorded by the weighperson on a scale sheet and the receiver at the point of delivery shall keep a delivery record showing the truck number and delivery time for each load placed, plus other pertinent information. The yield will be computed periodically on the basis of mass (weight) sub-totals sent out by the weighperson at regular intervals during the day. At the end of each day's operation, the receiver will confirm the number of loads delivered with the scale sheet prepared by the weighperson. In cases of unexplainable discrepancies the receiver's record shall prevail. The Project Engineer will not use this method of documentation prior to receiving approval from the Region for each particular project and documenting the approval in the project records.

10-2.2B Receipt of Small Quantities

When materials are received intermittently through the day and the quantities amount to less than 200 tonnes (tons) of untreated materials or 100 tonnes (tons) of treated materials per day, they may be received on the basis of masses (weights) supplied by the Contractor or supplier. An Item Quantity Ticket shall be filled out by the person that weighs the material and shall be signed by the weigher. Under these conditions, the acceptance of the material will depend entirely on the judgment of the receiver. If the quantity of material shown on the mass (weight) ticket appears to be reasonable upon observation, the person that receives the material shall note in the remarks section on the ticket that the mass (weight) was supplied by the Contractor and appeared reasonable.

When accumulating small quantities of materials over a period of days, the total quantity of material on a project to be accepted on the basis of masses (weights) supplied by the Contractor or supplier shall not exceed approximately 1,000 tonnes (tons) for untreated materials, nor more than approximately 500 tonnes (tons) for treated materials.

See Chapter 9, Materials, for additional information on acceptance of minor quantities.

10-2.2C Weighing Equipment

Scales for the weighing of natural, manufactured, or processed highway and bridge construction materials which are required to be proportioned or measured and paid for by mass (weight), shall be furnished, erected, and maintained by the Contractor, or be permanently installed, certified commercial scales. All weighing equipment will meet the requirements of Section 1-09.2 of the *Standard Specifications*.

10-2.2C(1) General Requirements of Weighing Equipment

Equipment for weighing highway and bridge construction materials shall be accurate within ½ percent of the correct mass (weight) throughout the range of use. Each time the scales are set up, they must be calibrated by a scale company with a copy of the test report furnished for the project files or checked by the Weights and Measures Section of the State of Washington Department of Agriculture with their certification attached to the scales and noted on the Scaleman's Daily Report, Form 422-027. The scales shall be recalibrated every six months during the life of the job. If any question develops concerning accuracy and adjustment of the scales, the Contractor must have them checked and adjusted by a competent commercial scale testing service. The weigher is required to inspect the scales at least daily. All platforms, bunkers, knife edges, and any other mechanical moving parts must be free from accumulations of material which may cause binding and introduction of errors. Checks shall be made throughout each day to see that the scales are balanced and return to zero when no load is on them. This requirement also applies to commercial weighers.

At each batching and platform scale installation, the Contractor shall have available throughout the period of use at least 225 kilograms (500 pounds) of standard test mass (weight) for calibrating and testing the weighing equipment.

10-2.2C(2) Specific Requirements for Batching Scales

The weighing equipment and the hopper shall be so arranged that the operator can conveniently add or remove material in the hopper and view beams or dials simultaneously. Weighing hoppers mounted on platform scales shall have the center of gravity directly over the center line of the platform.

The scales used for weighing Portland cement and asphalt cement shall be separate from those for weighing other materials primarily because of timing requirements for introducing these materials into a mixing drum.

When proportioning scales are used for measurement for payment, a check of the proportioning scales shall be made at least daily to establish reliability for the quantity of material received, by weighing a loaded truck of mixed material or by testing the scales with the test mass (weight).

10-2.2C(3) Specific Requirements for Platform Scales

Platform scales shall be of sufficient size and capacity to mass the entire hauling vehicle or combination of connected vehicles at one time. No part of the connected vehicles or combination will be permitted off the platform at the time of weighing.

Every day that the scale is used, one of the following three methods of checking the scales must be used to determine if the scale is operating to within one-half of one percent of the weighed load. The method used and the results shall be recorded on the Scaleman's Daily Report, Form 422-027.

Five methods of checking the scales are:

1. Weigh a loaded truck on another scale which has been inspected or certified, then mass (weight) the same truck on your scale.

2. Weigh your State vehicle on a certified scale and check your scale with it.

3. If one truck is used for an extended period of time, use it as a "tattle-tale" mass (weight) check. The tare mass (weight) of the truck should be established just after the scale has been tested by an agency or checked by methods (1) or (2). When the truck is originally weighed, check the amount of fuel and make the daily check when the amount of fuel is the same, and check to see that the truck is free of mud, etc. This procedure is best utilized during dry weather. When this procedure is used, check the scales by methods (1), (2), or (3) twice weekly.

Abrupt stops by locking and holding brakes, as well as large idling engines, will affect the accuracy of the scales. Occasional checks of the mass (weight) should be made with the brakes off and the motor stopped.

10-2.2C(4) Specific Requirements for Belt Conveyer Scales

Conveyor belt scales may also be accepted for untreated materials provided that this method or device meets the general requirements of weighing equipment in Section 1-09.2 of the Standard Specifications. The belt must be kept clean during weighing operations since any material clinging to the belt will also be weighed as it passes over

the scales. Zero load tests shall be made occasionally to determine that the scales are adjusted. If a problem develops concerning accuracy of the scales, they must be checked more frequently. The belt scales are equipped with recording odometers. Most of these record the mass (weight) of each load on the ticket to the nearest 0.1 tonne (ton) increments but the recording is a cumulative process on the totalizer. To obtain greater accuracy during the scale checks, the tonneage values shall be obtained from readings taken from the sealed odometer at the beginning and end of each check period.

Three methods of checking conveyor belt weighing are as follows:

1. Check five or more sequential hauling unit payloads on State tested platform scales.

2. Chain test. The chain used consists of a set of rollers accurately calibrated to its mass per meter (weight per foot). During the test, the chain must cover 5 idlers on the belt, 2 approach and retreat idlers along with the weigh idler, plus about 0.3 (1) additional meter (foot) on each end. One end is attached to a stationary part of the structure and allowed to ride on the belt over the scale. Care must be taken in sorting and placing this chain on the belt. The test is made by comparing the mass (weight) recorded on the meter with the mass (weight) obtained by multiplying the mass (weight) per meter (foot) of the chain by the number of meters (feet) the belt traveled. The number of meters (feet) the belt traveled is normally determined by measuring the length of the belt to the nearest 3 millimeters (0.01 foot) and counting the number of revolutions of the belt during the test.

3. Known mass (weight) test. The static mass (weight) test is the most convenient form of checking the belt scales but is not as accurate as the chain test since the static mass (weight) is applied directly to the scale carriage, belt effects are not taken into consideration during the test. The test mass (weight) is hung directly from the weigh idler. This mass (weight) must be converted to kilograms per meter (pounds per foot) by dividing it by the distance between the weigh idler and the approach idler. This distance must be measured to the nearest 3 millimeters (0.01 foot). If the space from the weigh idler to either adjacent approach idler is not the same, use the average of the two spaces. With this mass (weight) per meter (foot) of the static test mass (weight) determined, measurement of belt travel and calculation is the same as with the chain test.

For methods 2 and 3, the duration of the tests must be at least ten minutes.

10-2.3 Items Measured by Volume

10-2.3A Truck Measure

Except as noted below, when materials are measured and paid on the basis of volume delivered in trucks, a receiver shall be assigned at the point of delivery to issue or receive load tickets and to make periodic computations of yield where applicable.

Item Quantity Tickets (see Chapter 10-2.1C) shall be used for recording the volume of materials paid on the basis of truck measure. The tickets shall include all information previously noted as required for materials measured by mass, with the obvious substitution of volume for mass (weight) to be shown as the quantity received.

Surfacing Material, Gravel, Topsoil, etc.

In lieu of issuing individual load tickets when surfacing materials, gravel backfill, top soil, etc., are measured and paid on the basis of volume delivered in trucks, it will be satisfactory for the Inspector to keep a field book record of the deliveries and issue one ticket for the total amount delivered for each item at the end of each shift. The field book record will show the truck number, time of delivery and volume for each load. The ticket issued will show all pertinent data including reference to the field book number.

In documenting the size of loads received, the following procedure shall be followed:

1. The truck box will be measured, calculated, and recorded for final records to the nearest 0.1 cubic meter (yard) based on a struck or water level height. Although state law requires 152 millimeters (6 inches) of freeboard on loaded aggregate material trucks, a water level measurement is fairly accurate due to the normal practice of heaping material in the center.

2. The material receiver shall have sufficient loads leveled at the point of delivery in order to judge the quantity being hauled.

3. Load volume will be recorded to the nearest 0.5 cubic meter (yard) for pay purposes using the volume computed in part (1) above. If the Inspector questions whether a truck is fully loaded, the load will be leveled. If the vehicle is not fully loaded, the Inspector will measure and document the actual load to the nearest 0.5 cubic meter (yard).

Water

To document the amount of water delivered to the project, the Project Engineer shall have the truck driver maintain a Water Delivery Record Form 422-024, showing all pertinent information including time, volume, place of delivery of each load, project number, and truck number.

The Inspector must make, and record on the Water Delivery Record, daily spot checks to verify the quantities being delivered. The Inspector shall look into a water truck occasionally and determine whether its condition, full or empty, is correct in relation to its delivery schedule. An Item Quantity Ticket shall be issued to cover the water delivered by each water truck each shift. The water delivery record shall be signed by the truck driver each day, initialed by the Inspector, and attached to WSDOT's copy of the Item Quantity Ticket as support for the water received.

The capacity of each water truck shall be determined by measuring or weighing, and recorded in the project records. It is considered good practice to attach copies of the truck identification and capacity records to the water ticket book so this information is available to the field Inspector.

When water meters are installed at the discharge point for hydrants or water wagons, the Inspector shall read the meter at the beginning and end of each shift and issue a ticket for the net quantity of water placed in accordance with contract specifications for this item. All meters shall be checked for accuracy by comparing the metered volume to the calculated volume of a water truck.

10-2.3B Cross-Sections

Most of the excavation items are measured by field cross-sections and/or template notes. The project shall be staked and measured accurately in accordance with good engineering practice. The field notes shall show the date the data was taken, weather, and crew with their duties. When remeasurements are required, it is necessary that the same base line and elevation datum be used and recorded.

Excavation areas which require original and final measurements shall have cross-references between the original notes and the remeasure notes. Also references shall be made to the transit notes and elevation datum for that excavation area.

10-2.3C Neat Line Measurement

Some items such as concrete are paid based on dimensions given on the plans. For these items, the quantities need to be calculated and recorded, but it is not necessary to include these calculations in the record. If sketches or dimensions are required to compute the quantities, these should be included in the records.

Other items such as structure excavation and gravel backfill are measured for payment using neat line volumes based on plan dimensions as a maximum limit. These items require field measurement to determine pay quantities that may be less than neat line maximums. Many times sketches with the dimensions shown are desirable. The dimensions should show the limits of the actual work except when these limits exceed the maximum allowed for payment, then the dimensions shall be limited to the maximum allowed.

10-2.4 Items Measured by Hour

When contract items are to be measured and paid on an hourly basis, an Inspector shall be assigned to verify the hours for payment, and issue Item Quantity Tickets or other verified field note records. At least one ticket shall be issued at the end of each shift. The tickets shall show all pertinent information for the item involved. Some items measured by the hour may be eligible for payment during nonshift hours; for example, a 24-hour flashing arrow used for lane closures or detours in effect during nonworking hours. In these situations, an Item Quantity Ticket for one shift may show more hours for payment than are actually available within the shift.

In order to ensure agreement on the hours of work performed on a day to day basis, Item Quantity Tickets for items of work measured by the hour shall be initialed by the Inspector and signed by the Contractor's representative.

10-2.5 Items Measured by Lump Sum

The project records should show the item for which payment is to be made on a lump sum basis with the date that the material was received or the work was accomplished. A field note record shall be made showing the dates the work was performed, has the initial of the Inspector, and shows the work to be 100 percent complete. The field note shall show any estimated portions of the Lump Sum prior to 100 percent completion, and shall show the basis on which any quantities used for progress estimate payments were calculated.

10-2.6 Items Measured by Other Units

10-2.6A Linear Measurement

Records for materials measured by length should show the length measured, initials of the persons making the measurements, and the date measured.

Records for measurement should also include the beginning and ending stations of the work recorded by the Inspector or person making the measurement to tie this work to the location on the project. The dates of construction should also be recorded.

10-2.6B Area Measurement

Records for materials or work measured by area should show the length and width measured, initials of the persons making the measurements, and the date measured. In many instances a sketch of the area with the measurements would

be very helpful in showing and computing the area. The dates of construction should also be recorded.

10-2.6C Per Each Measurement

Records for materials or work measured by each unit should normally show the location of the item, dates constructed, and initials of the Inspector or person measuring the item.

10-2.7 Items Bid at "No Charge"

Normal documentation procedures are not required for items bid at "no charge" if the items do not physically constitute a portion of the finished work. Notes in the diary or Inspector's Daily Report are necessary to show when the work was done. Examples of these items are water, haul, and embankment compaction.

For items bid at "no charge" which physically constitute a portion of the finished work, normal documentation procedures such as Item Quantity Tickets or cross-sections are required to prove the item was incorporated in the project. Examples of these items are layering material and prime coat aggregate.

10-3 Final Records For Projects Constructed by Contract

10-3.1 Records

These consist of field books, Inspector's record of field tests, project and Inspector's diaries, Inspector's Daily Reports, all invoices, weigh bills, Item Quantity Tickets, receiving reports, project ledgers, mass diagrams, plotted cross-sections, computer listings, working profiles, and any other document that is a basis of payment for work performed or materials furnished. All records can be placed in one of two categories, either permanent records or temporary records. Those records, which are designated to be permanently filed, shall be assembled as a portion of the project final records and shall be submitted to the Olympia Service Center for numbering and filing. In order to comply with WSDOT Directive D 27-60, Federally Funded Highway Construction Project Closure Process, the project office must submit project final records to the Regional Documentation Engineer within ten months of the project completion date. Regional Documentation Engineers must submit a project's permanent final records to the Olympia Service Center within eleven months of the project completion date. Those records which are designated to be temporarily filed shall be retained in the Regional Office for at least a 3-year period following acceptance of the project as required by RCW 40.14. The date for the beginning of this 3-year period for State funded projects is the date the Secretary accepts the project. If Federal funds are involved in the project, the date for the beginning of this 3-year retention period is the date that FHWA accepts the final payment voucher. The Olympia Service Center Accounting Office sends a copy of Retention of Records on Federal Aid Projects (DOT Form 133-072) to the Region which specifically indicates the starting and ending dates of the 3-year retention period for the project.

The transmittal to the Olympia Service Center shall be addressed to Engineering Records, Room SC17, Transportation Building, Olympia, WA 98504, and shall include all of the final records which are to be filed permanently. Any part of the final records desired in the Region for further use may be requested immediately or designated in the transmittal letter. Requested records will be sent out as soon as the required files have been set up in the Olympia Service Center.

All of the final records sent to the Olympia Service Center will be kept permanently.

Permanent final records consist of the following:

Provided by Olympia Service Center Accounting:

- Contracts
- Change Orders
- Contract Estimate Payments

Provided by Project Office:

- Diary Records (Project Diary and Inspector's Daily Reports)
- Final Record Book No. 1
- As-Built Plans
- Pile Driving Records
- Record of Accidents and Traffic Surveillance
- Contractor's Daily Report of Traffic Control

The As-Built Plans will be microfilmed and returned to the Region along with a set of the microfilm aperture cards as soon as received.

The temporary final records are to be retained in the Region for the 3-year period as explained in the first paragraph of this subsection and then destroyed. If a claim or law suit is pending at the end of the 3-year period, these records shall be retained until the claim or law suit has been resolved. Also, the Region must determine if any of the temporary records have any future value and need to be retained. The following list is not a complete listing of all possible items that could be in this category. Temporary final records consist of all project records that are not included in permanent records. Examples of these temporary records are:

Item Quantity Tickets
Project Engineer's Copy of Estimates
Inspector's Record of Field Tests
Scaleman's Diary and Scale Checks
Scale Test Reports
Concrete Pour Records
Record of Field Audits
Approval of Source of Materials
Quantity Computation Sheets
Surfacing Depth Check Records
Prints of Shop Drawings
Contractor's Payrolls (Federal Aid Projects)
Source document files
Alignment (Transit) Book
Grade Book
Cross-Section Notes
Drainage Notes
Photographs
Mass Diagrams
Computer Summary Sheets
Computer Listings
Falsework and Form Plans
Daily Report of Force Account Worked

It is no longer necessary to keep a paper copy of the Project Ledger since it is stored electronically and can be reproduced on request.

10-3.2 Contracts

The signed original contract documents are maintained in the Contract Processing Section of the Olympia Service Center Accounting Office during the active stage of a contract. After final payment has been made, Accounting sends these documents to Records Services for permanent filing.

10-3.3 Change Orders

Approved change orders are a legal part of the contract documents and are treated just like the original contract documents. For a complete discussion of change orders, see Chapter 1-2.4C.

10-3.4 Contract Estimate Payments

Documentation of contract estimate payments is facilitated by use of the computerized Contract Administration and Payment System (CAPS) which includes both the monthly progress estimates and the final estimate. For a complete discussion of the contract estimate process, see Chapter 1-3.1. Specific information on the final estimate package is found in Chapter 1-3.1D. After final payment has been made, Accounting sends these documents to Records Services for permanent filing.

10-3.5 Diary Records

Diary records consist of both the Project Diary(s) and the Inspector's Daily Report (IDR). Together they should provide a complete word picture of the project, covering both the normal work process and anything unusual that occurs on the project.

10-3.5A Project Diary

The Project Engineer and preferably the principal assistant(s) must keep an up-to-date diary for every project. A minimum of one Construction Project Diary shall be required for each project. This diary may be primarily maintained by the Project Engineer's principal assistant(s), i.e., the Assistant Project Engineer or the Chief Inspector. The diary must contain a record of all matters of importance not covered by the routine reports or even of routine matters if the circumstances are unusual, conferences with the Contractor or the Contractor's field representative, agreements made, special notes regarding equipment or organization, labor conditions, weather or other causes for delays if of any consequence, and any other matters that have a bearing on the completion of the project. In lieu of keeping a separate diary and to avoid duplication, the Project Engineer and the principal assistant(s) may make entries in the same diary. Each entry in the diary will be followed by a signature or initials on the line immediately under the entry to identify the writer. The Project Engineer is responsible for ensuring the existence of a Construction Project Diary for each project, regardless of the fact that it may be maintained by others.

There are currently three options to fulfill the Construction Project Diary requirement.

1. Use of the bound book, Form 422-014, Construction Project Diary.

2. Record the day's activities on tape. The tapes shall be typed daily and include the same data as on Form 422-014. Each day's information must have page number, e.g., 1 of 3, 2 of 3, etc., and be signed by the author. At the end of the project, the pages should be bound together including a title page.

3. Use of Inspector's Daily Report, Form 422-004A. When this method is used, a Project Diary entry should be on its own separate sheet, not just a note added to the IDR. Also, to distinguish it from the IDR, a line should be drawn through the title, Inspector's Daily Report, and the words

"Project Diary" entered at the top of the page, either above the title or at the beginning of the diary entry area. Contract number, day and date information should be entered in the appropriate boxes at the top of the sheet, and the signature and title of the author must appear after the entry. The sheet can then be placed with the same day's IDR. At the end of the job, the bound book of IDRs must indicate on the title page that it includes Construction Project Diary entries.

The type of Construction Project Diary used to record the day's activities shall be consistent throughout the life of the project. If different individuals on a project are maintaining more than one Construction Project Diary, they may be of different types, but each diary must be the same type throughout the complete project.

A well-kept, complete diary becomes a valuable administration tool. It is a collection point for many of the project's pertinent facts arranged in chronological order. It shows how questions were answered, how problems were solved, progress of the work, and unusual conditions pertaining to working days charged. It can provide data for analysis of both claims and requests for extensions of contract time. It is also available for reference long after the work is completed.

10-3.5B Inspector's Daily Report

The Inspector's Daily Report (IDR) is a record of operations for a specific type of work on the project, such as surfacing, grading, paving, bridge, etc., which is being inspected by the writer. Page one of the Inspector's Daily Report is a structured sheet of questions addressing identification of work operations and the associated labor and equipment being used to accomplish the work. This page should be filled out completely for all questions that pertain to the specific type of work activity being inspected. Page two is a narrative portion which should include a notation of any orders given or received, discussions with the Contractor, unusual conditions, delays in the operations, and the presence of any visitors. If an operation is being inspected which results in the partial payment of an item, the item should be identified along with the basis for calculating the partial payment. It is also of value to note the Inspector's or Engineer's activities in the daily report.

Entry of information on the Inspector's Daily Report should begin as soon as the Inspector arrives at the job site and should continue on a periodic basis throughout the work shift. It should rarely be necessary to work overtime for the sole purpose of completing the daily report.

Inspector's Daily Report Form 422-004, 422-004A, and 422-004B is to be utilized for this daily report. Each page is printed separately in a tablet in duplicate on NCR paper. Both types of tablets have the instructions printed on the tablet cover. The original copy is to be submitted to the Project Engineer each day.

If necessary, the Project Engineer should add comments or remarks on the original copies of the Inspector's Daily Reports to clarify the report. The duplicate copy of the report should remain in the book for the Inspector's information and may be discarded when it is no longer useful. The original copies of the Inspector's Daily Report shall be included in the final records for permanent retention.

Subject to the following criteria, it is acceptable for inspectors to produce IDRs by recording information into a dictaphone machine while at the job site for later transcription to a paper format.

1. Once an inspector starts using this method of producing IDRs, it should be continued to the completion of the project. (This establishes a regular process and is more admissible in court.)

2. All information required on the regular handwritten form must appear on the typed version.

3. The inspector must **read** and **sign** the typed document. (It is desirable for this to take place within **24-48** hours of the reporting period. However, it is recognized that certain situations may not permit this time frame and therefore it is not mandatory.)

4. The inspector may make and initial hand corrections to the typed document.

Please note that those few inspectors who use lap top computers can produce their own typed IDR document, complete with signature, consistent with the above criteria.

10-3.6 Final Record Book No. 1

Each book included in the Final Records shall be numbered, and Final Record Book No. 1 shall bear the signature of the Regional Administrator. The Regional Administrator may subdelegate authority to sign Final Record Book No. 1 to another position within the Regional organization. This delegation must be in writing and maintained in the Region general files. Final Record Book No. 1 shall contain a title sheet, Form 422-009, and shall be assembled with a semi rigid, water resistant cover such as pressboard, 100 lb. TAG stock, or a similar material. Additional sheets, Form 422-018, can be obtained by requisition for use in preparing this book. Narrow cardboard fillers should be inserted along the binding area to compensate for thickness of folded data.

The following records are to be incorporated in Final Record Book No. 1 and the order in which it is to be

arranged is given below. No other material is to be included in this book.

1. Index. This should contain the detailed index for Final Record Book No. 1 and also the listing of the other final records contained in each book.

2. WSDOT personnel list. Final Record Book No. 1 shall contain a list of all WSDOT personnel assigned to the project and their classifications. Each person shall place their identifying initials after their name on this list in the same manner as it appears in other final record documents. This should be done at the beginning of the project and kept up to date with personnel changes.

3. Comparison of quantities. This is a computer-generated report prepared from the Final Estimate and a copy should be placed in Final Record Book No. 1.

4. Final Estimate Sheets. A copy of the Final Contract Voucher Certification, and the Contract Estimate Payment Totals from the final estimate should be placed in Final Record Book No. 1.

5. Wages and Change Orders. The original or a copy of Affidavits of Wages Paid and a List of Change Orders should be placed in Final Record Book No. 1.

6. Record of Construction Materials. This should be a tabulation of the source of the construction materials. If material of a certain type was obtained from two or more sources, the station limits or parts of a structure relative to each source should be shown. Depending on the size of project and the method used to record activity, a copy of the completed Record of Materials or a summary from the contract's ROM database may satisfy this requirement. This is an acceptable option to preparing a separate duplicate list.

10-3.7 As-Built Plans

As-Built Plans are a record of any deviations or changes to the original intended physical product of a contract. As-Built drawings should reflect the same degree of detail as the original plan drawings. As-Built Plans are necessary as a basis to plan and design future projects in the same location and to make repairs to damaged structural components or other nonworking facilities. In addition, Chapter 19.122 RCW mandates that owners of "underground facilities" be able to locate these facilities within 600 millimeters (24 inches) of the outside dimensions.

Within two weeks after a contract has been awarded, the Olympia Service Center Ad and Award Office or Printing Services Office will furnish the Region office with one set of large-size blackline prints of the contract plans which will be marked "For As Constructed Plans Only." These plans will be used by the Project Engineer solely for "As-Built" purposes; all corrections and revisions, including additional sketches, are to be shown on these plans. Corrections should be made by lining out quantities or other features which were changed on construction, and placing the correction in red ink. A neat and legible sheet must be obtained. Use a red repro pen that writes sharp, clear, and dark with a medium width line. Fine lines do not reproduce when micro-filmed. Special care must be taken to ensure that any construction change is entered on all contract plan sheets affected by the change. For instance, the change in location of a catch basin or manhole may affect the location listed in the structure note sheet, plan view of drainage sheet, and drainage profile sheet. If there is not enough free space on a sheet to show the as-built condition, do not place a "patch" over the existing original plan. An additional sheet can be used with a page number suffix A, B, C, etc., or the film negative procedure can be used as explained in the following paragraph.

The Project Engineer may request film negatives of the sheets that have too much information on them to permit making corrections by lining out the items that changed and adding the correction. When the film negatives are received, the items that changed should be "opaqued-out" on the film negatives with "photo opaque." After all areas on the film negatives where changes will be made have been "opaqued-out," the film negative should be sent to the Olympia Service Center with a request for film positives of these sheets. Those areas that have been "opaqued-out" on the film negatives will show up blank on the film positives. The As-Built quantities, stationings, remarks, etc., that have changed on construction should be hand-lettered with drawing ink for use on the film positives. Erasures may be made on the film positives where necessary. The film positives become a part of the As-Built Plans and shall be submitted with other As-Built Plan sheets.

If concrete foundations are partially removed, the remaining portions of the foundations must be shown on the As-Built Plans.

It is no longer required that the As-Built Summary of Quantities sheets be revised to agree with the final estimate quantities. This, however, will be optional and subject to policy and direction at the Regional level. If a Region elects to eliminate the corrections on the summary of quantities, the sheets must be clearly marked to the effect that the quantities on the sheets represent preliminary estimates only and that final As-Built quantities must be obtained from the final CAPS ledger.

Correction tape may be used only on Quantity Tabulations and Structure Note sheets.

Quantity Tabulation sheets must have the physical feature items changed, e.g., guardrail, posts, anchors, guideposts, stripe, lane markers, monuments, etc., but only on the

totals line at the bottom. Draw an X over the rest of the page and make a note "Totals Only Changed."

Structure Note sheets must have the physical feature items changed, e.g., pipe, catch basins, manholes, inlets, etc. Any added structure notes must be shown as well as alternates when used.

The As-Built Plans shall be kept up to date as the work progresses on a project. Should it be necessary in the course of construction to make an important change which cannot be accomplished in the above manner, it is requested that this change be made on duplicate tracings requested from the Olympia Service Center or supplemental standard size tracing sheets, and forwarded to the Regional Office for approval. White prints of these tracings, including any supplemental tracings prepared by the Regional Office, the Olympia Service Center, or a consultant, must be included with the "As-Builts."

In addition to the above, the Standard Specifications require that the Contractor furnish the Engineer with original tracings suitable for micro-filming, of shop drawings, including approved revisions, for prestressed structural elements, and all other structural steel components fabricated from shop plans. These requirements are covered in Sections 6-02.3(26)A and 6-03.3(7) of the Standard Specifications.

All As-Built Plans are to be arranged in numerical sequence, including a cover sheet with pertinent project data in the lower left corner, and submitted to the Olympia Service Center with the final records.

10-3.8 Pile Driving Records

The Pile Driving Record Book, Form 450-004, shall be included as part of the final records. For a more complete explanation see Chapter 6-5.7C.

10-3.9 Record of Accidents and Traffic Control

10-3.9A Record of Accidents and Traffic Surveillance

A separate file is required for each project containing only those documents pertaining to accidents occurring on the project and records of traffic control surveillance (Chapter 1-2.3J of this manual). This file will be included as a part of the project's permanent final records submitted to the Olympia Service Center.

10-3.9B Contractor's Daily Report of Traffic Control

The Contractor's Daily Report of Traffic Control (DOT Forms 421-040A and 421-040B) completed by the Contractor's Traffic Control Supervisor shall be included as part of the permanent final records. They may be a separate bound book, included with the Inspector's Daily Reports, or included in the Record of Accidents and Traffic Surveillance. The Contractor's Daily Report of Traffic Control is discussed in more detail in Chapters 1-2.3F and 1-2.3I(1) of this manual.

10-3.10 Project Ledger System

10-3.10A General

The current Contract Administration and Payment System (CAPS) has been developed into not only an accounting and payment system, but also an information collection system. The project ledger is the backbone of the system. All items of work on a project for which payment is made must be entered in the electronic project ledger. Items posted in the ledger become the basis and summary record document for dollars paid to the Contractor, quantity of work performed by the Contractor, status reports during the active life of the contract, and final reports when the project is completed.

As work is performed and the project office enters quantities into the ledger, those records become eligible for payment when the next estimate is due. Processing estimates (see Chapter 1-3 of this manual) is simplified to a few keystrokes which instruct the computer to compile all ledger records eligible for payment and transfer the data to the payment portion of the CAPS system. The system not only speeds up the payment to Contractors but also makes a large amount of corporate information available for use by many WSDOT employees.

All electronic data in the CAPS system is stored on either the current active file or on a history file. These files will be permanently retained and will be available for use whenever the need arises. It is not necessary to retain a paper copy of the project ledger for final records.

Detailed instruction on operation of a computer terminal to access the CAPS system is contained in the CAPS Manual.

One of the major operational functions of an accounting system such as CAPS is to provide a complete audit trail for every pay item, from the original source documents through actual payment to the Contractor. Audits are a vehicle used by both state and federal governments to ensure the proper use of public funds. It is an advantage to WSDOT to maintain sufficient records and documentation to stand the test of audits.

In order to satisfy the requirements of an accounting audit, the following conditions must be met:

- There must be a source document for every ledger entry.

- There must be a filing system for timely retrieval of source documents.
- Pre-estimate reports must be signed by the Project Engineer.
- The estimate payment advice report must be filed with its corresponding pre-estimate report.

10-3.10B Source Documents

Each ledger entry must be supported by a detailed source document which specifically identifies the type, amount, and location of the work or material being entered for payment. Examples of source documents are Item Quantity Tickets, field note records, Inspector's estimates, and force account sheets. Source documents are the beginning of the audit trail. They show that a WSDOT Inspector has observed and determined the amount of work performed by the Contractor. Also, the source document must show that all calculations have been checked by a second WSDOT employee to ensure they are correct.

Source documents must show four sets of dated initials as follows: 1) the person who does the original calculations, 2) the person who checks the original calculations, 3) the person who enters the payment quantity/amount in the CAPS ledger, and 4) the person who verifies the CAPS ledger entry. In addition, the source document must show the ledger entry number.

Lump sum items and excavation items often have progress payments based on an Inspector's estimate. When the Inspector's estimate is based on a schedule provided by the Contractor, such as a lump sum structural item, there is usually no calculation involved and the initials of a checker are not necessary. However, if calculations are involved or when the items of work are completed and measured for final payment, the source document must show all four sets of initials as described in the preceding paragraph.

Some project offices are using electronic data collectors for surveying work which eliminates hand-prepared transit and level field books. Also, some offices have developed programs on their personal computers that perform calculations and print results with a minimum amount of input. This type of electronic information handling will increase in the future. At times there is confusion concerning the need for checking data that has been compiled by a computer. In the absence of specific direction, when a computer produced record or set of notes is used as a source document for payment, some individual had to originate or cause the document to be originated, and someone can check it for reasonableness and accuracy. This may range from duplicating the process to verifying the input. Whatever the case may be, the dated initials of those two individuals must be on the source document.

Normally, the work date for each ledger entry will be the date that the work was actually performed. If an item of work is being summarized over a periodic time frame, such as a week's accumulation of force account sheets, the work date entered into the ledger should be the latest date work was actually performed in the time period.

10-3.10C Filing Systems

Basic criteria for a good filing system includes ease of set up and use and the capability to retrieve any specific document in a timely manner. The filing system should also coordinate easily with final records requirements. In the past, this was accomplished by labor intensive cross referencing with specific book and page numbers. The following described filing system is not mandatory. It is presented as one alternative which works well with the CAPS system and the final records process, and is easy to use. The unique ledger entry number from CAPS makes this method work. Files are set up by item number and structure note number. Source documents are filed by item number except drainage items, which are filed by structure note number. With this method there is only one item per source document except for drainage items. Drainage items are filed by structure note number because their source document (field note record) normally has multiple items and the structure note number is unique to a specific drainage facility. For all other items, if more than one item appears on a source document, make a copy for each item, highlight the desired item number, and file in their respective locations. This works extremely well if the source documents are placed in order by date in their respective files.

To look at the source document for a ledger entry, simply note the item number, entry number, and date; go to the file and look for the entry number in the item file. If files are in date order, it is even easier. The reverse process is essentially the same, using item and entry number to go to the ledger. For ledger entries of drainage items, it is necessary to include the structure note number in the remarks section.

With this system, it is easy for anyone to locate source documents. At final record time it is not necessary to cross reference with book and page, because everything is already in order and identified. All that has to be done is to bind the source documents into books with appropriate titles. The one disadvantage is that more field note records are used.

10-3.10D Pre-estimate Reports

Pre-estimate reports (see Chapter 1-3.1B) prepare the computer to make an estimate payment. It is an opportunity for the project office to preview the estimate and allows for corrections to be made before actual payment. The correct

pre-estimate report used to make a payment must have the signature of the Project Engineer to indicate authorization for payment. The signed pre-estimate report must be retained in the project files, and become part of the 3-year temporary records.

10-3.10E Estimate Reports

When an estimate is paid, the project office receives a copy of all the reports that are sent to the Contractor with the warrant. The Contract Estimate Payment Advice report and the Contract Estimate Payment Totals report should be compared to the Pre-estimate report to verify that the amount actually paid is the same as the amount authorized. These estimate reports should be filed with the pre-estimate reports in the project files, and become part of the 3-year temporary records.

10-3.11 Final Record Field Notebooks

Final Record Field Notebooks are comprised of either bound books used for a specific kind of work such as alignment notes, grade notes, and pile driving notes, or loose-leaf notes of specific kinds of work bound together by the Region as part of the final records. Any required records that appear in any of the field books shall not be duplicated and placed in any other final record book, except that copies of Field Note Records with multiple item numbers may be copied as described in paragraph 10-3.10C, Filing Systems, to maintain file consistency.

Adequate loose-leaf forms are available for any field note requirement other than alignment, grade, and pile driving and can be requisitioned by DOT form number. See Chapter 11 for available forms. Loose-leaf field notes should have a 12-millimeter ($^1/_2$-inch) minimum margin to be legible after binding for permanent filing.

Final record loose-leaf field notebooks shall be assembled with a semi rigid, water resistant cover. All Final Record Field Notebooks shall contain a title sheet, Form 422-012, and a table of contents.

Each Final Record Field Notebook shall be numbered and have the pages numbered beginning with number one. Typing information in the field book is not necessary and hand lettering is preferred. Erasure corrections on project records will not be permitted. If the filing system suggested in Chapter 10-3.10C is used, then those Final Record Field Notebooks which contain the source documents do not need page numbers.

The quantities for payment for each item of work in the field notebook shall correspond directly to entries in the CAPS project ledger. Adequate cross-referencing must be made between the field notebook and the project ledger in order to trace item quantities and entries from one to the other.

The field notes shall show the initials of the persons or person making them, the date, and the weather conditions if appropriate. In some cases different stages of work will be noted on the same page such as staking, measurement, and construction. This would require dates and initials at each stage of work. The notes shall also show the dates that quantities are computed and checked along with the initials of those persons doing the work. Most loose-leaf forms have specifically identified spaces for dated initials where necessary. If a form is being used that does not have these spaces, a rubber stamp can be obtained and used to identify the appropriate space. In all cases, field notes should be neat and legible and show all necessary information. Figures 10-4 and 10-5 show sample field notes and summary for clearing.

Sketches shall be shown when necessary to compute a quantity that cannot be computed from the As-Built Plans. Sometimes structure excavation sketches are helpful for determining the pay limits and computing the volume; other sketches are helpful on special details.

Current methods provide for storage of all types of detailed surveying data on electronic medium such as computer disks.

The Computer Manual covers the methods to be used on cross-sections for computer-run quantities. Computer input data forms for direct recording of field information shall be treated as an original source note.

Remeasure cross-section notes, where a deviation from the established roadway section or slopes has occurred, shall be indexed carefully so that they can be identified readily with the original cross-section. For convenience of calculation on remeasure, plotted cross-sections may be used.

Structure and drainage notes in the Final Record Field Notebook should show the stationing, distance left or right, angle or skew if applicable, flow line elevation and grade in the case of culverts, drains and ditches, and all information necessary for computation of the pay items involved in the construction. For convenience, it is recommended that all pay quantities pertaining to the construction of the items listed on the Structure Notes sheets of the plans, be shown in the field book with structure note number, item number, and quantities, and that cross-references be used to show where the totals were obtained. It should be remembered that quantities must be segregated by group number as shown in the summary of quantities contained in the contract plans.

Figures 10-6 and 10-7 show the front and back of a field note for the installation of a sewer pipe.

10-3.12 Computer Produced Documents

There are many computer applications available for use on a WSDOT highway construction project. Included are programs for earthwork quantities, mass diagrams, basic cut and fill, geometrics, surveying, and structural quantities. The Washington Computer Manual, Highway Engineering Applications, describes in detail all of the programs available on the mainframe.

When computer computations are used, the output generated must be bound together and identified with a title sheet for final record purposes. These documents become a part of the three-year records retained by the Region as explained in Chapter 10-3.1. When a computer program is used to calculate quantities for payment, the summary sheets containing the quantities entered in the project ledger must be treated as source documents with all required signatures, dates, ledger entry number, and sufficient cross referencing to provide a good audit trail.

10-3.13 Photographs

The photographic record is an important part of the project documents. Of particular value are “before” and “after” views taken from the same viewpoint. Photographs should also be taken of unusual equipment or construction methods, problems, areas of possible controversy, traffic control, and especially conditions in the area of an accident. All photographs must be identified showing when (date and time), where, and who took the picture. An identified photograph can be an important piece of evidence in court. Although photographs are placed in the category of three-year temporary records, some Regions have extended the retention period for photographs to permanent status.

10-3.14 Temporary Final Records

Chapter 10-3.1 contains a partial listing of temporary final records and an explanation of their retention period by the Region. With the exception of the Inspector’s Record of Field Test discussed below, most of the items listed are either self-explanatory or have been discussed in Chapter 10-2. In general, they are all of the project records and documents not specifically identified as being a part of the permanent final records listed in Chapter 10-3.1.

10-3.14A Inspector’s Record of Field Test

The Inspector’s Record of Field Tests, Form 422-020, shall be used by the field Inspector, first, as a project record, second, to inform the Project Engineer, and third, to inform the producer, of the results of field tests of aggregates. The white copy of field tests must not be detached. It must remain in the book and the book must remain with the Inspector at the test site until all testing is complete. It shall be available at all times for review by Department personnel, the Contractor, and the Federal Highway Administration.

These forms shall be used exclusively to record field test data. All other methods of recording field tests, such as level notebooks, scratch paper, etc., are not acceptable. Instructions pertaining to proper use of the forms may be found on the cover. Since the form is designed as both a work sheet and a test report, all computations must appear on the form.

10-3.15 Disposition of Records for Projects Constructed for Local Agencies

The foregoing procedures for record keeping and documentation of quantities must be followed on local agency State ad and award projects with one exception as follows:

All project records defined as temporary final records for Region retention in Chapter 10-3.1 should be properly indexed and retained by the local agency. All of these records must be retained a minimum of three years in accordance with the criteria contained in the first paragraph of Chapter 10-3.1.

10-3.16 Review Procedures for Final Estimates and Final Records

When work on the project is physically complete, it is imperative that the records be completed, the final quantities checked, and the final estimate furnished to the Contractor as soon as possible.

The final quantities should be computed and ready for Region review within 2 weeks following physical completion of the projects. The Region review and check of the final quantities to pass the Final Estimate should be completed within 2 weeks of the time the records are ready for checking. Should sufficient reason exist to preclude submission of the final estimate to the Contractor within this time schedule, the Regional Administrator should be notified in writing. If the delay is substantial, consideration should be given to issuance of an additional estimate as provided in Chapter 1-3.1B. The dates of these phases of record preparation and checking and the dates of submission and return of the estimate from the Contractor should be carefully documented in the event this becomes controversial.

It should be noted that in accordance with prompt pay legislation, RCW 39.76, the above time frame should be considered a maximum. It is recommended that Region Documentation conduct final record audits whenever possible during normal documentation reviews as suggested in Chapter 10-5.

The Region final records checker should review to see that the documentation procedures are correct for each type of payment item. Following this review, the checker should select about 10 percent of the items and make a check of approximately 10 percent of the quantity records for mathematical accuracy. Projects with less than 60 pay items may require more than 10 percent to be reviewed. In those situations, the checker must review enough items to ensure the procedure and accuracy of item calculations. Additionally, large projects (over 250 items) may require less than 10 percent to be reviewed. If care is exercised in selecting review items that cover the full range of payment types, a maximum of 25 items checked may be sufficient to verify the procedure and accuracy of item calculations. Considerable judgment may be exercised by the Region regarding procedures on this check. A suggested procedure follows:

1. Quantities based on computer computations such as earthwork, resteel, etc. Determine arithmetical accuracy of summaries.

2. Items by linear measurement such as curb, gutter, guardrail, slope treatment, etc. Check the arithmetical accuracy of the summary on a random basis for a representative quantity.

3. Quantities paid on basis of Item Quantity Tickets. Selectively determine accuracy of book totals, machine add tapes, receiving reports, and summary sheets.

4. Items paid per each as inlets, lane markers, etc. Similar procedures to 2 above.

5. Items paid by unit measurement involving computations such as structure excavation, concrete masonry, clearing, etc. A sampling of the computations, as 1 in 20, should be followed through for arithmetical correctness. Verification of summary totals.

Spot checks should be expanded in the event of significant errors. At the discretion of the Regional Administrator, a complete check of all items may be desirable. The Regional checker shall mark, initial and date those portions of the records that have been reviewed. The Examination Sheets for Contract Items Form 421-014, should be kept until the final record check and then filed with the temporary final records so they will be available during any audit of the records.

Chapter 10-3.1 of this manual requires final records to be submitted to the Olympia Service Center within 11 months. This allows ample time for any remaining documentation checks, cataloguing, and cross-referencing desired by the Region. Chapter 10-3.15 of this manual covers Local Agency Final Record Disposition when the project is State ad and award.

10-4 Documentation for Monthly Estimates

Source documents used to back up entries in the project ledger are usually complete documents that stand alone. If information from other documents is used in the source document, the additional document(s) must be identified to complete the audit trail.

The record should show the methods used to determine the tentative estimate of monthly quantities for grading, lump sum, and other items which lend themselves to accurate measurement after the item is completed. For lump sum items, the field notes or diaries should show the estimated percent completed or what remains to be completed. The method of computing the percentage of completion should be included.

When truck count is used for estimating excavation quantities, care must be taken in establishing the average quantity in the load. As soon as possible, the quantity obtained by truck count should be checked against a measured quantity in order to establish an average load. The Contractor or the Contractor's field superintendent should have a clear understanding of the estimating procedure being used and that actual measurements will be used for final quantities. When the excavation work is nearing completion, the quantities should be adjusted based on actual measurements so any error in quantity due to estimating will be minimized.

For many of the lump sum items, it is necessary for the Project Engineer to break the item into basic units of work to document percentage of work performed during each estimate pay period. A bridge superstructure, for example, may be broken down into parts such as constructing falsework, furnishing and placing steel reinforcing bars, structural steel, furnishing and placing concrete, finishing concrete, painting, and cleanup. These items should be assigned a percentage of the whole lump sum unit in relation to the cost to the Contractor of each part to the whole unit. Payment to the Contractor can not be made for constructing forms, so the cost of this item is included with the cost of furnishing and placing concrete.

Quantities of work should be calculated and checked as soon as time permits so that payment may be based on actual measured quantities rather than estimates based on preliminary amounts.

10-5 Project Record Keeping and Documentation Reviews

The Regional Documentation Engineer makes reviews of record keeping and documentation procedures during the progress of the work to ensure that the original field

records are being properly prepared and proper procedures are being carried out. If proper procedures and records are maintained throughout the life of the project, documentation of the payment to the Contractor will be adequate and preparation of the final records should require a minimum amount of time at the completion of the project. The Regional Documentation Engineer reviews both specific pay items, according to Chapter 10-3.16, and procedural items. Reviews of specific pay items are recorded on Forms 421-014 and 421-015. Reviews of procedural items are recorded on either Form 230-036A or Form 230-036B. Version A is to be used for the first review made on a project. Version B has been modified to place more emphasis on individual pay items and is to be used for the second review on larger projects where this emphasis is more appropriate.

On projects which are estimated to cost more than $150,000, the Regional Documentation Engineer shall conduct a review when the project is about 50 percent complete. This review should be thorough and complete to ensure that records are adequate and being properly maintained. This review includes both procedural checks for those items listed on Form 230-036A and numerical checks on specific pay items. Audit work on pay items may be started at this time in preparation for final records checking, particularly on work items that are completed. Form 421-014 completed for any pay items during this review should be kept until the final record check and then filed with the temporary final records.

On projects which require more than 60 working days to construct or projects which are estimated to cost more than $500,000, a documentation review should be considered as early as 30 percent completion but no later than 50 percent completion. On these larger projects it is important that adequate documentation procedures be verified before inadequate procedures become difficult to correct. However, on some projects the nature of the work completed at 30 percent may not provide an adequate representation of the documentation procedure to merit a documentation review.

Each Regional Documentation Engineer must make a conscious decision to perform any documentation reviews in addition to the reviews described above. This is especially true when projects are estimated to cost over $500,000 or will require more than 60 working days to complete. In addition to cost and time, other criteria used to evaluate the need for additional documentation reviews should include any results of previous documentation reviews as well as the history, knowledge, and experience of the specific project office personnel involved. Each Regional Documentation Engineer must be satisfied on an individual case basis that each project's records are adequate and being properly maintained.

Every time a documentation review is performed on a project, the Regional Documentation Engineer will discuss the results of the review with the project office staff and leave a copy of the completed Form 230-036 for the project records.

10-6 Phased Records

Listed below, with their appropriate chapter reference, are various reports which are required at the completion of certain phases of work. Please note that the completion of the particular phase of work does not necessarily correspond to completion of the project. In order for these reports to be effective, they must be received in a timely manner.

Prime Contractor Performance Report DOT 421-010. See Chapter 1-2.8H.

Pit Evaluation Report, Form 350-023. See Chapter 3-1.6A.

Department of Natural Resources Forms SM-3 and SM-7. See Chapter 3-3.3.

10:DP:CM

Washington State Department of Transportation

Item Quantity Ticket

DATE 1-17-95	STATION 27+860 KILOMETER GROUP 1
REMARKS Legal Gross 23,587 kg From PS-201-48	
TIME RECEIVED 12:34 ☐ A.M. ☑ P.M.	TIME WEIGHED 11:47 ☑ A.M. ☐ P.M.
RECEIVED BY BA	WEIGHED BY DKS
CHECK ONE ☐ TONNES ☐ HOURS ☑ KG ☐ LITERS ☐ M^3 ☐ EACH	TRUCK NUMBER 32
	GROSS 16,850
	TARE 7,550
OTHER UNIT OF MEASURE ☐	NET 9,300

ITEM IDENTIFICATION	
ITEM NO.	CONTRACT NO.
CONTRACTOR	CONTRACT 4711
SUBCONTRACTOR	ACE CONSTRUCTION CO
	ITEM NO. 36
ITEM DESCRIPTION	GRAVEL BACKFILL FOR DRAINS

GRAVEL BASE	BALLAST	CRUSHED BASE	SURFACING TOP
☐	☐	☐	☐

A.T.B.	C.T.B.	WATER	TOP SOIL	A.C. CLASS
☐	☐	☐	☐	☐

OTHER (SPECIFY) ☑	No.

DOT Form 422-021 Metric 9/95 ORIGINAL

Figure 10-1

Washington State Department of Transportation

Daily Report of Force Account Worked

Contract Number	Date	Item Number	Item Name
3711	1/12/95	156	Slide Repair

Prime Contractor	Subcontractor / Lower Tier Subcontractor
Ace Construction Co.	Acme Brothers, Inc.

Line / Station	Group	Basis of Material Acceptance	RAMS Number
27+656	3	Test, Manufacturer's Cert.	3650, 3666

Description of Work Performed

Place rock for slope protection, laying 150 mm drain pipe

Time Worked Record

	Code or Craft Group	Workman and/or Equipment Working	Occupation of Workman or Equipment Size	Hours Worked Reg.	Hours Worked O.T.	Rate	Amount
1		Labor:					
2	350-1215	Tim Craig	Pipelayer	8.0		19.49	151.00
3	570-1201	Wayne Hagerty	Dozer Operator	8.0		22.80	182.00
4	730-0310	Bob Morris	Truck Driver	8.0		20.98	168.00
5		Add Med. Aid, Indust. Ins, Supp. Pension		24.0		0.61	15.00
6			Labor Subtotal				516.00
7							
8		Equipment:					
9		Crawler Dozer, Case 450C		8.0		22.20	178.00
10		Hydraulic Excavator, Deere 190E		8.0		27.90	223.00
11		Truick, Belly Dump, Mack R-600 #25		8.0		38.80	310.00
12			Equiipment Subtotal				709.00
13							
14		Material:					
15		Rock, 122 tonnes @ $3.60/tonne					439.00
16		150 mm drain pipe, 40 m @ $5.00/m	Invoice attached				200.00
17			Material Subtotal				639.00
18							
19			Subtotal				1,864.00
20							
21		Add 20% of Labor for O.H. & Profit					103.00
22		Add 15% of Equip. for O.H. & Profit					106.00
23		Add 15% of Material for O.H. & Profit					96.00
24							
25			Subtotal				2,169.00
26							
27		Add 5% for Sub-Contr. Ins, tax & bonding					108.00
28			Subtotal				2,277.00
29							
30		Add 5% for Prime Contr. Admin. costs					114.00
31			Subtotal				2,391.00
32							
33		Add 5% for Prime Contr. Ins., tax, & bond					120.00
34							
35			Total				2,511.00
36							
37							
38							
39							

Calculated By	Date	Checked By	Date	Total
CBK	9-8-95	DS	9-8-95	2,511.00

CAPS Entry Number	Entered By	Date	Entry Verified	Date
1134	BJ	9-9-95	DS	9-10-95

Inspector	Contractor's Representative	Title
John Doe	John Goodfellow	Supt.

DOT Form 422-008 EF
Revised 3/95

Figure 10-2

Washington State Department of Transportation **FIELD NOTE RECORD**

BOOK NO. _____ PAGE NO. _____

CONTRACT NO.	STATION	LINE	C/S
4747	See detail	L Line	2316

STAKED BY / MEASURED BY	DATE	WORK STARTED	WORK COMPLETED
H Lewis	2-12-95	2-5-95	2-9-95

CALCULATED BY	DATE	CHECKED BY	DATE	INSPECTOR'S SIGNATURE	DATE
HL	2-14-95	CB	2-15-95	John Smith	2-9-95

Crew: Lewis M, Barnes, Toms
Weather: Clear, cool

Clearing & Grubbing

Group 1 Total 21 172 m^2 From reverse side

= 2.12 hectares

Group 2 Total 14 609 From page 4

= 1.46 hectares

Project Total = 3.58 hectares

ITEM NO.	ITEM	GROUP NO.	DATE	UNIT	QUANTITY	RAMS NO.	BASIS OF MATERIAL ACCEPTANCE	CAPS ENTRY NO.	INTIALS POST	INTIALS CK	EST. NO.
2	clearing & Grub.	1	2/9/95	hectare	2.12	—	—	7	DS 4/16	CR 4/20	1
2	clearing & Grub.	2	2/9/95	hectare	1.46	—	—	8	DS 4/16	CR 4/20	1

DOT Form 422-635 (Front)
Revised 9/95

Figure 10-3

CONTRACT NO. 4747

STATION	LEFT	RIGHT	LENGTH OR WIDTH	AREA m^2	REMARKS
Group 1,	Begin	Clearing			
57+400		8-15			
57+420		8-15	7	140	
57+440		10-15	6	120	
57+460	0	10-15	5	100	
57+480	18-10	12-15	8	160	
57+500	18-3	0	13	260	
57+520	18-1		16	320	
57+540	18-0	0-7	21	420	
57+560	21	7	26.5	530	
57+580	24	7	29.5	590	
57+600	24	7	31		
57+620	24				
57+640				590	
		7	29.5	590	
	21	10	31	620	
61+000	18	7.5	28.25	565	
61+020	18	7.5	25.5	510	
61+040	18	5.5	24.5	490	
61+060	18.5	5.5	23.75	475	
61+080	17.5	5	23.25	465	
61+100	17.5	5.5	22.75	455	
61+120	17.5	5.5	23	460	
61+140	17	5	22.5	450	Group 1 End Clearing
			PAGE TOTAL	21 172	

DOT Form 422-635 (Back) Revised 9/95

Figure 10-4

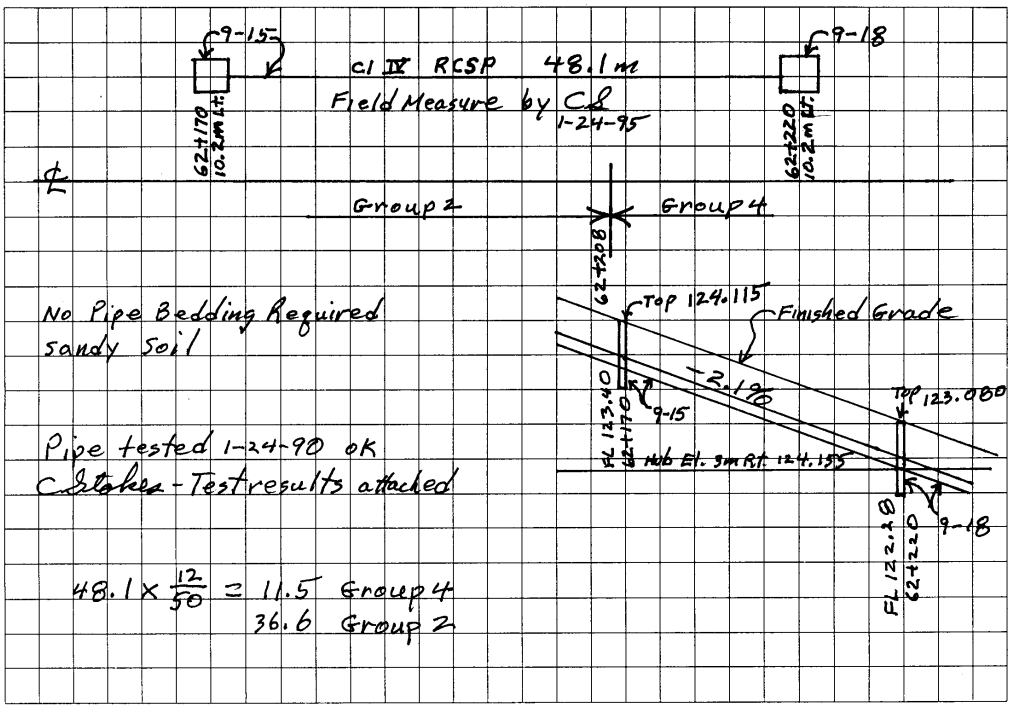
Washington State Department of Transportation — **FIELD NOTE RECORD FOR DRAINAGE**

BOOK NO. _____ PAGE NO. _____

CONTRACT NO.	STATION	LINE	C/S	CODE NO.
4747	62+170 to 62+220	L Line	1701	9-15

STAKED BY	DATE	WORK STARTED	WORK COMPLETED
T. Roberts	1-12-95	1-16-95	1-24-95

CALCULATED BY	DATE	CHECKED BY	DATE	INSPECTOR'S SIGNATURE	DATE
TMC	1-26-95	DCM	1-30-95	C. Stokes	1-24-95



ITEM NO.	ITEM	GROUP NO.	DATE	UNIT	QUANTITY	RAMS NO.	BASIS OF MATERIAL ACCEPTANCE	CAPS ENTRY NO.	INTIALS POST	INTIALS CK	EST. NO.
7	Str. Exc. Cl. B	2	1/18/95	m^3	17.6	—	—	53	DS 1/19	CR 1/20	1
7	" " " "	4	1/18/95	m^3	6.7	—	—	54	DS 1/19	CR 1/20	1
24	Cl. IV RCSP 300 mm	2	1/24/95	m	36.6	4063	Tag A123456	76	DS 1/25	CR 1/26	1
24	" " " "	4	1/24/95	m	11.5	4063	Tag A123456	77	DS 1/25	CR 1/26	1
25	Testing Sewer Pipe	2	1/24/95	m	36.6	—	—	78	DS 1/25	CR 1/26	1
25	" " "	4	1/24/95	m	11.5	—	—	79	DS 1/25	CR 1/26	1
26	C.B. Type 1	2	1/24/95	Each	1	4063	Tag A123456	80	DS 1/25	CR 1/26	1

DOT Form 422-637 (Front)
Revised 9/95

Figure 10-5

BOOK NO. _____ PAGE NO. _____

STRUCTURE EXCAVATION

(PIPE STRUCTURE EXCAVATION WIDTH = 1 m)

STATION	FLOW LINE GRADE	ORIGINAL GROUND	SUB-GRADE	CENTERLINE CUT FLOW LINE	CENTERLINE CUT BOTTOM DITCH	OFFSET HUB (RK 1.8m Rt)	OFFSET CUT-F.L.	REMARKS
CB9-18								
0+000	122.28	123.02		C-0.74		122.97	C-0.69	
0+000.7	122.29	123.02		C-0.73				Begin Str. Exc.
0+010	122.53	122.96		C-0.43				
0+020	122.80	123.14		C-0.34		123.51	C-0.71	
0+030	123.00	123.38		C-0.38				
0+040	123.33	123.60		C-0.27		124.05	C-0.72	
0+049.3	123.38	123.81		C-0.43				End Str. Exc.
0+050	123.40	123.81		C-0.41		124.21	C-0.81	
CB9-15								

0.05m added for pipe thickness

REMARKS Str. Exc.

												m^3	
GRP 4	0+000.7	C-0.74	0.64	X	9.3	X	1	=	5.95				
	0+010	C-0.43	0.48	X	1.5	X	1	=	0.72				
	0+011.5	C-0.42	0.43	X	8.5	X	1	=	3.66				6.7 Group 4
GRP 2	0+020	C-0.34	0.41	X	10	X	1	=	4.10				
	0+030	C-0.38	0.38	X	10	X	1	=	3.80				
	0+040	C-0.27	0.40	X	9.3	X	1	=	3.72				
	0+049.3	C-0.43							15.3 Group 2				

CB 0.85 X 0.91 X 0.61

1.46 X 1.52 X 1.04 = 2.3 m^3

6.7
15.3
2.3
24.3 m^3 Total Str. Exc.

Pay 6.7 m^3 Grp 4
17.6 m^3 Grp. 2

DOT Form 422-637 (Back) Revised 9/95

Figure 10-6

11-1 Introduction

This chapter of the manual is published to acquaint engineers and inspectors with the various forms provided by WSDOT for their use in keeping records of the construction activities and payment for the various phases of the work.

The following pages contain a list of forms to be used in reporting project progress. An attempt has been made to include samples of the forms listed in this manual.

No attempt has been made to include the number of copies of the forms to be made for each distribution. Normally, distribution of copies will be as indicated on the form.

Although this chapter only includes the metric version of a form, both English and metric versions are available.

11-2 General Instructions

The following list of forms is categorized under the responsible persons or offices which are engaged in the administration of construction contracts.

When a form is revised, the previous version (except those indicated by an asterisk) may be used until the existing supply is gone. If the supply of the older form is not exhausted at the end of six months after the revision date shown below, the supply of old forms should be discarded and the latest version used. The latest version may be used immediately if desired.

Blank forms should be ordered when supplies run low rather than photocopying an existing form. Blank forms should be photocopied only for emergency use. This will help ensure that the latest version of the form is used.

Form numbers followed by the letters “EF” indicate that an electronic version of the form is also available.

*** Indicates only forms with the revised date shown are to be used. All older forms will be discarded.**

11-2A Project Office

Form No.	Revised Date	Form Name	Page
272-051	8/93	M/D/WBE On-Site Review	65
272-054	5/84	Monthly Employment Utilization Report Worksheet	79
272-060A	3/87	Federal-Aid Highway Construction Annual Project Training Report	91
350-009	12/95	Concrete Test Cylinder Transmittal Letter	17

Form No.	Revised Date	Form Name	Page
350-016	2/80	Asphalt Sample Label	18
350-023	8/92	Pit Evaluation Report	1
350-026	12/95	Preliminary Sample Transmittal	17
350-042	12/95	Report of Beam Test	19
350-056	7/87	Sample Transmittal	18
350-073	7/95	Asphalt Concrete Test Section Report	21
350-074	5/95	Field Density Test	22
350-092	12/95	Asphalt Concrete Pavement Compaction Control Report	20
350-100A	1/96	Asphalt Concrete Mix Test Report	23
350-114	11/95	Summary Report of Acceptance, Sampling and Testing	84
350-115 EF	11/94	Contract Materials Checklist	67
350-566 EF	4/96	Yield and Cement Content	45
350-568 EF	4/96	Adjust Concrete Mix Design	46
350-572	2/91	Transmittal of Manufacturer's Certificate of Compliance	26
351-006	5/84	Soil Sample Transmittal Letter	2
351-015	12/95	Daily Compaction Test Report	24
410-025	9/86	Transmittal of Falsework, Form, and Shop Drawings	3
410-027	12/95	Test Pile Record	7
420-012 EF	8/92	Recommended Changes to Specifications and Construction Manual	4
421-006 EF	8/92	Order to Suspend Work	86
421-007 EF	8/92	Order to Resume Work	87
421-010 EF	**3/93 ***	**Prime Contractor Performance Report**	9-10
421-026	5/95	Asphalt Concrete Pavement Random Sample Worksheet	92
422-004 EF	**12/92 ***	**Inspector's Daily Report**	56
422-004A EF	**12/92 ***	**Inspector's Daily Report**	57
422-004B EF	**4/96 ***	**Inspector's Daily Report**	58
422-008 EF	**10/94 ***	**Daily Report of Force Account Worked**	27
422-009 EF	3/79	Final Record Notes Title Page	11

Form No.	Revised Date	Form Name	Page
422-009B EF	6/81	Final Record Notes Title Page	12
422-010 EF	**1/95 ***	**Force Account Equipment Rate Request**	15
422-012	2/82	Title Sticker — Final Record Books	14
422-018	11/77	Final Record Notes — Plain	13
422-020	5/95	Inspector's Record of Field Test	28
422-021	9/95	Item Quantity Ticket	29
422-024	7/95	Water Delivery Record	29
422-027	5/84	Scaleman's Daily Report	30-31
422-568	5/95	Load Tally Sheet	25
422-635	9/95	Field Note Record	32-33
422-636	9/95	Field Note Record (Sketch Grid)	34-35
422-637	9/95	Field Note Record for Drainage	36-37
422-644	**12/95 ***	**Daily Report of BST Operations**	38
424-003	8/92	Employee Interview Report	16
450-001	1/96	Manufacturer's Certificate of Compliance for Ready Mix Concrete	40
450-004	12/95	Pile Book	63
540-020 EF	12/95	Backflow Report	8
750-001	10/95	Fall Protection Plan	5-6

11-2B Regional Office

Form No.	Revised Date	Form Name	Page
230-036A	1/92	Initial Documentation Review (Procedures)	47
230-036B	1/92	Follow-Up Documentation Review	48
272-061	5/87	Federal-Aid Highway Construction Cumulative Training Report	90
410-001	8/78	Verbal Approval	42
420-012 EF	8/92	Recommended Changes to Specifications and Construction Manual	4
421-014	2/90	Examination Sheet for Contract Items	43
421-015	2/78	Recapitulation of Final Contract Examination	44
422-100	10/94	Inspection of Federal-Aid Project	61
FHWA-1392	3/92	Federal-Aid Highway Construction Summary of Employment Data	49-50

11-2C Fabrication Inspector

Form No.	Revised Date	Form Name	Page
350-004	1/96	Fabrication Progress Report	51
350-021	4/96	Approved for Shipment Tag	52
350-086	9/95	Prestress Pile Record	53
450-002	12/95	Prestressed Concrete Girder Report	54
450-005	9/95	Post-Tensioning Record	55

11-2D Olympia Service Center

Form No.	Revised Date	Form Name	Page
410-001	8/78	Verbal Approval	42
422-101	10/94	Final Inspection of Federal-Aid Interstate Project	62
FHWA-1392	3/79	Federal-Aid Highway Construction Summary of Employment Data	49-50

11-2E Materials Laboratory (Olympia Service Center or Region)

Form No.	Revised Date	Form Name	Page
350-054	8/92	Monthly Progress Sampling and Inspection Report	64
350-112	9/90	Correlation — Nuclear Gauge to Core Density	39
350-564	1/96	Gradation Chart	68
351-003	12/95	Log of Test Borings	69-70

11-2F Contractor

Form No.	Revised Date	Form Name	Page
134-146 EF	1/95	Final Contract Voucher Certificate	71
272-049	5/90	Training Program	88
272-050	5/90	Apprentice/Trainee Approval Request	89
350-040	4/96	Proposed Mix Design	66
350-071	**8/92 ***	**Request for Approval of Materials Source**	72
350-109	8/92	Certification of Materials Origin	85
410-029	8/92	Contractor's Construction Process Evaluation	59-60
420-004	**10/94 ***	**Contractor and Subcontractor or Lower-Tier Subcontractor Certification for Federal-Aid Projects**	73

Form No.	Revised Date	Form Name	Page
421-009	2/88	Release — Retained Percentage (Except Landscaping)	74
421-012	**4/94 ***	**Request to Sublet Work**	75
421-023	10/94	Affidavit of Amounts Paid DBE/MBE/WBE Participants	80
421-025 EF	11/94	Public Liability and Property Damage Insurance Certification	93
421-040A	2/94	Contractor's Daily Report of Traffic Control - Summary	76
421-040B	10/95	Contractor's Daily Report of Traffic Control - Traffic Control Log	77
421-506	9/87	Contract Progress Schedule	78
540-509 EF	3/96	Commercial Pesticide Application Record	41
FHWA-1391	3/92	Federal-Aid Highway Construction Contractors' Annual EEO Report	81
FHWA-47	**6/90 ***	**Statement of Materials and Labor Used by Contractors on Highway Construction Involving Federal Funds**	82-83

Alphabetical Listing of Forms

Form No.	Form Name	Page
350-568	Adjust Concrete Mix Design	46
421-023	Affidavit of Amounts Paid DBE/MBE/WBE Participants	80
272-050	Apprentice/Trainee Approval Request	89
350-021	Approved for Shipment Tag	52
350-092	Asphalt Concrete Pavement Compaction Control Report	20
350-100A	Asphlat Concrete Mix Test Report	23
421-026	Asphalt Concrete Pavement Random Sample Worksheet	92
350-073	Asphalt Concrete Test Section Report	21
350-016	Asphalt Sample Label	18
540-020	Backflow Device Test Report	8
350-109	Certification of Materials Origin	85
540-509	Commercial Pesticide Application Record	41
350-009	Concrete Test Cylinder Transmittal Letter	17
350-115	Contract Materials Checklist	67
421-506	Contract Progress Schedule	78

Form No.	Form Name	Page
420-004	Contractor and Subcontractor or Lower-Tier Subcontractor Certification for Federal-Aid Projects	73
410-029	Contractor's Construction Process Evaluation	59-60
421-040A	Contractor's Daily Report of Traffic Control - Summary	76
421-040B	Contractor's Daily Report of Traffic Control - Traffic Control Log	77
350-112	Correlation — Nuclear Gauge to Core Density	39
351-015	Daily Compaction Test Report	24
422-008	Daily Report of Force Account Worked	27
422-644	Daily Report of BST Operations	38
424-003	Employee Interview Report	16
421-014	Examination Sheet for Contract Items	44
350-004	Fabrication Progress Report	51
750-001	Fall Protection Plan	5-6
272-060A	Federal-Aid Highway Construction Annual Project Training Report	91
FHWA-1391	Federal-Aid Highway Construction Contractors' Annual EEO Report	81
272-061	Federal-Aid Highway Construction Cumulative Training Report	90
FHWA-1392	Federal-Aid Highway Construction Summary of Employment Data	49-50
350-074	Field Density Test	22
422-635	Field Note Record	32-33
422-637	Field Note Record for Drainage	36-37
422-636	Field Note Record (Sketch Grid)	34-35
422-101	Final Acceptance of Federal-Aid Interstate Project	62
134-146	Final Contract Voucher Certificate	71
422-018	Final Record Notes — Plain	13
422-009	Final Record Notes Title Page	11
422-009B	Final Record Notes Title Page	12
230-036B	Follow-Up Documentation Review	48
422-010	Force Account Equipment Rate Request	15
350-564	Gradation Chart	68

Form No.	Form Name	Page
230-036A	Initial Documentation Review (Procedures)	47
422-100	Inspection of Federal-Aid Project	61
422-004	Inspector's Daily Report	56
422-004A	Inspector's Daily Report	57
422-004B	Inspector's Daily Report	58
422-020	Inspector's Record of Field Test	28
422-021	Item Quantity Ticket	29
422-568	Load Tally Sheet	25
351-003	Log of Test Borings	69-70
272-051	M/D/WBE On-Site Review	65
450-001	Manufacturer's Certificate of Compliance for Ready Mix Concrete	40
272-054	Monthly Employment Utilization Report Worksheet	79
350-054	Monthly Progress Sampling and Inspection Report	64
421-007	Order to Resume Work	87
421-006	Order to Suspend Work	86
450-004	Pile Book	63
350-023	Pit Evaluation Report	1
450-005	Post-Tensioning Record	55
350-026	Preliminary Sample Transmittal	17
350-086	Prestress Pile Record	53
450-002	Prestressed Concrete Girder Report	54
421-010	Prime Contractor Performance Report	9-10
350-040	Proposed Mix Design	66
421-025	Public Liability and Property Damage Insurance Certification	93
421-015	Recapitulation of Final Contract Examination	44
420-012	Recommended Changes to Specifications and Construction Manual	4
421-009	Release — Retained Percentage (Except Landscaping)	74
350-042	Report of Beam Test	19
350-071	Request for Approval of Materials Source	72
421-012	Request to Sublet Work	75
50-056	Sample Transmittal	18

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11A:DP:CM

Washington State Department of Transportation

Pit Evaluation Report

PIT NO.

LOCATION

(Show approximate limits and measurements of actual deposit, property lines, area already worked, etc. Use notes on sketch to clarify.)

SKETCH

PIT OWNED BY

LEASED	FOR HOW LONG?	ROYALTY BASIS	HOW MUCH PER YARD?

DATE LAST WORKED	YDS. REMOVED	CONTRACT NO.

Supplementary data. (Type of material made, quality and uniformity, amount of oversize, difficulties in operation, washing required, any unusual features of pit, etc.)

HAS THE SITE BEEN RECLAIMED?

☐ YES ☐ NO ☐ PARTIAL ☐ COMPLETE

DO RECLAMATION MEASURES CONFORM WITH THE APPROVED RECLAMATION PLAN?

☐ YES ☐ NO IF NO, EXPLAIN

IS FURTHER TESTING REQUIRED BEFORE ESTIMATE CAN BE MADE OF REMAINING QUANTITY?

☐ YES ☐ NO EXPLAIN

ESTIMATED CUBIC YEARS STILL AVAILABLE

REMARKS: (Stripping required, recommendations for future development, additional area required)

BY _____

Project Engineer

NOTE: Any testing information by Soils Engineer should be added with red pencil.

DISTRIBUTION: WHITE – District Operations Engineer
CANARY – District Soils Lab.
PINK – Materials Engineer
GOLDENROD – Project Engineer

DOT 350-023
Revised 8/92 Frame

Washington State
Department of Transportation

SOIL SAMPLE TRANSMITTAL LETTER

DEPARTMENT OF TRANSPORTATION
MATERIALS LABORATORY
1655 SOUTH SECOND
TUMWATER, WA 98504

PLACE
DATE

I HAVE FORWARDED BY TODAYS_____THE FOLLOWING SOIL SAMPLES:

CONTRACT OR JOB NO.	S.R.	SECTION

SAMPLE NO.	STATION AND OFFSET	DEPTH (FROM-TO)	DESCRIPTION	REPRESENTING STATION TO STATION	REMARKS: (Give information regarding proposed use, spec. tests, etc.)

ENGINEER

DISTRIBUTION:
COPY 1 (WHITE) SUBMIT WITH SAMPLES
COPY 2 (CANARY) ADDRESSEE
COPY 3 (PINK) DISTRICT ENGINEER

DOT FORM 351-006 REVISED 5/84 -853- 3

Washington State Department of Transportation

INTRA-DEPARTMENTAL COMMUNICATION

DATE: _____

FROM: PROJECT ENGR. _____

Phone: (SCAN) _____

TO: BRIDGE AND STRUCTURES OFFICE
CONSTRUCTION PLANS ENGINEER

SUBJECT: TRANSMITTAL OF FALSEWORK, FORM, AND SHOP DRAWINGS:
CONTRACT NO. _____

SR NO. _____

CONTRACT TITLE _____

_____

TRANSMITTED HEREWITH FOR REVIEW AND APPROVAL ARE CONTRACT SHOP DRAWINGS AS FOLLOWS:

ITEMS: _____

_____

_____

_____

SUBMITTED BY CONTRACTOR/SUBCONTRACTOR: _____

_____

NOTE: SUPPLIER AND APPROVAL APPLICABLE TO SHOP DRAWINGS ONLY.

MANUFACTURER/SUPPLIER:

_____

_____

APPROVAL OF SOURCE REQUEST: ITEM NO. _____ REQUEST NO. _____

ACTION: APPROVED ☐ PENDING ☐ DATE _____

PROJECT ENGINEER'S REQUIRED REVIEW FOR CONFORMANCE WITH CONTRACT PLANS AND SPECIFICATIONS HAS BEEN MADE AND APPLICABLE ANNOTATIONS MADE IN GREEN.

SIGNATURE: _____
Project Engineer

Distribution: White - Bridge and Structures Office
Canary - Headquarters Materials Office
Pink - District Construction Engineer
Goldenrod - Project Engineer

DOT Form 410-025
Revised 9/86

Washington State Department of Transportation

Recommended Changes to Specifications and Construction Manual

To: Specifications Engineer
Construction Office
Olympia, WA 7354

From: _____
(Dist. or Division)

Proposed by: _____
(name) (job title) (date)

Recommended Changes To:

_____ Standard Specifications — Section _____ Page _____

_____ General Special Provisions — Number _____

_____ Construction Manual — Chapter _____ Page _____

Recommended Change:

Reasons for Recommendation

_____
Operations Engineer or Supervisor of Division

DOT 420-012
Revised 8/92

Submit Original to Headquarters

Washington State Department of Transportation

Fall Protection Plan

DATE	LOCATION	SUPERVISOR

DESCRIPTION OF WORK

Recognized Fall Hazards

- ❑ Ladders
- ❑ Forming
- ❑ Catwalks
- ❑ Sloped Access
- ❑ Work over Water
- ❑ Scaffold
- ❑ Pouring
- ❑ Welding at Height
- ❑ Set Girders
- ❑ Leading Edge
- ❑ Bridge Decks
- ❑ Excavations
- ❑ Drilling Shafts
- ❑ Connect Girders
- ❑ Perimeter Edge, Stairwell, Roof, Window Openinn
- ❑ Work Decks
- ❑ Walkways / Ramps
- ❑ Stressing
- ❑ Tieback Strands

Personnel Hoisting

- ❑ Crane
- ❑ Boom Truck
- ❑ Forklift
- ❑ Other _____

Method of Protection

Fall Restraint

Type of Harness _____

Type of Lanyard _____

Anchorage _____

Control Zones / Warning Lines and Monitor _____

Guardrail ❑ Yes ❑ No

Nets ❑ Yes ❑ No

Other _____

Fall Arrest

Type of Harness _____

Type of Lanyard _____

Type of Life Line _____

Anchorage _____

Deceleration Device ❑ Yes ❑ No

Other Type of Equipment Used _____

Overhead Protection

Hard Hats ❑

89 mm Toe Boards ❑

Warning Signs ❑

Debris Nets ❑

Other ❑ _____ Describe

Tool Handling, Storage, and Securing

89 mm Toe Boards ❑

Debris Nets ❑

Tool Buckets ❑

Tool Belts ❑

Other ❑ _____ Describe

Procedure for Assembly, Maintenance, Inspection, and Disassembly of System

Assembly, disassembly, and maintenance of all equipment will be done according to manufacturer's recommended procedures. A visual inspection of all safety equipment will be done daily or before each use. Any defective equipment will be tagged and removed from service immediately.

DOT Form 750-001 Metric (front) 10/95

A COPY OF THIS WORK PLAN MUST BE ON JOB SITE

Emergency Action Plan

First Aid / CPR

NAMES OF TRAINED PERSONNEL ON SITE

LOCATION OF FIRST AID EQUIPMENT

Initiate Emergency Services (call or radio 911 if available)

LOCATION OF PHONE	PHONE NO. OF SHERIFF	PHONE NO. OF EMERG. RESP. TEAM

DESCRIBE PROCEDURE FOR REMOVAL OF INJURED EMPLOYEE (NOTE: no removal will be attempted without supervision of qualified emergency rescue personnel)

Crane ❑ Yes ❑ No _____ Location

Hoist ❑ Yes ❑ No _____ Location

Winch ❑ Yes ❑ No _____ Location

Block / Tackle ❑ Yes ❑ No _____ Location

Other (describe)

Plan Reviewed at Job Site ❑ Yes ❑ No

Employee Signature	Employee Signature
Employee Signature	Employee Signature

DOT 750-001 (back)
Revised 1/92

Washington State Department of Transportation

Test Pile Record

Project	Contract
Structure	Date Driven

Specification:
Bearing Newtons, Min Tip Elev. m

Pile:
Type , Size mm, Length m

Location:
Pier Sta. , Offset m L/R

Elevation:
Cutoff m, Ground m, Final Tip m

Pile Hammer:
Type , Make

Ram Wt. kg, Stroke m, Rated Energy Min. N•m, Max N•m

Pile Tip:
Type

Bearing Formula Used: (*check one*)

☐ $P = \frac{1.63\ MH}{S + 25.4}$ ☐ $P = \frac{1.63\ MH}{S + 2.54}$ ☐ $P = \frac{(9.81\ M + .001Ap)H}{6(S + 2.54)}$

Remarks

Tip Elev.	*	Blows/300 mm	Bearing Newtons	Tip Elev.	*	Blows/300 mm	Bearing Newtons

Project Engineer

Inspector

***Gage pressure or blows/minute as appropriate.**

DOT Form 410-027 Metric
Revised 12/95

Distribution: White — OSC Construction/Records Control
Pink — OSC Materials Lab
Green — Region
Goldenrod — Project Engineer

Washington State Department of Transportation

Backflow Prevention Assembly Test Report

Name of Premises

Service Address

Location of Assembly

Manufacturer | Model | Size | Serial Number

Type of Assembly
☐ RPBA ☐ DCVA ☐ PVB

Line Pressure at Time of Test

	Check Valve No. 1	Check Valve No. 2	Differential Pressure Relief Valve	Pressure Vacuum Breaker
Initial Test	☐ Held At _____ Press. ☐ Leaked ☐ Closed Tight	☐ Leaked ☐ Closed Tight	☐ Opened At _____ Reduced Pressure ☐ Did Not Open	☐ Air Inlet Opened At _____ Press. ☐ Did Not Open
Repairs	☐ Cleaned Replaced: ☐ Disc ☐ Spring ☐ Guide ☐ Pin Retainer ☐ Hinge Pin ☐ Seat ☐ Diaphragm ☐ Other, Describe	☐ Cleaned Replaced: ☐ Disc ☐ Spring ☐ Guide ☐ Pin Retainer ☐ Hinge Pin ☐ Seat ☐ Diaphragm ☐ Other, Describe	☐ Cleaned Replaced: ☐ Disc, Upper ☐ Disc, Lower ☐ Spring Diaphragm, Large ☐ Upper ☐ Lower Diaphragm, Small ☐ Upper ☐ Lower ☐ Spacer, Lower ☐ Other, Describe	☐ Check Valve Held At _____ Press. ☐ Leaked ☐ Cleaned Replaced: Air Inlet ☐ Disc ☐ CHeck Disc Air Inlet ☐ Spring ☐ Check Spring ☐ Other, Describe
Final Test	RP _____ Press. ☐ Closed Tight	☐ Closed Tight	Opened At _____ Reduced Pressure	Air _____ Press. Check Valve _____ Press.

Remarks

The Above Report is Certified to Be True

Initial Test Performed By	Organization	Certificate Number	Date
Repaired By			Date
Final Test Performed By	Organization	Certificate Number	Date

DOT Form 540-020 EF
Revised 12/95

Distribution: Originator, Project Engineer, Water Purveyor, O.S.C. Maintenance & Operations Roadside

Washington State Department of Transportation

Prime Contractor Performance Report

Section I Contractor Data

Report type ❒ Interim ❒ Final ❒ Special	Contractor no. (HQ use only)
Company Name	
Address	Phone no.
Superintendent	Foreman

Section II Project Data

District	Contract no. / FA no.	County	SR
Project title			
Authorized working days	Working days charged	Work starting date	Completion date
Contract award amount		Contract completion amount	

Work class performed by contractor:

Description of work:

Section III Numerical Rating

A ADMINISTRATION / MANAGEMENT / SUPERVISION	*Inadequate.	*Below Standard	Standard	Above Standard	*Superior	Rating
1 Supervision and decision making	2	3.8	4.5	5.6	6.4	
2 Coordination and communication with subcontractors and suppliers	2	2.2	3.2	4.2	4.8	
3 Submission of documents and reports	1	1.8	2.7	3.5	4.0	
4 Adequacy and timeliness of progress schedules	1	1.8	2.7	3.5	4.0	
5 Public safety and traffic control	2	2.2	3.2	4.4	4.8	
6 Compliance with laws, ordinances and regulations	1	1.2	1.9	2.5	3.0	
7 Maintenance of employee safety standards	1	1.2	1.9	2.5	3.0	
8 Coordination and cooperation with department personnel on project matters	1	1.2	1.9	2.5	3.0	
9 Compliance with EEO, affirmative action requirements and MBE/DBE/WBE requirements	1	1.2	1.9	2.5	3.0	
10 Public relations with the general public, other agencies and adjacent contractors	1	1.4	2.1	2.8	3.0	
Total	13	18	26	34	39	
Q QUALITY OF WORK						
1 Adherence to plans and specifications	10	14.0	20	26	30	
2 Standards of workmanship	8	11.5	16	21	24	
3 Completion of final (punch list) work	2	2.5	4	5	6	
Total	20	28	40	52	60	
P PROGRESS OF WORK						
1 Completion of project within allotted time	9	12.5	18.0	23.5	27.0	
2 Scheduling and execution of schedule	3	4.6	6.6	8.6	9.9	
3 Delivery of materials and supplies	1	1.3	1.8	2.3	2.7	
4 Operation and use of equipment	1	1.3	1.8	2.3	2.7	
5 Use of personnel	1	1.3	1.8	2.3	2.7	
Total	15	21	30	39	45	
E EQUIPMENT						
1 Condition	1	1.5	2.0	2.5	3.0	
2 Maintenance	1	1.5	2.0	2.5	3.0	
Total	2	3	4	5	6	
Grand Total (A+Q+P+E) (Performance Rating)	50	70	100	130	150	
RANGE	(50–69)	(70–99.9)	(100)	(100.1–130)	(130.1–150)	

* Explain any inadequate, below standard, and superior ratings in narrative section.

PERFORMANCE SCORE **HQ use only**

DOT 421-010X Pg 1 of 2
Revised 3/93

DISTRIBUTION: White — Precontract Administration; Canary — District Administrator; Goldenrod — Project Engineer; Pink — Contractor

Contract No. _____

SECTION IV NARRATIVE RATING

A GENERAL ELEMENTS Enter comments which generally describe the contractor's overall performance and provide background data on the project.

B BELOW STANDARD ELEMENTS Enter comments here to substantiate below standard ratings. (See instructions)

C SUPERIOR ELEMENTS Enter comments here to substantiate superior ratings. (See instructions)

SECTION V AUTHENTICATION AND REVIEW

I certify that I have objectively prepared this report basing it upon data contained in available project records and discussed the report with the contractor.

PROJECT ENGINEER DATE

I have reviewed this report for objectivity and accuracy. I have given a copy of this report to the rated contractor and I have advised the contractor that any appeal must be made within 20 calendar days.

DATE COPY GIVEN/MAILED TO CONTRACTOR OPERATIONS ENGINEER OR DESIGNEE DATE

I have reviewed this Contractor Performance Report and make the following comments and changes as cited herein or on attached sheets. _____

DISTRICT ADMINISTRATOR DATE

DOT 421-010X Pg 2 of 2
Revised 3/93

DISTRIBUTION: White — Precontract Admin. Canary — District Administrator Goldenrod — Project Engineer Pink — Contractor

DEPARTMENT OF TRANSPORTATION

Olympia, Washington

FINAL RECORD NOTES

BOOK NO.

CONTRACT NO. ..... FEDERAL AID NO. .....

SR NO. .....

COUNTY .....

SECTION .....

NATURE OF IMPROVEMENT .....
Grading, Paving, Graveling, Bridge

STATION ..... TO STATION .....

LENGTH .....

CONTRACTOR .....

WORK BEGUN .....

WORK COMPLETED .....

PROJECT ENGINEER .....

DISTRICT ADMINISTRATOR .....

CHECKED AND
APPROVED: .....
District Administrator

DOT FORM 422-009
REVISED 3/79

DEPARTMENT OF TRANSPORTATION

Olympia, Washington

FINAL RECORD NOTES

BOOK NO.

CONTRACT NO. ..... FEDERAL AID NO. .....

SR NO. .....

COUNTY .....

SECTION .....

NATURE OF IMPROVEMENT .....
Grading, Paving, Graveling, Bridge

STATION ..... TO STATION .....

LENGTH .....

CONTRACTOR .....

WORK BEGUN .....

WORK COMPLETED .....

PROJECT ENGINEER .....

DISTRICT ADMINISTRATOR .....

CHECKED AND
APPROVED: .....
District Administrator

DOT FORM 422-009B
REVISED 6/81

DOT Form 422-018
Revised 11/77

STATE HIGHWAY NO.....

CONTRACT NO.....

SHEET NO.....

Washington State Department of Transportation

FINAL RECORD NOTES

BOOK NO. **OF** **BOOKS**

CONTRACT NO.

SR NO.	FED. AID NO.

COUNTY

SECTION

NATURE OF IMPROVEMENT (Grading, Surfacing, Paving, Bridge)

TYPE OF NOTES (Transit, Level, Cross Section, Drainage, etc.)

Station to Station

CONTRACTOR

WORK BEGUN	WORK COMPLETED

PROJECT ENGINEER

DISTRICT ENGINEER

DOT FORM 422-012 REVISED 2/82

INDEX ON NEXT PAGE

Washington State Department of Transportation

Force Account Equipment Rate Request

Description			Rental Rate Blue Book								Hourly Rate	
Equipment Type	Manufacturer	Model/Capacity	Code	Sect	Page	Monthly Rate	Rate Adjust. Factor	Region Factor	Adjust. Monthly Rate/Hr	Oper. Cost/Hr	Working Rate	Standby Rate

$$\frac{\text{Monthly Rate X Adjust. Factor X Region Factor}}{176} = \text{Adjusted Monthly Rate/Hr.}$$

Adjusted Monthly Rate/Hr. + Oper. Cost/Hr. = Working Rate

Adjusted Monthly Rate/Hr. X 0.33 = Standby Rate

Note: When rates are not shown in the Rental Rate Blue Book, the following information must be supplied to establish a Rental Rate.

1. Equipment Type
2. Manufacturer
3. Year Manufactured
4. Model or Capacity
5. Purchase Price*
6. Horsepower
7. Gas or Diesel
8. Contractor (Owner of Equipment)

* Cost is to be shown without sales tax.

Contract _____

Requested By _____ Date _____

Approved By _____ Date _____

DOT Form 422-010 EF
Revised 1/95

Washington State
Department of Transportation

Employee Interview Report
Federal-Aid Interstate Project
Minimum Wage Compliance Survey

CONTRACT NO.	S.R. NO.	F.A.	SECTION
CONTRACTOR			SUB-CONTRACTOR
INTERVIEWER			DATE

EMPLOYEE	CLASSIFICATION CODE	CURRENT DUTIES	HOURLY WAGE RATE			REMARKS (4)
			Stated (1)	Record (2)	Min. (3)	

DISTRIBUTION: Headquarters (1)
District Operations Engineer (1)
Project Engineer (1)

(1) Wage rate claimed by employee.
(2) Wage rate recorded on Contractor's payroll.
(3) Minimum wage rate prescribed by Contract Wage Determination Schedule.
(4) Include reference to supplemental reports, if any.

DOT 424-003
Revised 8/92 Frame

Washington State Department of Transportation
Materials Laboratory
P.O. Box 167
Olympia, WA 98507-0167

Concrete Cylinder Transmittal

Section	Contract	F.A. No.	SR No.
C.S.	Org.No.	Date	Avg. Temp. First 10 Days
Mixing Plant	Place	Cement	Type
Sand Source	Water Gal/100 wt. of Cement		
Gravel Source	Approx. Slump	Cement lb./c.y.	
Air Ent. Adm. Brand	Amount Air Ent. Adm. per 100 wt.	% Air	
Water Reducing Additive Brand	Amount Water Reducer per 100 wt.		

Cyl No.	Location (Pier, Column, Curb, etc.)	Date Made	Test Age Days	Class Conc.	Cert. No.

Curing Procedure Used

Remarks

DOT Form 350-009
Revised 12/95

Project Engineer's Signature | Phone

Washington State Department of Transportation
Materials Laboratory
P.O. Box 167
Olympia, WA 98507-0167

Preliminary Sample Transmittal

Date	Org Number	Contract / Job Number	Pit Number	OSC Lab Number
Preliminary Sample Number	Of	Intended Use		
FA Number	Place	S.R. Number	Section	

Natural Deposit Location (County)
1/4, 1/4, Sec. T. N., R. E. or W.W.M. Access @ Sta. No.

Deposit Type	Avg. Stripping Depth	Avg. Depth Other Stripping	Est. Depth	Known Depth	NW-NW	NE-NW	NW-NE	NE-NE
Estimated Area X	Est. Quantity	This Sample is Considered Truly Representative of			SW-NW	SE-NW	SW-NE	SE-NE
Sample Taken as Follows		Water Available ☐ Yes ☐ No	If Ledge, Will it Shoot ☐ Large ☐ Small		NW-SW	NE-SW	NW-SE	NE-SE
Suitable Plant Site Nearby ☐ Yes ☐ No	Are Other Samples from Same Deposit Included in Shipment ? ☐ Yes ☐ No	Grading Satisfactory for Intended Use ? ☐ Yes ☐ No (Why)			SW-SW	SE-SW	SW-SE	SE-SE
Location of Supplemental Material for Shortage		Other Known Deposits Available ☐ Yes ☐ No	Reference					
Characteristics Not Apparent in Sample		If Worked Previously, When and by Whom ?						
Name and Address of Owner								
Does Sketch Attached Show Relationship to Deposit as a Whole ? ☐ Yes ☐ No	Remarks							

DOT Form 350-026
Revised 12/95

Distribution: White - With Sample
Canary - Project Files

Project Engineer's Signature and Phone Number

Washington State Department of Transportation

ACCEPTANCE/ASSURANCE/INDEPENDENT ASSURANCE
SAMPLE TRANSMITTAL

NO.

MATERIAL			CONTRACT NO		HDQTRS. LAB. NO.
ACCEPTANCE SAMPLE NO.	ASSURANCE SAMPLE NO.	I.A.S. NO.	SR NO.		DIST. LAB. NO.
BRAND	HEAT NO.		SECTION		
I.D. NO./LOT NO.	REEL NO.		COUNTY		CITY/COUNTY/AGENCY CONT. NO.
CERTIFICATE NO.	TRUCK/CAR NO.		CONTRACTOR		
STOCKPILE NO.	PIT NO.		SUBCONTRACTOR		
USED AT STATION	TO STATION		SAMPLED AT	BY	DATE
FIELD ☐ ACCEPT ☐ REJECT	BASED ON FIELD TEST NO.		TESTED AT	BY	DATE
QUANTITY REPRESENTED	PRODUCED ON DATE		ASPHALT CONTENT IN MIX DESIGN	ASPHALT CONTENT REQUESTED AT JOBSITE	

SCREEN										Coarse/ Fine Fracture	S.E.	Dust Ratio	S/S	% Asph.	Max. Density
FIELD															
DIST. LAB.															
SPEC'S.															

REMARKS: Mix Design Desired ☐ Yes ☐ No

DOT FORM 350-056 7/87

DISTRIBUTION: WHITE - With Sample
CANARY - Project Files

Project Engineer
Organization Code
Phone: (SCAN)

DOTFORM 350-016
2/80

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

Certificate No. (Notice of Shipment) . . . . . _____

Asphalt Sample No. . . . . _____

Grade . . . . . _____

Supplier/Brand . . . . . _____

Shipped From . . . . . _____

Shipped To . . . . . _____

Contract Number . . . . . _____

Name of Project _____

Sampled By . . . . . _____

Date Sampled . . . . . _____

Washington State Department of Transportation

Report of Beam Test

Place _____ **Region** _____

Date _____

Contract No. _____ Section _____

F.A. No. _____ S.R. No. _____

Beam No. _____ Modulus of rupture, R _____ N per sq. mm

Designed age _____ days Observed load _____ N

Test age _____ days Corrected load, W _____ N

Sta. No. _____ Span length, L _____ mm

Date made _____ Tested _____ Width, b _____ mm; Depth, d _____ mm

Cement per m^3 _____ kg Average temperature to date of test _____ °C

Cement type, brand _____ Curing first 24 hours _____

Certificate No. _____ Subsequent curing methods _____

Mill Test No. _____

Density _____ kg/m^3

Cement factor _____ kg/m^3

Source of sand _____

Source of gravel _____

Total water in mixture _____
(Includes water in aggregates)

Slump _____

Fracture *(state if unusual collection of large aggregate, unsound aggregate, wood, etc., in plane of fracture; otherwise mark "OK").*

Air-entraining admixture: Yes ❒ No ❒

Brand _____

Quantity per m^3 _____

% by air test _____

Beam was saturated at time of test and was tested with side *(as cast)* in tension unless otherwise noted.

$$\text{Formula } R = \frac{3\,PL}{2Gd^2}$$

Project Engineer _____

Distribution: White — Record Copy, Materials Lab; Green — Materials Copy, Materials Lab; Canary — Memo, OSC Construction; Pink — Memo, Region Engineer; Goldenrod — Memo, Retain-Project Engineer

DOT Form 350-042 Metric
Revised 12/95

Washington State Department of Transportation

ASPHALT CONCRETE PAVEMENT COMPACTION CONTROL REPORT

Region _____ Date _____

Contract No. _____ SR No. _____ Gauge No. _____ Project Engineer _____

Section _____

Sta.	U.L. Dens.	Offset / Depth	Readings	Avg.	Corr. Ga / Corr. UL	% Rice

Sta. _____ to Sta. _____
Control Lot. No. _____ Mass _____
ACP _____ ATB _____ Thick _____
Class B, D, E, F, G
Lane: Lt. or Rt.; EB, WB, NB, SB
Other _____
Leveling _____ Wearing _____
Std. Density Rice Density

Rollers / Passes			

Temp: Laydown _____ Test _____
Air: A.M. _____ P.M. _____
Gauge Correction Factor _____

Remarks

Sta.	U.L. Dens.	Offset / Depth	Readings	Avg.	Corr. Ga / Corr. UL	% Rice

Sta. _____ to Sta. _____
Control Lot. No. _____ Mass _____
ACP _____ ATB _____ Thick _____
Class B, D, E, F, G
Lane: Lt. or Rt.; EB, WB, NB, SB
Other _____
Leveling _____ Wearing _____
Std. Density Rice Density

Rollers / Passes			

Temp: Laydown _____ Test _____
Air: A.M. _____ P.M. _____
Gauge Correction Factor _____

Remarks

Inspector _____ Street Inspector _____ Contractor _____

Roller Code:
SDV – Single Drum Vibratory
DDV – Double Drum Vibratory
P – Pneumatic
TS – Tandem Steel
3WS – 3 Wheel Steel

DOT Form 350-092
Revised 12/95

Distribution: OSC Materials Lab; Project Engineer; Region Materials Lab; Inspector; Contractor

Page _____ of _____ Pages

Washington State
Department of Transportation

Asphalt Concrete Test Section Report

STANDARD DENSITY READINGS

NO.		READINGS	AVERAGE	CORRECTED
1.	0°			
	90°			
2.	0°			
	90°			
3.	IP*			
SUM				
AVG.				

GAUGE CORRECTION FACTOR: _____

REMARKS: _____

RICE _____ Std Den. % of RICE _____

STAND. DENSITY - INITIAL PT. _____

INSP. _____ ST. INSP. _____

Date _____

Gauge _____

PROJECT: _____

_____ CONT. NO.: _____

PROJ. ENGR.: _____ SR. NO.: _____

Weather: _____ Air Temp _____ to _____

ACP _____ ACB _____ Thickness _____

Wearing _____ Leveling _____ Class B, D, E, F, G

Lt. _____ Rt. _____ Lane NB SB EB WB

Other: _____

ROLLERS: Name, Type and Mass

1. _____
2. _____
3. _____
4. _____

CONTROL STRIP APPROX. _____ SQ. METERS

Sta. _____ Sta. _____

Roller												
Gauge Reading												
Time (min.) After Pavt. Laydown												
Temp.												
Roller Passes	1	2	3	4	5	6	7	8	9	10	11	12
DENSITY k/m³												
TEMP. °C												

***IP = Initial Point**

Region Matls. _____
Project Engineer _____

DOT Form 350-073 Metric
Revised 7/95

Washington State Department of Transportation

Field Density Test

Contract Number _____ SR Number _____ Date _____

Section _____ Inspector _____

*** Test Hole Number**			
Sta. to Sta.			
* Test Station			
* Reference to Center Line			
* Reference to Subgrade			
* Material (Silt, Clay, Top Course, etc.)			
Depth of Material (if surfacing)			
Wet Density Determination			
Wet Density kg/cu m 0			
90			
Wet Density kg/cu m Average			
Moisture Determination (Field Test)			
Mass of Tare			
Mass Damp Soil + Tare			
Mass Dry Soil + Tare			
Mass of Moisture			
Mass Dry Soil			
* % Moisture (Field Dried) = Mass of Moisture X 100 / Wt. of Dry Soil			
Gradation Determination (Use Dry Soil from Moisture Determination)			
Mass Retained on 4.75 mm Sieve + Tare			
Mass of Tare			
Mass of Material Retained on 4.75 mm Sieve			
% Retained on 4.75 mm Sieve (% Oversize) = Mass Retained on 4.75 mm Sieve X 100 / Wt. of Dry Soil			
% Passing 4.75 mm Sieve = (100 Minus % Retained)			
Dry Density Determination (Field Test)			
* Dry Density kg/cu m = Mass Density / 1 + (% Moisture / 100)			
Specification Density Determination			
* Maximum Density from appropriate curve kg/cu m			
* Standard, Curve or Lab. No.			
* Corrected Maximum Density from flower pot kg/cm (for non-granular mat. only)			
* Density kg/cu m (% of maximum) = Dry Density X 100 / Maximum Density			
Optimum Moisture Determination			
* Optimum Moisture (from curve)			
* Opt. Moisture Corrected (non-granular mat. only)= Opt. Moisture X % Passing 4.75 mm			

Note: If retest, add letter to number such as 1st test No. 27, retest 27A
***Information is to be transferred to DOT Form 351-015, "Daily Compaction Test Report"**

DOT Form 350-074 Metric
Revised 5/95

Washington State Department of Transportation

Asphalt Concrete Mix Test Report

STATE ROUTE	SECTION	CONTRACT NO.	PAGE OF

JMF	CLASS MIX	SAMPLE NUMBER ACCEPTANCE	SAMPLE NUMBER ASSURANCE	OIL SOURCE	PLANT LOCATION	AGG SOURCE	DATE SAMPLED

TIME	ASPHALT PERCENTAGES % ORDERED	% TOLERANCE LIMIT

TEMP MIX °C	TEMP ASPH °C	% PARTICLE COATING	% CALC. FROM PRODUCTION	% ANTISTRIP

WATER CONTENT

1. Mass Original Sample (Water Content)		3. Mass H_2O (1) – (2)	
2. Mass Dry Sample (Constant @ 110 – 132° C)		4. Percent H_2O $\frac{(3)}{(1)}$ X 100	

EXTRACTION DATA

5. Mass Original Sample		8. Corrected % Asphalt (7) – (4)	
6. Mass Dry Sample $5 - \frac{(5)(4)}{100}$		9. Corrected Mass Asphalt $\frac{(8)(6)}{100}$	
7. % Asphalt from Nuclear Gauge		10. Mass Dry Aggregate (6) – (9)	

AGGREGATE GRADATION

SIEVE	MASS RETAINED *(ACCUMULATIVE)* *	PERCENT RETAINED *(ACCUMULATIVE)* **	PERCENT PASSING	JMF	TOLERANCE LIMITS	% FRACTURE
31.5 mm						
25.0 mm						
16.0 mm						
12.5 mm						
9.5 mm						
6.30 mm						
2.00 mm						
0.425 mm						
0.075 mm						
PAN		NOT USED IN COMPUTING GRADING				
		TOTAL AGGREGATE (From Line 10)				

* Weights to nearest gram.
** Compute to nearest percent except 0.075 mm only to nearest 0.1%

CONTRACTOR	DATE	INSPECTOR	DATE

COMMENTS

DOT Form 350-100A Metric
Revised 1/96

DISTRIBUTION: White – OSC Mats Lab; Canary – Region Mats Lab

Washington State Department of Transportation

Daily Compaction Test Report

Project Engineer _____ Cont. No. _____

Contractor _____ Date _____

Project Name _____ Page _____ of _____

Test No.	Sta. and Ref. to C/L	Ref. to Sub-grade	Type of Material and Use	Moisture Percent			Percent Passing #4 Sieve	Dry Density PCF					Comp. Method	Check One	
				Opt.	Opt. Corrected	Field Test		Max.	Corr.	Std. No.	Field Test	% Max		Sat.	Fail*

Optimum Moisture - Moisture content of No. 4 minus from Proctor curve.
Corrected Moisture - Optimum moisture corrected for oversize = Optimum Moisture Content x Percent Passing No. 4 Sieve
Maximum Dry Density - Density from Proctor curve or Maximum Density for Granular Materials Curve.
Corrected Density - Proctor Maximum Dry Density corrected for oversize.
Standard Number - Laboratory or identifying number of Density Standard used; i.e., Proctor No. or Maximum Density Curve No.
Field Test - Moisture content or density of field sample tested.
Method of Compaction (specified): A, B, C, Rock Embankment (RO), Bridge Approach Embankment (BA).
**Note corrective action under Remarks.*

Summary of Compaction Quantities

Test Nos.	Lift Thick.	Compaction Equipment Used (Number, Weight, and Type of Units)	No. of Coverages Per Lift	Daily Quantities (C.Y. or Ton)	Accum. Total Quantities	No. of Density Tests Required To Date
Rock Emb.						

Remarks

DOT Form 351-015 Revised 12/95

Distribution: OSC Construction Office, Region Construction Engineer, Project Engineer, Region Soils Engineer

Washington State Department of Transportation

LOAD TALLY SHEET

SHEET _____ OF _____

CONTRACT NO	CONTRACTOR	DATE
ITEM NO	MATERIAL	

NET MASS	TRUCK NO	TIME	NET MASS	TRUCK NO	TIME	NET MASS	TRUCK NO	TIME

Washington State Department of Transportation

Transmittal of Manufacturer's Certificate of Compliance

Date	Contract No.	SR No.
From *(Project Engineer)*	To *(Contractor)*	

The attached Manufacturer's Certificate of Compliance for a quantity of _____ for Bid Item # _____; Material _____ has been checked for conformance to Section 1-06.3 of the *Standard Specifications* per the checklist shown below.

	Yes	No
1. Is the certification being provided PRIOR to the material being installed?	☐	☐
2. If the answer to number 1 above is "NO," attached is a copy of the contractor's approved request for permission to install prior to providing a Mfg. Cert. for acceptance.	☐	☐
3. Is a Mfg. Cert. proper documentation for this item of material? See Note 2.	☐	☐
4. Is this manufacturer an approved source for this bid item?	☐	☐
5. Does the Mfg. Cert. identify the name of the mfg. and/or fabricator?	☐	☐
6. Does the Mfg. Cert. identify the type or size of material being certified?	☐	☐
7a. Does the Mfg. Cert. identify the quantity of material being certified by type, size, lot, or heat number? See Note 3.	☐	☐
7b. Is a Bill of Lading or invoice attached to verify the quantity? See Note 3.	☐	☐
8. Does the Mfg. Cert. identify the applicable specification (i.e., AASHTO, ASTM, AWWA) that the material is to meet? See Note 4.	☐	☐
9. Does the applicable specification (i.e., AASHTO, ASTM, AWWA) shown on the Mfg. Cert. conform to the contract requirements? See Note 6.	☐	☐
10. Is the Mfg. Cert. signed by a corporate official?	☐	☐
11. Where more than a single delivery is made, are the lot numbers identified?	☐	☐
12. Is a supporting mill test attached showing the physical and chemical test values? See Note 5.	☐	☐

Remarks:

Notes:

1. This form not required for concrete delivery tickets.
2. Check the Record of Materials, Special Provisions, or the completed Request for Approval of Material Sources.
3. Not required for concrete admixtures, cement, liquid asphalt, plastic pavement markings, traffic paint. Rebar cut sheets may be used in lieu of a bill of lading or invoice.
4. Check special provisions for specifications or requirements for materials such as guide posts, plastic pavement markings, traffic paint, geotextiles, and others.
5. Test values required to be supplied with Mfg. Cert. for steel reinforcing bars and structural steel. Mfg. Cert. for some steel items, such as steel culvert pipe items, may reference heats used.
6. If answer is "NO," submit Mfg. Cert. to Headquarters Material Laboratory for approval.

☐ Accepted as proper documentation per Section 1-06.3 of the Standard Specifications.

☐ Manufacturer Certificate of Compliance submitted to Headquarter's Materials Laboratory for "APPROVAL ACTION."

☐ Returned to contractor for correction of "NO" answers recorded in Items _____.

Distribution: HQ Lab – Original District Construction	Signed
	Date

DOT 350-572
2/91

Washington State Department of Transportation

DAILY REPORT OF FORCE ACCOUNT WORKED

CONTRACT NO.	DATE	ITEM NUMBER	ITEM NAME

PRIME CONTRACTOR	SUBCONTRACTOR / LOWER TIER SUBCONTRACTOR

LINE / STATION	GROUP	BASIS OF MATERIAL ACCEPTANCE	RAMS NO.

DESCRIPTION OF WORK PERFORMED

TIME WORKED RECORD

	CODE OR CRAFT GROUP	WORKMAN AND/OR EQUIPMENT WORKING	OCCUPATION OF WORKMAN OR EQUIPMENT SIZE	HOURS WORKED		RATE	AMOUNT
				REG.	O.T.		
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							

Calculated By	Date	Checked By	Date	TOTAL	

CAPS ENTRY NO.	ENTERED BY	DATE	ENTRY VERIFIED	DATE

INSPECTOR	CONTRACTOR'S REPRESENTATIVE	TITLE

DOT Form 422-008
Revised 10/94

Washington State Department of Transportation

INSPECTOR'S RECORD OF FIELD TEST

Cont. No. _____ Date _____ Time _____ Pit No. _____
Acceptance Sample No. _____ Assurance Sample No. _____ I.A.S. No. _____
Material _____ Quantity Produced to Date _____

❒ State Provided Source ❒ Contractor's Source ❒ Informational Sample Only
❒ Material Being Placed in Stockpile ❒ Sampled at Point of Acceptance

Total Mass of Sample Taken _____ (before split)

SIZES		RETAINED		PASSING	SPECIFICATIONS	FRACTURE
63 mm	kg		%	%		%
50 mm	"		%	%		%
37.5 mm	"		%	%		%
36.5 mm	"		%	%		%
25.0 mm	"		%	%		%
19.0 mm	"		%	%		%
16.0 mm	"		%	%		%
12.5 mm	"		%	%		%
9.5 mm	"		%	%		%
6.3 mm	"		%	%		%
Pan	"		4.75 mm	%		%
Total	"		2.00 mm	%		%
			0.85 mm	%		%
			0.60 mm	%		%
			0.425 mm	%		%
			0.300 mm	%		%
			0.180 mm	%		%
			0.150 mm	%		%
			0.075 mm	%		%

Fine Grading (6.3 mm)

MM		RETAINED	PASSING
4.75	g	%	%
3.35	"	%	%
2.36	"	%	%
2.00	"	%	%
1.18	"	%	%
0.85	"	%	%
0.60	"	%	%
0.425	"	%	%
0.300	"	%	%
0.180	"	%	%
0.150	"	%	%
0.075	"	%	%
Pan	"		
Total	"		

		SPECIF.	
Organic p.p.m.			Max.
Sand Equivalent			Min.
Fracture Fine	%	%	Min.
Other			

Sieving ❒ Wet ❒ Dry

Moisture Content _____

COARSE AGGREGATES			SPECIF.
Wood Waste	%		% Max.
Fracture	%		% Min.

COMPUTATIONS

REMARKS

❒ Conditionally Accepted.
❒ Substandard Material.
❒ Rejected; describe corrective action taken and disposition of non-specification material.
❒ Written notification of rejection forwarded to Prime Contractor.

Inspector: _____ Contractor: by _____

White Copy - Do not detach
Canary Copy - Contractor Foreman

Copies To: Project Engineer
Prime Contractor

DOT Form 422-020X Metric
Revised 5/95

Washington State Department of Transportation

Water Delivery Record

Contractor / Subcontractor		
Contract No.		Date
Time of Loading Hr. Min.	Quantity	Placed S.B. Lane, Detour, Haul Rd., etc.

Washington State Department of Transportation

Scaleman's Daily Report

Contract No.	Date	Pit No.
Scale Location		
Materials Hauled		
State Scaleman Signature	Contractor's Scaleman Signature	

Morning Tare

Time	Truck No.	Tare	Legal Gross

Afternoon Tare

Time	Truck No.	Tare	Legal Gross

Remarks

Contractor's weighman operated the scales and the state inspector observed ( ) or
weighing operations were performed by the state inspector ( )

Scale Tested By (*Company or Agency)*	Date

The reverse side of this form must be used ***daily*** to document scale checking activity.

DOT Form 422-027
Revised 9/95

Reference: Construction Manual Section 10-2.2C

Everyday use of the following five methods to determine if the scale is operating to within one-half of one percent of the weighed load.

1. Weigh a loaded truck on another sale which as been inspected or certified, then weigh the same truck on your scale.

2. Weigh your vehicle on a certified or recently tested scale and check your scale with it.

3. Use the test weights with a loaded truck. Place the weights, then check the amount of change on your scale. The difference between the two weighings must be exactly the amount of the test weights or there is a significant error. (Use this method only occasionally.)

4. If one truck is used for an extended period of time, use it as a “tattle-tale” check. The tare of the truck should be established just after the scale has been certified or checked by methods (1) or (2). When the truck is originally weighed, check the amount of fuel and make the daily check when the amount of fuel is the same, and check to see that the truck is free of mud, etc. This procedure is best utilized during dry weather. When this procedure is used, check the scales by methods (1), (2), or (3) twice weekly.

5. Weigh a loaded truck and then have it turn around and weigh it again facing the opposite direction with the load as near opposite ends of the platform as possible. (Use this method only occasionally.)

Use the space below to describe the check method and show the computations for the percent of variance.

In addition, periodic checks must be made throughout each day to see that the scale is balanced and returns to zero. If the scale does not return to zero, check for binding and/or clean the platform.

Time	Results	Time	Results

Abrupt stops by locking and holding brakes will affect the accuracy of the scales as well as large idling engines.

DOT Form 422-027
Revised 9/95

Washington State Department of Transportation

FIELD NOTE RECORD

BOOK NO. _____ PAGE NO. _____

CONTRACT NO.	STATION	LINE	C/S

STAKED BY MEASURED BY	DATE	WORK STARTED	WORK COMPLETED

CALCULATED BY	DATE	CHECKED BY	DATE	INSPECTOR'S SIGNATURE	DATE

ITEM NO.	ITEM	GROUP NO.	DATE	UNIT	QUANTITY	RAMS NO.	BASIS OF MATERIAL ACCEPTANCE	CAPS ENTRY NO.	INTIALS		EST. NO.
									POST	CK	

DOT Form 422-635 (Front)
Revised 9/95

CONTRACT NO. _____

STATION	LEFT	RIGHT	LENGTH OR WIDTH	AREA	REMARKS

Washington State Department of Transportation

FIELD NOTE RECORD (SKETCH GRID)

BOOK NO. _____ PAGE NO. _____

CONTRACT NO.	STATION	LINE	C/S

STAKED BY	DATE	WORK STARTED	WORK COMPLETED

CALCULATED BY	DATE	CHECKED BY	DATE	INSPECTOR'S SIGNATURE	DATE

ITEM NO.	ITEM	GROUP NO.	DATE	UNIT	QUANTITY	RAMS NO.	BASIS OF MATERIAL ACCEPTANCE	CAPS ENTRY NO.	INTIALS		EST. NO.
									POST	CK	

DOT Form 422-636 (Front)
Revised 9/95

DOT 422-536 (Back)
Revised 1/90

Washington State Department of Transportation

FIELD NOTE RECORD FOR DRAINAGE

BOOK NO. _____ PAGE NO. _____

CONTRACT NO.	STATION	LINE	C/S	CODE NO.

STAKED BY	DATE	WORK STARTED	WORK COMPLETED

CALCULATED BY	DATE	CHECKED BY	DATE	INSPECTOR'S SIGNATURE	DATE

ITEM NO.	ITEM	GROUP NO.	DATE	UNIT	QUANTITY	RAMS NO.	BASIS OF MATERIAL ACCEPTANCE	CAPS ENTRY NO.	INTIALS		EST. NO.
									POST	CK	

DOT Form 422-637 (Front)
Revised 9/95

BOOK NO. _____ PAGE NO. _____

STRUCTURE EXCAVATION

(PIPE STRUCTURE EXCAVATION WIDTH =)

STATION	FLOW LINE GRADE	ORIGINAL GROUND	SUB-GRADE	CENTERLINE CUT		OFFSET HUB	OFFSET CUT-F.L.	REMARKS
				FLOW LINE	BOTTOM DITCH			

REMARKS

DOT Form 422-637 (Back)
Revised 9/95

Washington State Department of Transportation

Daily Report of BST Operations

Region	Report No.

Contract No.	Section		Contractor		
Date	Weather	Min/Max Temp.	SR No.	Grade	Class

Application is to a: ☐ New ☐ Old Surface If old is indicated, describe the overall condition of the surface:

Note: List loads of Bituminous Cement for each operation. Where spreads of Bituminous Cement are continuous on same side of road, such loads may be reported as a unit load.

Bituminous Cement Applications

Load Nos.	KP From Sta.	KP to Sta.	Side/ Road	Width in Meters	Area	Hot Liters	Asphalt Temp.	Cold Liters	Yield Asphalt		Yield Aggregate	
									Ordered	Applied	Ordered	Applied

Remarks (Embedment, Rollers, etc.)

Item Quantity Calculations

Item	Location	Quantities Today	Job Total
Preparation of Rdwy.		Kilometers	Kilometers
Asphalt (Grade)		Tonnes	Tonnes
Asphalt (Grade)		Tonnes	Tonnes
Min. Aggr. (Size)		m^3	m^3
Min. Aggr. (Size)		m^3	m^3

Completed Kilometers to Date	Kilometers Today	Total

Superintendent	Foreman
Inspector	Project Engineer

DOT Form 422-644 Metric
Revised 12/95

Washington State Department of Transportation

CORRELATION - NUCLEAR GAUGE TO CORE DENSITY

CONTRACT NO.	SR NO.	GAUGE NO.	MODE BACKSCATTER _____ DIRECT _____	PROJECT ENGINEER
SECTION				
PIT NO.	ACP CLASS		LIFT THICKNESS	

	STATION/OFFSET (1)	NUC. GAUGE DENSITY #/FT 3 (2)	CORE DENSITY #/FT 3 (3)	DENSITY RATIO (4)
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

(1) The ten test points can represent either the first two control lots or ten points within the first control lot (attach the compaction control report)

(2) Nuclear gauge density tests must be taken the day of paving.

(3) Cores must be taken at the same location as the nuclear density readings, the day following paving.

(4) DENSITY RATIO = $\frac{\text{CORE DENSITY}}{\text{NUCLEAR GAUGE DENSITY}}$

(5) CALCULATION OF GAUGE CORRELATION FACTOR (GCF)

ADD TEN DENSITY RATIOS

GCF = $\frac{\text{SUM OF DENSITY RATIOS}}{10}$ = $\frac{_____}{10}$ = _____

Date of paving _____ Date of coring _____

Project office notified of gauge correlation factor _____ (DATE) By _____ (SIGNATURE)

DISTRIBUTION:
DISTRICT MATERIALS (WHITE)
PROJECT ENGINEER (CANARY)
HDQTRS. LAB (PINK)
HDQTRS. CONSTRUCTION (GOLDERNROD)

DOT 350-112
REV 9/90

Washington State Department of Transportation

Manufacturer's Certificate of Compliance for Ready Mixed Concrete

Manufacturer's Plant			WSDOT Contract Number
Contractor		Date	Time Batched ☐ am ☐ pm
Truck Number	Initial Counter Reading		Quantity
Concrete Class or Design Mix Number	Cement Producer (Brand)	Type	Mill Certificate Number

		Target Mass kg/m³ Agg. Mass at SSD	Actual Mass kg/m³ Include Free Moisture	Moisture %	Actual Mass kg/m³ Agg. Mass at SSD
Cement					
Flyash	Type				
CCA #1	WSDOT or AASHTO Designation				
CCA #2	WSDOT or AASHTO Designation				
FCA	Class 1 or Class 2				
Water	Liters or Kilograms				

Admixtures Used - Brand and Dosage

Admixture	Brand or Type	ml/kg	Total Volume (L) This Batch
Air Entraining			
Water Reducing			
Other			

Signature of Plant Representative

On Site Data

Time Discharged _____ ☐ am ☐ pm Revs at Start of Discharge _____

Water _____ L *1 Liter = 1 kg* Water _____ kg
(Added at Site) (Total Water)

Location Concrete Placed

Test Values

Slump _____ Air _____ Concrete Temp _____ Test Cylinder No. _____

WSDOT Inspector _____

DOT Form 450-001 Metric
Revised 1/96

Washington State Department of Transportation

Commercial Pesticide Application Record

Remember Backflow Protection

Reference (RCW 17.21) A new form shall be filled out each day or time the pesticide tank mixture is modified during the day or each time the Sign Route or County is changed. This Record Must be Retained for 7 Years. This form must be completed on day of application.
WSDOT, Roadside Management Branch, P.O. Box 47358, Olympia, WA 98504-7358. Phone (360) 705-7853.

Contract Number	County	Date of Application	Day of Week	Start ☐ AM ☐ PM Finish ☐ AM ☐ PM

SR	Description of Area Treated	Station to Station

Check Appropriate Boxes

☐ NB ☐ EB ☐ SB ☐ WB
☐ Median ☐ Landscaped Area ☐ Shoulder
☐ Roadside ☐ Rest Area ☐ Park-n-Ride
☐ Interchange ☐ Bridge ☐ Ramp
☐ Spot Spray ☐ Blanket Spray ☐ Banded Width
☐ Aquatic ☐ Wetlands

☐ Weeds ☐ Noxious Weeds ☐ Disease ☐ Seed
☐ Brush ☐ Insects ☐ Other
List Pest(s):

Temperature _____ °F(°C) Wind (Direction From) _____ Wind (Range) _____ mph(km/h)
☐ Sunny ☐ Broken ☐ Overcast, No Rain ☐ Light, Scattered Showers ☐ Hard Showers

Material Name	Manufacturer	EPA Reg. No.	Lot Number	Product Per Acre (hectare)	Active Ingredient per Acre(hectare)	Unit	Amount Per Tank	Total Daily Usage	Unit
	Oil (As Carrier)	Units: Ozd= Ounces Dry Lb= Pound Ozl= Ounces Liquid Ga= Gallon Pt= Pint Qt= Quart			g= gram kg=kilogram ml=Milliliter L= Liter				
	Water Source								

No. of Tanks per Day _____ Tank Size _____ Gallons(liters).

Total _____ Acres(hectares) Treated at _____ gallons(liters) of spray per acre(hectare).

Equipment Information	Apparatus Number	Calibration Date	Vehicle Speed mph(km/h)	☐ Boom ☐ Other (Specify)

☐ Handspreader ☐ Belly Grinder ☐ Backpack	☐ Handgun ☐ Manifold ☐ Fixed Nozzle ☐ Nozzle Cluster	☐ Tank Mix (Conv.) ☐ Invert ☐ Injection

Nozzle Information	Model Number	Pressure PSI(kPa)	Number of Nozzles	Width of Spray Pattern Feet(meter)

Business Name	Phone

Address	City	State	Zip Code

Applicator /Operator Name	Commercial Pesticide Lic. No.	Commercial Operator Signature

Prime Contactor	Subcontractor	Inspector Name	Phone

Remarks

Pesticide Sensitivity Registration Applies: ☐ Yes ☐ No

Contacts

Division of Emergency Management (1-800-258-5990)

DOT Form 540-509 EF
Revised 3/96

Distribution: Operator Project Engineer OSC Maint.
Send OSCCopy Within 5 Days

VERBAL APPROVAL

DATE: _____ **CONTRACT:** _____

REQUEST BY: _____

APPROVED BY: _____

FHWA: PERSON NOTIFIED _____

DATE: _____ **REMARKS:**

DOT FORM 410-001
REVISED 8/78

EXAMINATION SHEET FOR CONTRACT ITEMS

CONTRACT NO.	F.A. NO.	ACTIVE	COMPL.

ITEM NO.	DESCRIPTION	UNIT	PRICE/UNIT

PLAN QUANTITY	PRESENT QUANTITY	FINAL QUANTITY	MAJOR ITEM ☐ YES ☐ NO	ADDED ITEM	C.O.

QUANTITIES EXAMINED:

ENTRY	DATE	LOCATION	EST.	RECORDED QTY	EXAMINED QTY	SOURCE	BK/PG

TOTAL = _____ ____ %

DOCUMENTATION PRACTICES EXAMINED:

- ____ 1.Selected representative samples
- ____ 2.Proj. Ledger properly prepared and maint.
- ____ 3. Ledger qty. checked to source document
- ____ 4.Field Rec. Bk. current and computations compl.
- ____ 5.Field Rec. Bk. entries cross-ref. to support doc.
- ____ 6.Inspection Reports maintained.
- ____ 7.Mat'ls furnished from approved source.
- ____ 8.Proper tests for quality accceptability.
- ____ 9.Operations for Pour and Piling observed and docum.
- ____ 10.Scales Certification date: _____.
- ____ 11.Tare Weights properly recorded.
- ____ 12.Change orders approved prior to start of work.
- ____ 13.Force Acct. docum. & confirmed with Contractor.

TYPE OF SUPPORTING RECORDS EXAMINED:

- ____ Delivery Tickets
- ____ Receiving Reports
- ____ EDP Input/output sheets
- ____ Cross-sect. notes
- ____ Mass Diagram
- ____ Scalehouse Records
- ____ Field Notes and Diary
- ____ Pile Book
- ____ Project Ledger
- ____ Invoices
- ____ Truck Measurements
- ____ Mat'ls Lab Reports
- ____ Force Acct. Records
- ____ _____
- ____ _____
- ____ _____

REVIEW RESULTS

The examination shows this item was measured in accordance with the Contract and the Std. Specifications. _____

The documentation practices were in accordance with the requirements of the Construction manual. _____

Comments and Recommendations _____

Project Engineer _____ Examiner _____ Date _____

DOT 421-014
Revised 2/90

RECAPITULATION OF FINAL CONTRACT EXAMINATION

Washington State Department of Transportation

Contract No. _____ F. A. Project No. _____

Project Description: _____

_____

Project Engineer: _____ Examiner: _____

Dates of Examination: _____

_____

ITEM NO.	DESCRIPTION	% EXAMINED

+ Item(s) requires Project Engineer's Comment.

See attached Examination Sheets for details on Pay Items.

Date Project Completed _____ Date Final Estimate Sent to Accounting _____.

DOT FORM 421-015(X) REVISED 2/78

Washington State Department of Transportation

Yield and Cement Content

Contracting Agency Mix Design Only

Test Number	IAS Number	Concrete Temperature °C	Slump	Test Air (TA) %

Ticket Number	Plant	Mix Number	Truck Number	Batch Size (BS) m^3	Cylinder Number

Date	Contract Number	Class Concrete	Design Air (DA) %	Min. Cement Content (MCC) kg/m^3	Air Temperature °C

Use Actual Batch Weights Per Truckload

Cement Weight	[A]	_____	kg
Fly Ash Weight		_____	kg
Total Cementitous Material	[B]	_____	kg
Fine Aggregate	[C]	_____	kg
Coarse Aggregate 1		_____	kg
Coarse Aggregate 2		_____	kg
Coarse Aggregate 3		_____	kg
Total Coarse Aggregate	[D]	_____	kg
Plant Mix Water		_____	kg
Water Added _____	Liters X 1 kg/L =	_____	kg
Total Water	[E]	_____	kg
Total Weight	(B+C+D+E) = [F]	_____	kg

Unit Weight

Yield Bucket Volume	[G]	_____	m^3
Gross Weight		_____	kg
Tare Weight		_____	kg
Net Weight	(Gross Weight - Tare Weight) = [H]	_____	kg
Unit Weight	(H / G) = [I]	_____	kg/m^3

Air Correction

If concrete does not contain an air-entraining agent, then skip Air Correction.

Design Air Correction	100 - [DA] = [J]	_____
Test Air Correction	100 - [TA] = [K]	_____
Air Correction Total	({J / K} X [I]) = [L]	_____

Actual Yield

*If concrete does not contain an air-entraining agent, then [L] = [I].

[F] _____ / [L*] _____ = [M] _____ m^3

Calculated Cement Content

[B] _____ / [M] _____ = [CCC] _____ kg/m^3

If Calculated Cement Content is 5 kilograms per cubic meter less than the Minimum Cement Content [MCC], then an adjustment in the Aggregate Batch Weights is needed. (See Adjusted Concrete Mix Design).

Calculated By _____

DOT Form 350-566 Metric EF
Revised 4/96

Washington State Department of Transportation

Adjusted Concrete Mix Design

To Contractor _____

The following Contracting Agency Mix Design is to be adjusted as follows:

Approved Mix Design			Adjusted Mix Design		
Designated Mix Design Number	_____		Designated Mix Design Number	_____	
Cement					
Type I	_____	kg/m³	Type I	_____	kg/m³
Type II	_____	kg/m³	Type II	_____	kg/m³
Other	_____	kg/m³	Other	_____	kg/m³
Fly Ash	_____	kg/m³		_____	kg/m³
Fine Aggregate					
Pit Number	_____		Pit Number	_____	
Class I	_____	kg/m³	Class I	_____	kg/m³
Class II	_____	kg/m³	Class II	_____	kg/m³
Coarse Aggregate					
Pit Number	_____		Pit Number	_____	
WSDOT No. 2	_____	kg/m³	WSDOT No. 2	_____	kg/m³
WSDOT No. 4	_____	kg/m³	WSDOT No. 4	_____	kg/m³
WSDOT No. 5	_____	kg/m³	WSDOT No. 5	_____	kg/m³
WSDOT No. 6	_____	kg/m³	WSDOT No. 6	_____	kg/m³
AASHTO No. 8	_____	kg/m³	AASHTO No. 8	_____	kg/m³
Water (Maximum)	_____	kg/m³	Water (Maximum)	_____	kg/m³
Water / Cement Ratio	_____		Water / Cement Ratio	_____	
Water Reducer	_____	ml/m³	Water Reducer	_____	ml/m³
Water Reducer/Retarder	_____	ml/m³	Water Reducer/Retarder	_____	ml/m³
High-Range Water Reducer	_____	ml/m³	High-Range Water Reducer	_____	ml/m³
Air Entrainment	_____	ml/m³	Air Entrainment	_____	ml/m³

Adjusted Average Cement Content

_____ kg/m³ + _____ kg/m³ = _____ / 2 = [P] _____ kg/m³

Calculated Cement Content — Calculated Cement Content — Average Calculated Cement Content

Aggregate Correction

[P] _____ kg/m³ / [MCC] _____ kg/m³ = [Q] _____

Fine Aggregates	_____	kg X [Q] =	_____	kg
Coarse Aggregate	_____	kg X [Q] =	_____	kg
Coarse Aggregate	_____	kg X [Q] =	_____	kg
Coarse Aggregate	_____	kg X [Q] =	_____	kg

Contractor's Signature _____ Date _____

Project Engineer's Signature _____ Date _____

DOT Form 350-568 Metric EF 4/96 Distribution: Original - Contractor Copy - Project Engineer

Washington State Department of Transportation

Initial Documentation Review (Procedures)

CONTRACT NUMBER	CONTRACT TITLE		
REVIEW DATE	CONTRACT AMOUNT $	START DATE	REVIEWED BY
PROJECT ENGINEER		% COMPLETE	FEDERAL AID NUMBER

Preconst Conference (1-2.1C)	Yes	No
Minutes in project records	☐	☐
Copies to attendees & all invited	☐	☐
Davis-Bacon Statement in minutes (Fed)	☐	☐
Safety Stds Questionnaire (1-2.21I (3))	☐	☐
Job site posters noted (1-2.2K)	☐	☐
Signing (1-2.3)		
Approved signing plans or std plan	☐	☐
Time of initial installation recorded	☐	☐
Signing checked twice daily & recorded	☐	☐
Sign log being used	☐	☐
Force Account (1-2.4D)		
FA sheet signed by inspector & contractor	☐	☐
Equipment rates correct	☐	☐
Labor rates correct & documented	☐	☐
OH & P correct	☐	☐
Supplemental markup correct (sub items)	☐	☐
Traffic control items correct	☐	☐
Progress Schedule (1-2.5)		
Approved by District Construction Engineer	☐	☐
Project on schedule	☐	☐
Employee Interviews (1-2.6C(B)) Federal Projects		
On file prime contractor	☐	☐
On file all subcontractors	☐	☐
Statement of Intent to Pay Prevailing Wage (1-2.6B)		
On file for prime contractor	☐	☐
Received before first estimate payment	☐	☐
Payroll Review (1-2.6C(a)) (Prime & All Subs)		
First payrolls checked & initialed	☐	☐
All other payrolls checked 10%	☐	☐
—Check for the following items—		
Cont #, payroll #, payroll period	☐	☐
Labor classification correct	☐	☐
Minimum wage met or exceeded	☐	☐
Overtime shown separately	☐	☐
Travel pay shown separately	☐	☐
Proof of apprentice registration	☐	☐
Employees address & Soc Sec # shown	☐	☐
Fringe benefits paid	☐	☐
Compliance statement signed	☐	☐
Project Diaries (10-3.5 & 10-3.10)		
Project diary current & signed	☐	☐
IDR's complete	☐	☐

Training (1-2.7B)	Yes	No
Training program submitted	☐	☐
Program approved	☐	☐
Program outline follows requirements	☐	☐
Trainees submitted for approval	☐	☐
"Good Faith Effort" documentation provided if non protected person approved	☐	☐
Sublets (1-2.4H)		
Sublets approved before working	☐	☐
257 Monthly Utility Report (1-2.7A(3))		
Received monthly from prime & sub	☐	☐
Reviewed by project office	☐	☐
Change Orders (1-2.4B)		
Approved before work starts	☐	☐
M / W / DBE On-Site Reviews		
Cond of award M / W / DBE subs on job yet	☐	☐
Reviews made & submitted to ECR	☐	☐
Project Ledger (10-3.9)		
Entry back-up easy to follow	☐	☐
Item Checks (Procedures)		
Item quantity tickets	☐	☐
Scaleman's daily report	☐	☐
Scale certification	☐	☐
Truck measure	☐	☐
Concrete plant daily report	☐	☐
Delivery tickets	☐	☐
Other	☐	☐
Materials (Chapter 9)		
Record of materials current	☐	☐
Approval of source before use	☐	☐
Certification of origin before use	☐	☐
Certification of American made steel	☐	☐
Remarks (Use back for additional remarks)		

DOT 230-036A
Revised 1/92

Washington State Department of Transportation

Follow-Up Documentation Review

(Use only if initial review is completed)

CONTRACT NUMBER	CONTRACT TITLE		
REVIEW DATE	CONTRACT AMOUNT $	START DATE	REVIEWED BY
PROJECT ENGINEER		% COMPLETE	FEDERAL AID NUMBER

Signing (1-2.3)	Yes	No
Approved signing plans or std plan	☐	☐
Time of initial installation recorded	☐	☐
Signing checked twice daily & recorded	☐	☐
Sign log being used	☐	☐
Force Account (1-2.4D)		
FA sheet signed by inspector & contractor	☐	☐
Equipment rates correct	☐	☐
Labor rates correct & documented	☐	☐
OH & P correct	☐	☐
Supplemental markup correct (sub items)	☐	☐
Traffic control items correct	☐	☐
Progress Schedule (1-2.5)		
Approved by District Construction Engineer	☐	☐
Project on schedule	☐	☐
Employee Interviews (1-2.6C(B)) Federal Projects		
On file prime contractor	☐	☐
On file all subcontractors	☐	☐
Payroll Review (1-2.6C(a)) (Prime & All Subs)		
First payrolls checked & initialed	☐	☐
All other payrolls checked 10%	☐	☐
—Check for the following items—		
Cont #, payroll #, payroll period	☐	☐
Labor classification correct	☐	☐
Minimum wage met or exceeded	☐	☐
Overtime shown separately	☐	☐
Travel pay shown separately	☐	☐
Proof of apprentice registration	☐	☐
Employees address & Soc Sec # shown	☐	☐
Fringe benefits paid	☐	☐
Compliance statement signed	☐	☐
Project Diaries (10-3.5 & 10-3.10)		
Project diary current & signed	☐	☐
IDR's complete	☐	☐
Sublets (1-2.4H)		
Sublets approved before working	☐	☐
257 Monlthy Utility Report (1-2.7A(3))		
Received monthly from prime & sub	☐	☐
Reviewed by project office	☐	☐
Change Orders (1-2.4B)		
Approved before work starts	☐	☐
M / W / DBE On-Site Reviews		
Cond of award M / W / DBE subs on job yet	☐	☐
Reviews made & submitted to ECR	☐	☐

Item Checks (Procedures)	Yes	No
Item # - descr.	☐	☐
Ledger vs source document	☐	☐
Field note record complete	☐	☐
Item quantity tickets complete	☐	☐
Scale cert. scaleman's daily report Wghmstr Lic.	☐	☐
Work noted on inspector's daily report	☐	☐
Material source approved	☐	☐
Mat'l test report, M.A.R., mfg. cert.	☐	☐
Item # - descr.	☐	☐
Ledger vs source document	☐	☐
Field note record complete	☐	☐
Item quantity tickets complete	☐	☐
Scale cert. scaleman's daily report Wghmstr Lic.	☐	☐
Work noted on inspector's daily report	☐	☐
Material source approved	☐	☐
Mat'l test report, M.A.R., mfg. cert.	☐	☐
Item # - descr.	☐	☐
Ledger vs source document	☐	☐
Field note record complete	☐	☐
Item quantity tickets complete	☐	☐
Scale cert. scaleman's daily report Wghmstr Lic.	☐	☐
Work noted on inspector's daily report	☐	☐
Material source approved	☐	☐
Mat'l test report, M.A.R., mfg. cert.	☐	☐
Item # - descr.	☐	☐
Ledger vs source document	☐	☐
Field note record complete	☐	☐
Item quantity tickets complete	☐	☐
Scale cert. scaleman's daily report Wghmstr Lic.	☐	☐
Work noted on inspector's daily report	☐	☐
Material source approved	☐	☐
Mat'l test report, M.A.R., mfg. cert.	☐	☐

Remarks
(Use back for additional remarks)

DOT 230-036B
Revised 1/92

FEDERAL-AID HIGHWAY CONSTRUCTION

SUMMARY OF EMPLOYMENT DATA (INCLUDING MINORITY BREAKDOWN)
FOR ALL FEDERAL-AID PROJECTS FOR MONTH ENDING JULY 31st, 19_____

NOTE: See Instruction on Reverse

OMB NO. 2125-0019

STATE-REGION (5-8)	NUMBER OF PROJECTS (9-12)	TOTAL DOLLAR VALUE (13-23)
01		

EMPLOYMENT DATA

Table A

JOB CATEGORIES	TOTAL EMPLOYEES		TOTAL MINORITIES		BLACK *Not of Hispanic Origin*		HISPANIC		AMERICAN INDIAN OR ALASKAN NATIVE		ASIAN OR PACIFIC ISLANDER		WHITE *Not of Hispanic Origin*		APPRENTICES		ON THE JOB TRAINEES	
	9-13	14-18	19-23	24-28	29-33	34-38	39-43	44-48	49-53	54-58	59-63	64-68	69-73	74-78	79-83	84-88	89-93	94-98
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
02 OFFICIALS *(Managers)*																		
03 SUPERVISORS																		
04 FOREMEN / WOMEN																		
05 CLERICAL																		
06 EQUIPMENT OPERATORS																		
07 MECHANICS																		
08 TRUCK DRIVERS																		
09 IRONWORKERS																		
10 CARPENTERS																		
11 CEMENT MASONS																		
12 ELECTRICIANS																		
13 PIPEFITTERS, PLUMBERS																		
14 PAINTERS																		
15 LABORERS, SEMI-SKILLED																		
16 LABORERS, UNSKILLED																		
17 **TOTAL**																		

Table B

18 APPRENTICES																		
19 ON THE JOB TRAINEES																		

11. PREPARED BY: *(Signature and Title)*	DATE	REVIEWED BY: *(Signature and Title of State Highway Official)*	DATE

This report is required by law and regulatic:. (23 U.S.C. 140a and 23 CFR Part 230). Failure to report will result in noncompliance with this regulation.

Form FHWA-1392 (Rev. 3-92) PREVIOUS EDITIONS ARE OBSOLETE 50625—M-Form1

This form is to be developed from the "Contractor's Annual EEO Report." The data is to be compiled by the State and submitted annually. It should reflect the total employment of all Federal-Aid Highway Projects in the State as of July 31st. The staffing figures to be reported should represent the project work force on board in all or any part of the last payroll period preceding the end of July. The staffing figures to be reported in Table A should include journey-level men and women, apprentices, and on-the-job trainees. Staffing figures to be reported in Table B should include only appentices and on-the-job trainees as indicated.

Entires made for "Job Categories" are to be confined to the listing shown. Miscellaneous job classifications are to be incorporated in the most appropriate category listed on the form. All employees on projects should thus be accounted for.

This information will be useful in complying with the U.S. Senate Committee on Public Works request that the Federal Highway Administration submit a report annually on the status of the Equal Employment Opportunity Program, its effectiveness, and progress made by the States and the Administration in carrying out Section 22(A) of the Federal-Aid Highway Act of 1968. In addition, the form should be used as a valuable tool for States to evaluate their own programs for ensuring equal opportunity.

It is requested that States submit this information annually to the FHWA Divisions no later than September 25.

LINE 01.—State and Region Code. Enter the 4-digit code from the list below.

Alabama	01-04	Montana	30-08
Alaska	02-10	Nebraska	31-07
Arizona	04-09	Nevada	32-09
Arkansas	05-06	New Hampshire	33-01
California	06-09	New Jersey	34-01
Colorado	08-08	New Mexico	35-06
Connecticut	09-01	New York	36-01
Delaware	10-03	North Carolina	37-04
District of Columbia	11-03	North Dakota	38-08
Florida	12-04	Ohio	39-05
Georgia	13-04	Oklahoma	40-06
Hawaii	15-09	Oregon	41-10
Idaho	16-10	Pennsylvania	42-03
Illinois	17-05	Puerto Rico	43-01
Indiana	18-05	Rhode Island	44-01
Iowa	19-07	South Carolina	45-04
Kansas	20-07	South Dakota	46-08
Kentucky	21-04	Tennessee	47-04
Louisiana	22-06	Texas	48-06
Maine	23-01	Utah	49-08
Maryland	24-03	Vermont	50-01
Massachusetts	25-01	Virginia	51-03
Michigan	26-05	Washington	53-10
Minnesota	27-05	West Virginia	54-03
Mississippi	28-04	Wisconsin	55-05
Missouri	29-07	Wyoming	56-08

50525,1—M-Form1

* U.S Government Printing Office1992- 312-673/62902

Washington State Department of Transportation

Fabrication Progress Report

Report No.	Date
Contract No.	Contractor
Fabricator	Location
Shop Job No.	Period

Contract Item No.			
Girders Series			
Contract Quantity			
Girders in Fabrication			
Girders Fabricated This Period*			
Total Fabricated to Date			
Total Finished and Ready to Ship			
Shipped Previously			
Shipped During This Period			
Total Shipped to Date			

Remarks

*Girder Number	Date Poured	Camber	*Girder Number	Date Poured	Camber

cc: Project Engineer
File

Note: This report will be made out each Thursday and distributed to reach the Project Engineer on the following Monday.

State Inspector

DOT Form 350-004
Revised 1/96

APPROVED FOR SHIPMENT

_____ Date _____

Inspector, Washington State Department of Transportation

MM/DD/YR

DOT FORM 350-021
REVISED 4/96

Washington State Department of Transportation

Prestress Pile Record

Highway No. _____ Section _____

Contract No. _____ Report No. _____ Outside Diameter _____ Wall Thickness _____

Pre-Tension Cables: Lot No. _____ Reel No. _____ Straight Cables: No. _____ Size _____

Elongation: Calculated _____ Measured _____ Straight Jacking Force _____ N/Cable _____ Total Newtons

Pile No.	Cast Length	Date Pour	Begin Pour	End Pour	Air Temp	Conc. Temp.	Slump (mm)	Avg. Temp. Curing	Hours of Cure		Cyl. Nos.	Test Bge.	MPa	Destress Date/Time	Finished Length
									Accel.	Water					

Remarks

_____

_____

_____

_____

Distribution: White - Materials (Record)
Canary - Bridge Engineer (Memo)
Pink - Region Oper. Engineer (Memo)
Goldenrod - Retain (Memo)

Inspector _____ Date _____

DOT Form 350-086 Metric 9/95

Washington State Department of Transportation

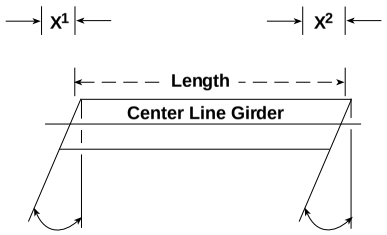
Prestressed Concrete Girder Report No. _____

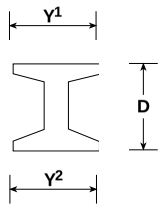
Contract No.	F.A. No.	S.R.	Concrete Mix	Aggregate Source

Section	% Sand Passing 1.18 mm	% Gravel Passing 19.0 mm

Bridge Name	Contractor	Cement Brand	Type	SKS./m^3	Water L/SK

Ft. Series _____





Pretension Cables:

Lab. No.(s)

Strght. Cable No. Size HRPD. Cables No. Size

Strght. Jack Force N/Cable Newtons Total

Elongation Calculated Measured

Hrpd. Jack Force N/Cable Newtons Total

Elongation Calculated Measured

Pre-tension Release Date Time

Specified Release MPa:

Specified Design MPa:

Girder No.	Date Poured	Pour Time Begin	Pour Time End	Air Temp.	Conc. Temp.	Slump	Curing Hr. Steam	Curing Avg. Temp.	Cyl. No.	Date Tested	Age Hrs.	MPa	* Camber	Finished Length	Remarks

Remarks _____

Project Engineer

Field Inspector

Date

***Camber at center of girder.**

DOT Form 450-002 M
Revised 12/95

Distribution: White — Materials Lab Canary — Field Inspector

Washington State Department of Transportation

Post-Tensioning Record

CONTRACT NO.	PAGE NO.
SECTION	
STRUCTURE	
PROJECT ENGINEER	INSPECTOR

Date	Gir. No.	Tendon No.	Jack No.	Jack Location	Req 'd. Jacking Force Per Tendon (kN)	Strands Per Tendon	20% Jacking Force (MPa)	Req'd. Jacking Force (MPa)	Actual Jacking Force (MPa)	Actual Elong. (mm)	(A) 100% Actual Elong. -20% Actual Elong. (mm)	(B) Req'd. 80% Elong. (mm)	% Elong. Per Tendon	100% Actual Elong. -Seated Elong. = Seating Take-up (mm)	Req'd. Seating Take-up (mm)

DOT Form 450-005X Metric
Revised 9/95

Distribution: Final Records
Olympia Service Center Construction
Olympia Service Center Bridge

Note: % Elong. = The sum of columns "A" for both ends of the tendon divided by the sum of columns "B" for both ends of the tendon X 100.
% Elong. shall be between 93% minimum and 107% maximum.

Washington State Department of Transportation

Inspector's Daily Report

IDR Sheet 1 of Sheets	Final Record Book Page

Contract	SR Nos.	Day S M T W T F S	Date

Weather (see instructions) AM PM

A. Prime Contractor | Representative / Title

Subcontractor or Agent	Appr'd	D/M/WBE	Representative / Title
B.	Y / N	Y / N	
C.	Y / N	Y / N	
D.	Y / N	Y / N	
E.	Y / N	Y / N	

Contractor's Work Activity

Description and Location

Contractor's Equipment

Operating Contractor's ID (A–E, see above)

No.	Equipment – ID No. and Description	Opr	Stdby	Down	Idle

Contractor's Workforce

Operating Contractor's ID (A–E, see above)

Number / Hours								Number			
Laborers	Carpenters	Operators	Teamsters	Ironworkers	Masons	Flaggers	Electricians	Male	Fmale	Appr	Trnee
/	/	/	/	/	/	/	/				
/	/	/	/	/	/	/	/				
/	/	/	/	/	/	/	/				
/	/	/	/	/	/	/	/				
/	/	/	/	/	/	/	/				

Item, Description, and Location of Work (Note: any "NO" is to be explained in Diary)

Item No.	Contract Item Description	Location	Required Backup Samples Taken Y/N	Matls Documentation Approved Y/N	Matls Source Approved Y/N	Pay Note Made Y/N

Traffic Control Log (Note: explain any deviation from approved plan in Diary)

Location and Type of Traffic Control	Time Set Up	Time(s) Checked	Per Approved Plan Y/N	Time Remov'd

Photos / Videos taken today? ☐ Yes ☐ No

Inspector's Shift Hours From / To

(Signed) Inspector

Reviewed By

DOT Form 422-004
Revised 12/92

Washington State Department of Transportation

Inspector's Daily Report

IDR Sheet of Sheets	Final Record Book Page	
Contract	Day S M T W T F S	Date

DIARY — Including but not limited to: a report of the day's operations, time log (if applicable), orders given and received, discussions with contractor, and any applicable statements for the monthly estimate.

DOT Form 422-004A
Revised 12/92

(Signed) Inspector

Washington State Department of Transportation

(Street) Inspector's Daily Report

IDR Sheet 2 of Sheets	Final Record Book	Page
Contract	Day S M T W T F S	Date

DIARY - Including but not limited to: a report of the day's operations, time log (if applicable), orders given and received, discussions with contractor, and any applicable statements for the monthly estimate.

Surface Temp. Min: Max:	Air Temp. Min: Max:	Paver Speed (meters per minute) Min: Max:	Pneumatic Roller Tire Pressure:
From Station	To Station	m^2	Tonnes of Mix

	Base	Leveling	Wearing	Area m^2	Avg. Mass/m^2	Tack Coat
Daily Total						
Previous Total						
Total To Date						
Plan Quantity						

DOT Form 422-004B 4/96

Signed Inspector

Washington State Department of Transportation

Contractor's Construction Process Evaluation

CONTRACT NO:	CONTRACT TITLE:	
TYPE OF WORK:	CONTRACT AMOUNT:	
CONTRACTOR:	PROJECT ENGINEER:	DISTRICT:

A. PLANS AND SPECIFICATIONS

	POOR (1)	MARGINAL (2)	SATISFACTORY (3)	GOOD (4)	EXCELLENT (5)
1. Accuracy					
2. Completeness					
3. Clarity					
4. Organization					
5. Match with Field Conditions					

6. Comments and Examples: _____

7. Suggestions for Improving the Plans and Specifications: _____

8. Suggestions for Improving Methods of Measurement and Payment: _____

B. MANAGEMENT AND ADMINISTRATION

	POOR (1)	MARGINAL (2)	SATISFACTORY (3)	GOOD (4)	EXCELLENT (5)
1. Coordination and Cooperation					
2. Anticipation of Problems					
3. Timely Decision-Making					
4. Availability of Project Engineer					
5. Willingness to Resolve Difficult Issues					
6. Accuracy of Progress Payments					
7. Timeliness of Progress Payments					

8. Comments and Examples: _____

9. Suggestions for Improvement: _____

C. INSPECTION AND SURVEYING

	POOR (1)	MARGINAL (2)	SATISFACTORY (3)	GOOD (4)	EXCELLENT (5)
1. Effectiveness of On-Site Supervision					
2. Knowledge and Training of Inspectors					
3. Objectivity and Fairness of Inspectors					
4. Timeliness of Inspection and Surveying					
5. Accuracy and Sufficiency of Surveying					
6. Timeliness of Sampling and Test Results					
7. Accuracy of Sampling and Testing					
8. Attitude Toward Public Safety and Traffic Control					

9. Comments: _____

DOT 410-029 (sheet 1)
Revised 8/92

D. APPROVALS

PLEASE CHECK WHETHER APPROVALS OF THE FOLLOWING WERE A PROBLEM ON THIS PROJECT.

	YES	NO
1. Change Orders		
2. Shop Drawings		
3. Falsework, Formwork, and Shoring Drawings		
4. Material Sources		
5. Preliminary Material Samples		
6. Mix Designs		
7. Progress Schedule		
8. Traffic Control Plans		

9. Description of Problems Indicated Above: _____

10. Suggestions for Modifying Approval Processes: _____

E. CONSTRUCTIBILITY

PLEASE CHECK WHETHER ANY OF THE FOLLOWING WERE A PROBLEM ON THIS PROJECT.

	YES	NO
1. Time Restrictions		
2. Weather Limitations		
3. Traffic Restrictions		
4. Size or Length of Project		
5. Order or Staging of Work		
6. Availability and Accessibility of Staging Areas		
7. Utility and Other Third Party Involvement		

8. Description of Problems Indicated Above: _____

9. Modifications that the State could have made prior to contract that would have resulted in significant cost savings: _____

SIGNATURE OF CONTRACTOR'S REPRESENTATIVE DATE

DOT 410-029 (sheet 2)
Revised 8/92

WHITE – CHIEF CONSTRUCTION ENGINEER CANARY – DISTRICT PINK – CONTRACTOR

Washington State Department of Transportation

Inspection of Federal-Aid Projects

Washington Division	Report Number	Date of Inspection	Federal-Aid No.
Cont. No.	Project Title		

Type of Inspection	Inspected By	Quality of Work	Progress of Work	Time Elapsed	Work Completed
☐ Interim ☐ Final	☐ Region ☐ Construction Office	☐ Satisfactory ☐ Unsatisfactory	☐ Satisfactory ☐ Unsatisfactory	%	%

Inspection Made By	In Company With

Remarks:

DOT Form 422-100
10/94

Washington State Department of Transportation

Final Acceptance of Federal-Aid Interstate Projects

Washington Division	Cont. No.	Federal-aid No.	Date of Final Inspection Report
Date Contract Started		Date Contract Completed	Acceptance by Contracting Agency
Project Title			
Scope of Project			

Note: FHWA 47 ☐ Submitted ☐ Not Required

There is compliance with seciton 1.23 of the Regulations pertaining to encroachments on the right-of-way.

Remarks: Procedures and controls were sufficient to assure that this project has been completed in conformance with the approved plans and specifications including authorized changes and extra work.

I recommend that project closing procedures be implemented.		Accepted by:	
Signature		Signature	
Title	Date	Title	Date

DOT Form 422-101
10/94

Pile Book

Book Number _____

Contract Number _____

Contract Title _____

Structure _____

Washington State Department of Transportation

DOT Form 450-004X Metric
12/95

Contract Number	Pile Number
Structure	Date Driven
Location	Cut Off Elevation
Type Hammer	Ground Elevation
Leads	Final Tip Elevation
Type Pile	Length in Lead
Pile Size	Cut Off
Date Pile Inspected	Pay Length

Jet Drill	Drive Tip Elev.	"C"	Blows/ 300 mm	Brng Tonnes	Time	Remarks
						Inspected

Washington State
Department of Transportation

Monthly Progress Sampling & Inspection Report

Sheet No. _____ of _____

Month _____, 19____

District No. _____

Cont. _____ SR ____ _____ Proj. Engr. _____

DATE	TYPE OF INSPECTION AND LOCATION	PROG. SPLE. NO.	REMARKS

DISTRIBUTION:
Hqs. Mat'ls. Laboratory
Dist. Oper. Engr.
Proj. Engr.

Dist. Soils Engr. _____

Progress Inspector _____

DOT 350-054
Revised 8/92 Frame

Washington State Department of Transportation

M / D / WBE On-Site Review

	Federal Aid #
Prime Contractor	Contract #
Subcontractor	District
Project Engineer	☐ MBE ☐ DBE ☐ WBE

1. Per the condition of award, indicate M/D/WBE work observed this date (note partial items).

Bid Item No.	Approximate % Complete	Item Description (Note partial items)	Dollar Amount

2. M/D/WBE Subcontractor's Start Date | 3. WSDOT Contract Percent Complete | 4. Anticipated Completion Date

5. Subcontractor's ☐ Site Superintendent ☐ Foreman (Name) | 6. Exclusively Employed by the M/D/WBE Contractor ☐ Yes ☐ No

6a. If No, Please Explain

7. Is Superintendent/Foreman Shown on M/D/WBE's Payroll? ☐ Yes ☐ No | 8. Is Superintendent/Foreman Shown on any other On-Site Contractor's Payroll? ☐ Yes ☐ No

8a. If Yes, Please Explain

9. If known to whom does the M/D/WBE's Superintendent/Foreman directly report to within his/her own organization?
Name Title

10. List Names of M/D/WBE's Crew as Observed. Indicate the Craft (Use additional sheets, if needed)

11. Are any Crew Members on the Prime or any Other Project Subcontractor's Payroll(s)? ☐ Yes ☐ No | 11a. If Yes, Please Indicate

12. List M/D/WBE's Major (Self-Propelled) Equipment Used

13. Does Equipment have M/D/WBE's Markings or Emblems? ☐ Yes ☐ No | 13a. If No Please Indicate

14. Equipment ☐ Owned ☐ Leased From | 15. Has any Other Contractor Performed, on behalf of M/D/WBE, Substantial Amount of Work Designated to the M/D/WBE? ☐ Yes ☐ No

15a. If Yes, Please Explain

16. Has the Minority/Woman Owner been Present on the Job Site? ☐ Yes ☐ No What % _____ | 17. Are Personnel and Equipment Under Direct Supervision of the M/D/WBE Subcontractor? ☐ Yes ☐ No

18. Does the M/D/WBE Subcontractor Appear to have Control over Methods of Work on its Items? ☐ Yes ☐ No

Comments

Note: Attach any Documents pertinent to the review, i.e., Invoices, Photographs, Daily Reports, Correspondence, etc.

Review Conducted By _____ Date of This Review _____

DOT Form 272-051
Revised 8/93

Distribution: White - Project Engineer, Pink - District EEO Officer, Canary - Headquarters EEO Office, Goldenrod - OMWBE

Washington State Department of Transportation

Proposed Mix Design

Structural Concrete: Section 6-02

From Contractor: _____ by (signature) _____

To WSDOT Project Engineer: _____

The following mix design is proposed for use on:

Contract No: _____ **Contract Name:** _____

for concrete Class: ❒ 20 ❒ 28 ❒ 28P* ❒ 28D* (check one only)

To be used in **Bid Items**: _____ It is proposed for supply from: _____ (supplier) _____ (plant location) and for use under (Section 6-02.3(2)A Contractor Provided Mix Design) (Section 6-02.3(2)C Contracting Agency Provided Mix Design).

Designated Mix Design No: ( ) ( )

	Contractor Provided Mix Design Spec. Ref. 6-02.3(2)A	**State Provided Mix Design** Spec. Ref. 6-02.3(2)C
Cement	Type II _____ kg/cu m Type I P(MS) _____ kg/cu m	Type II _____ kg/cu m *Type I P(MS) _____ kg/cu m
Fly Ash	_____ kg/cu m	*_____ kg/cu m
Microsilica	_____ kg/cu m	*_____ kg/cu m
Fine Aggregate	Pit Number: _____ Class 1 _____ kg/cu m Class 2 _____ kg/cu m	Pit Number: _____ Class 1 _____ kg/cu m
Coarse Aggregate	Pit Number: _____ (ssd) kg/cu m WSDOT No. 2: _____ WSDOT No. 4: _____ WSDOT No. 5: _____ WSDOT No. 6: _____ AASHTO No. 467: _____ AASHTO No. 57: _____ AASHTO No. 67: _____ AASHTO No. 7: _____ AASHTO No. 8: _____	Pit Number: _____ (ssd) kg/cu m WSDOT No. 2: _____ WSDOT No. 4: _____ WSDOT No. 5: _____ WSDOT No. 6: _____
Water (Max)	_____ kg/cu m	_____ kg/cu m
Water Cement Ratio	_____ Max	_____ Max
Water Reducer	_____ ml/kg	_____ ml/kg
High-Range Water Reducer	_____ ml/kg	_____ ml/kg
Air Entrainment	_____ ml/kg	_____ ml/kg

Project acceptance is based on certified conformance to the proportions listed, conformance to contract required properties, and subject to provisions for required compressive strength.

*State provided Class 28P and 28D mixes.

Reviewed by: PE Signature: _____ Date: _____

Mix Design Average 28-day Compressive Strength _____ kPa. Attach Laboratory Test Reports.

Comments:

DOT Form 350-040 Metric Revised 4/96

Distribution: Original to Contractor OSC Materials Region Materials Project Inspector

Washington State Department of Transportation

Contract Materials Checklist

Contract Number	SR	Federal Aid Number
Project Title		

	Yes	No*	N/A	Item(s)
1. All items on ROM have approved sources, including items added by C.O.		**		
2. Approved sources were used for all items and source used is documented.		**		
3. Use of approved proprietary products and QPL items is documented.				
4. Change of Source letters were initiated when required (see 3-1.7 Constr. Manual).				
5. Acceptance Sample testing frequency is adequate with final quantities considered.		**		
6. Assurance and verification of sample testing frequency is adequate with final quantities considered.				
7. Acceptance Sample Test results produced satisfactory correlation with assurance test results.		***		
8. Acceptance sample test results produced satisfactory correlation with IAS test results.		***		
9. All independent Assurance Samples are on file.				
10. Justification is provided for all material which was accepted and incorporated into the project but which failed to meet specifications when tested.		**		
11. Was credit received for any non specification material used?		**		
12. All required approved catalog cuts are on file.		**		
13. All required documentation for inspected Items Acceptance IIA) is on file.		**		
14. IIA quantities match the final quantities.		**		
15. All required Manufacturers Certifications and Mill Certifications are on file.		**		
16. The manufacturers Certification quantities match the final quantities.		**		
17. Minor quantities are documented.				
18. All material acceptance actions have satisfactory test results or other approved documentation prior to payment for the work.				
19. Pavement and Surfacing depths meet plan requirements.				
20. Pavement and Bridge widths meet plan requirements.				

* All "No" checks constitute materials certification deficiency. These each require a comment or an explanation by the Project Engineer and an attachment to the Certification of Materials detailing the circumstances.

** These deficiencies reflect acceptance of non specification materials and may result in loss of participation on Federal Aid Contracts.

*** Follow up documentation for questionable and excessive deviations is attached.

Comments: (Use additional Sheet if necessary)

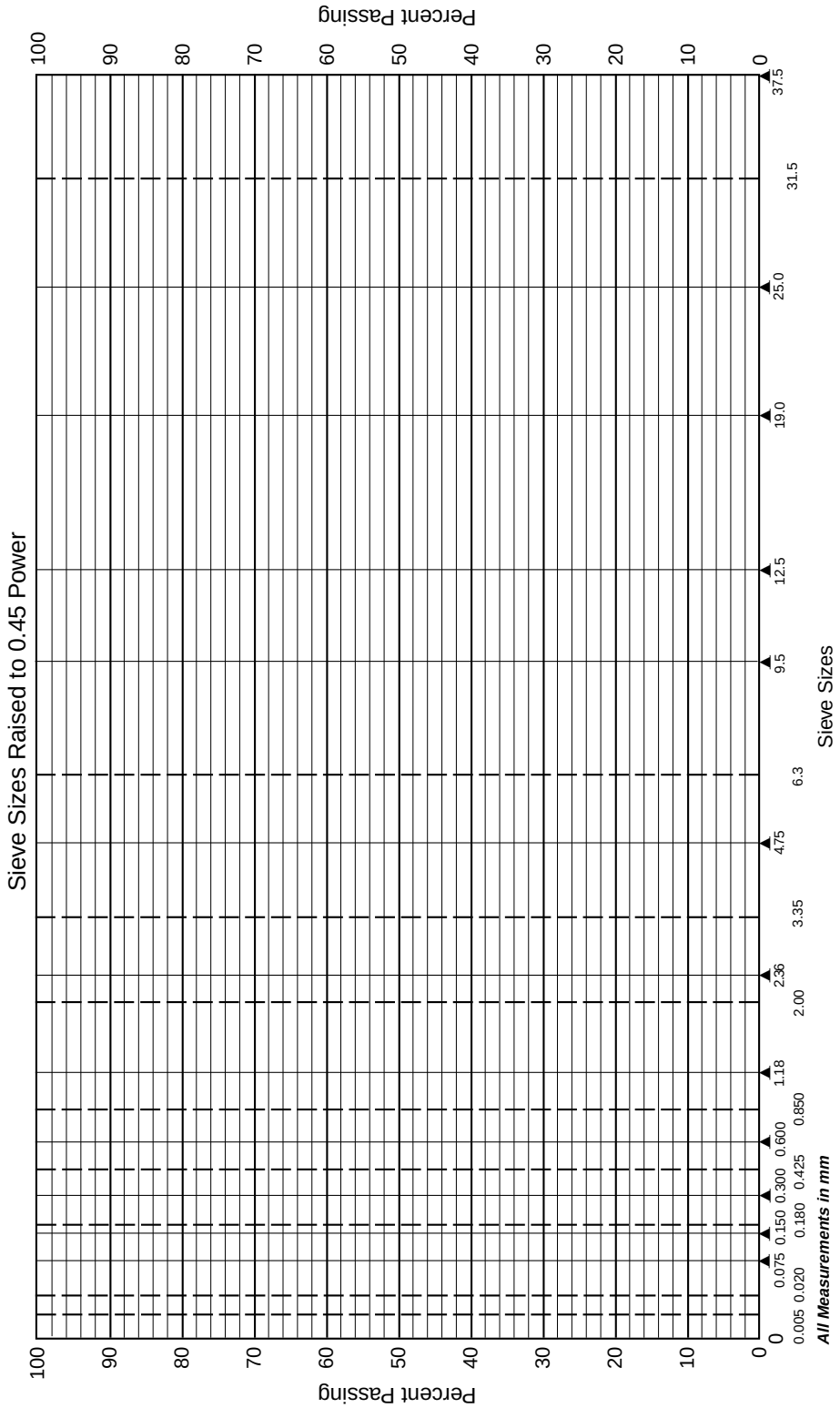
Project Engineer Signature — Date

Construction/Operations Engineer Signature — Date

DOT Form 350-115 EF
Revised 11/94

Washington State Department of Transportation

Gradation Chart



▲ This symbol identifies simplified practice and compatible sieve sizes

Identification of gradations:

Sheet No.
Date

DOT Form 350-564 Metric
Revised 1/96

Washington State Department of Transportation

Log of Test Boring

____ S.H. ____ S.R. _____ Section _____ Job No. _____

Hole No. _____ Sub Section _____ Cont. Sec. _____

Station _____ Offset _____ Ground El. _____

Type of Boring _____ Casing _____ W.T. El. _____

Inspector _____ Date _____ Sheet _____ of _____

Depth	Blows/ 300 mm	Profile	Sample Tube Nos.	Description of Material

DOT Form 351-003X Metric
Revised 12/95

Copy to _____

Hole No. _____ Sub Section _____ Sheet _____ of _____

Depth	Blows/ 300 mm	Profile	Sample Tube Nos.	Description of Material

Washington State Department of Transportation

Final Contract Voucher Certificate

Contractor			
Street Address			
City	State	Zip	Date
State Project Number	Federal-Aid Project Number		Highway Number
Job Description (Title)			
Date Work Physically Completed	Final Amount $		

Contractor's Certification

I, The undersigned, having first been duly sworn, certify that I am authorized to sign for the claimant; that in connection with the work performed and to the best of my knowledge no loan, gratuity or gift in any form whatsoever has been extended to any employee of the Department of Transportation nor have I rented or purchased any equipment or materials from any employee of the Department of Transportation; I further certify that the attached final estimate is a true and correct statement showing all the monies due me from the State of Washington for work performed and material furnished under this contract; that I have carefully examined said final estimate and understand the same and that I hereby release the State of Washington from any and all claims of whatsoever nature which I may have, arising out of the performance of said contract, which are not set forth in said estimate.

X _____
Contractor Authorized Signature Required

_____
Type Signature Name

Subscribed and sworn to before me this _____ day of _____ 19 _____

X _____ Notary Public in and for the State of Washington,

residing at _____.

Department of Transportation Certification

I, certify the attached final estimate to be based upon actual measurements, and to be true and correct.

Approved Date _____

X _____
Project Engineer

X _____
Regional Administrator

Oympia Service Center Use Only

Date of Acceptance _____ By X _____

This Final Contract Voucher Certification is to be prepared by the Engineer and the original forwarded to the Olympia Service Center for acceptance and payment.

Contractors Claims, if any, must be included and the Contractors Certification must be labeled indicating a claim attached.

DOT Form 134-146 EF Revised 1/95 Distribution: White - Olympia Service Center Canary - Region Pink - Engineer Goldenrod - Contractor

Washington State Department of Transportation

Request for Approval of Materials Source

Contract: _____ (_____) ; F.A. Number _____ ; SR - _____ Date _____
For PE Use

Section _____ ; County _____

Contractor _____ Submitted By _____
Signature

See Section 1-06.1 of Std. Spec. and reverse side for instructions.

CONTRACT BID ITEM		SOURCE		For WSDOT Use		
BID NO.	MATERIAL OR MANUFACTURER'S PRODUCT/TYPE	NAME OF MANUFACTURER/FABRICATOR OR PIT NUMBER	SPECIFICATION REFERENCE	P.E. APPR'L CODE	HQTR. APPR'L CODE	FILE NO.

PROJECT ENGINEER	DATE	HQ'S MATERIALS ENGINEER	DATE

Approval Action Codes for use by Project Engineer and HQ Materials Laboratory

1. Source Approved: Acceptance based upon 'Satisfactory' Test Report fore samples of materials to be incorporated into project.
2. Source Approved: Submit Mfg. Cert. of Compliance for 'Approval' prior to use of material.
3. Source Approved: Submit Catalog Cuts for 'Approval' prior to use of material.
4. Source Approved: Submit Shop Drawings for 'Approval' prior to fabrication of material.
5. Source Approved: Only materials identified 'Approved for Shipment' by WSDOT Fabrication Inspection Office *prior to shipment* to be used.
6. Source Approved: Materials to be certified as either 100% American manufacturer or identification of foreign manufacturer and materials cost within the permissible limits for the project (See Special Provisions).
7. Approval Pending: Request Transmitted to Hdqtr. Lab. for Approval Action.
8. Source Approved:

Remarks:

Approval Action Codes for Headquarters Laboratory use – only

9. Source Approved: Approval of Change of source must be secured from Headquarters Materials Engineer per Std. Specifications.
10. Approval Withheld: Submit samples for preliminary evaluation.
11. Approval Withheld:
12.

Remarks:

Project Engineer Distribution
Contractor ✓_____
Dist. Oper. Engr. ✓_____
Dist. Mats ✓_____
HQ. Mats Lab (Docum) ✓_____
( ) Mandatory Distribution

Headquarters Materials Engineer Distribution
HQ Mats Lab (General File) ✓_____
HQ Mats Lab (Elec) (all E & S Codes) _____
HQ Mats Lab (Asphalt) (all B codes) _____
Seattle Insp. Office (all 5 codes) _____
Project Engineer _____
Other _____

Supersedes Previous Editions

DOT 350-071
Revised 8/92

Washington State Department of Transportation

Contractor and Subcontractor or Lower Tier Subcontractor Certification for Federal-Aid Projects

(Required for each subcontractor or Lower Tier Subcontractor on all Federal-Aid projects)

Contract Number	Federal-Aid Number	State Route Number

Subcontractor or Lower Tier Subcontractor

To be signed by proposed subcontractor or lower tier subcontractor

The contract documents for this subcontract include as part of the subcontract a special provision entitled "Required Federal-Aid Provisions", the "Required Contract Provisions Federal-Aid Construction Contracts (FHWA 1273)", and the minimum wage rates.

I certify the above statement to be true and correct.

Company _____

By _____ Date _____

Title _____

Contractor Certification

To be completed and signed by the contractor

1. ☐ A written agreement has been executed between my firm and the above subcontractor.

2. ☐ A written agreement has been executed between (the subcontractor) _____ and the above lower tier subcontractor.

All documents required by the special provision entitled "Required Federal-Aid Provisions" are included in the agreement for (1) or (2) marked above.

I certify the above statements under Contractor Certification to be true and correct.

Company _____

By _____ Date _____

Title _____

DOT Form 420-004
Revised 10/94

RELEASE - RETAINED PERCENTAGE (EXCEPT LANDSCAPING)

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

CONTRACTOR _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____ DATE _____

STATE PROJECT NUMBER	FEDERAL-AID PROJECT NUMBER		HWY. NO.	ESTIMATE NUMBER

JOB TITLE:

REQUEST

The undersigned Contractor hereby requests that payment be made of all amounts retained except for moneys earned on landscaping.

This request is made in accordance with R.C.W. 60.28.010 which includes the following:

"Provided, further, that the Commission, thirty days after completion and acceptance of all contract work other than landscaping, may release and pay in full the amounts retained during the performance of the contract (other than continuing retention of five percent of the moneys earned for landscaping) subject to the provisions of R.C.W. 60.28.020."

All contract work other than landscaping has been completed and accepted. Retainage eligible for release $

FOREGOING APPROVED

Date _____ 19 _____

SURETY

_____
CONTRACTOR

By _____
ATTORNEY-IN-FACT

By _____
AUTHORIZED SIGNATURE

THIS AREA FOR DEPARTMENT OF TRANSPORTATION USE ONLY

R.C.W. 60.28.010, Sec. 1, Para. (b)

1. AMOUNT OF LANDSCAPING MONEYS EARNED TO DATE $ _____
2. REMARKS: _____

APPROVED _____
PROJECT ENGINEER DATE

RECOMMENDED FOR APPROVAL
DISTRICT ADMINISTRATOR

By _____
TITLE DATE

DATE _____ 19 _____

APPROVED

_____
Construction and Materials Group

DISTRIBUTION: Original & Green - Headquarters Canary - District Construction Engineer Pink - Project File Goldenrod - Contractor

DOT Form 421-009
Revised 2/88

Washington State Department of Transportation

Request to Sublet Work

☐ Subcontractor ☐ Lower Tier Subcontractor

Prime Contractor	Federal Employer I.D. No. *	State Contract No.
Job Description (Title)		Request No.

Approval is Requested to Sublet the Following Described Work to:

Subcontractor or Lower Tier Subcontractor			Federal Employer I.D. No. *
Address			Telephone No.
City	State	Zip	Estimated Starting Date
If Lower Tier Subcontractor, ID of Corresponding Subcontractor			** If no Federal Employer ID Number, Use owner's Social Security Number*

Item No.	Partial	Item Description	Amount

I understand and will insure that the subcontractor will comply fully with the plans and specifications under which this work is being performed.

Prime Contractor Signature Date

This Area for Department of Transportation Use Only

Percent of Total Contract

This Request _____ %

Previous Requests _____ %

Sublet to Date _____ %

☐ DBE ☐ MBE ☐ WBE

Remarks:

☐ Approved

Project Engineer Date

Approved District Construction Engineer (when required) Date

DOT Form 421-012X Revised 4/94

Distribution: White - District Canary - Project Engineer Pink- Contractor

Washington State
Department of Transportation

Contractor's Daily Report of Traffic Control - Summary

Page One

Contract Number _____ SR Number _____ Day _____ Date _____

Photos/Videos taken today for record? ☐ Yes ☐ No

If yes, note locations:

Summary of TCS Activities:

Contractor

Contractor's Traffic Control Supervisor's Signature

WSDOT Project Office
Comments:

To be Completed by Contractor's Traffic Control Supervisor (TCS)

DOT Form 421-040A
2/94

Distribution: White - Contractor Canary - Project Engineer

Washington State Department of Transportation

Contractor's Daily Report of Traffic Control - Traffic Control Log

Use Separate Sheet for Each Setup
(May be altered to record Class A signs.)

Page _____

Contract Number _____ SR Number _____ Day _____ Date _____

Setup

	Station - Time	Station - Time	
◇	—	—	◇
◇	—	—	◇
◇	—	—	◇
◇	—	—	◇
◇	—	—	◇

Work Area

◇	—	—	◇
◇	—	—	◇
◇	—	—	◇
◇	—	—	◇
◇	—	—	◇

↑ One Way Traffic (one or more lanes) ↑

↓ Two Way Traffic (two or more lanes) ↑

Legend

(List of Signs Used)

1 _____
2 _____
3 _____
4 _____
5 _____
6 _____
7 _____
8 _____

Cones ☐ Yes ☐ No

Piloted ☐ Yes ☐ No

Per Approved Plan ☐ Yes ☐ No

Flagger(s)	Start	End

_____
Contractor

_____
Contractor's Traffic Control Supervisor's Signature

Type of Traffic Control	Time Set Up	Time(s) Checked	Time Removed

To be Completed by Contractor's Traffic Control Supervisor (TCS)

DOT Form 421-040B
Revised 10/95

Distribution: White – Contractor; Canary – Project Engineer

CONTRACT PROGRESS SCHEDULE

PROJECT TITLE	SR NO.	CONTRACT NO.

SHOW DATE CONTRACT TIME STARTS

WORKING DAYS

ITEMS	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
1																					
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					
13																					
14																					
15																					
16																					

INSTRUCTIONS:
1 *Show date Contract Time Starts.*
2 *Fill in pertinent items for the contract; such as, clearing & grubbing, grading & draining, surfacing, CTB, paving or oiling, bridge excavation, bridge substructure, bridge superstructure, miscellaneous items.*
3 *Show by pencil or color the number and sequence of working days allotted to each item shown.*
4 *Submit one copy to Project Engineer.*

NOTE: Use two or more sheets if necessary for working days or items.

CONTRACTOR _____

BY _____

DATE _____

DOT FORM 421-506
REVISED 9/87

MONTHLY EMPLOYMENT UTILIZATION REPORT WORKSHEET

Craft: _____

REPORTING PERIOD	NUMBER OF EMPLOYEES			WORK HOURS OF EMPLOYMENT (Federal & Non-Federal)			WORK HOURS PERCENTAGE		COMPLIANCE	
	TOTAL	MINORITY	FEMALE	TOTAL	MINORITY	FEMALE	MINORITY	FEMALE	YES	NO

DOT FORM 272-054
5/84 -1016

Washington State Department of Transportation

Affidavit of Amounts Paid DBE/MBE/WBE Participants

July 1, _____ thru June 30, _____ (Fiscal Year) or Completion Date _____ (Final)

State Contract No.

Contractor

Federal Employer I.D. No.

DBE/MBE/WBE Participant Name and Federal Employer I.D. No.	DBE, MBE or WBE	Ethnic Code	Contract Type	Bid Item No.(s)	Amount Paid Participants (Including Retainage Held) $

Ethnic Code:
B = Black
H = Hispanic
A = Asian Pacific
X = Asian Indian
I = Native American
O = Other

Contract Type:
S = Subcontractor
M = Manufacturer
J = Joint Venture
A = Lower Tier Subcontractor
R = Regular Dealer
V = Service Provider

Total DBE/MBE Participation Achieved
$

Total WBE Participation Achieved
$

Affidavit

I, the undersigned, do hereby certify that in connection with all work on the project for which this statement is submitted, each DBE/MBE/WBE participant contracted by me has been paid the amounts shown for bid items, or portions thereof listed.

Signature

Title

NOTARY SEAL

Subscribed and sworn before me this _____ day of _____ , 19 _____

X _____ Notary Public in and for the State of Washington

residing at _____

This Form Required from the Prime Contractor on all Projects Annually by the 20th of July and Upon Final Completion of the Project

Distribution: Olympia Service Center Office of Equal Opportunity – White; Regional Oper. Engr. – Canary; Project Engineer – Pink; Contractor – Goldenrod

DOT Form 421-023
Revised 10/94

FEDERAL-AID HIGHWAY CONSTRUCTION CONTRACTORS ANNUAL EEO REPORT

OMB NO. 2125-0019

Report For

JULY _____ 19 ____

1. CHECK APPROPRIATE BLOCK ☐ Contractor ☐ Subcontractor	2. NAME AND ADDRESS OF FIRM	3. FEDERAL-AID PROJECT NUMBER	4. TYPE OF CONSTRUCTION

5. COUNTY AND STATE	6. PERCENT COMPLETE	7. BEGINNING CONSTR. DATE	8. DOLLAR AMOUNT OF CONTRACT	9. ESTIMATED PEAK EMPLOYMENT	
				Month and Year (a)	Number of Employees (b)

10. EMPLOYMENT DATA

JOB CATEGORIES	Table A: TOTAL EMPLOYEES		TOTAL MINORITIES		BLACK *Not of Hispanic Origin*		HISPANIC		AMERICAN INDIAN OR ALASKAN NATIVE		ASIAN OR PACIFIC ISLANDER		WHITE *Not of Hispanic Origin*		Table B: APPRENTICES		ON THE JOB TRAINEES	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
OFFICIALS *(Managers)*																		
SUPERVISORS																		
FOREMEN / WOMEN																		
CLERICAL																		
EQUIPMENT OPERATORS																		
MECHANICS																		
TRUCK DRIVERS																		
IRONWORKERS																		
CARPENTERS																		
CEMENT MASONS																		
ELECTRICIANS																		
PIPEFITTERS, PLUMBERS																		
PAINTERS																		
LABORERS, SEMI-SKILLED																		
LABORERS, UNSKILLED																		
TOTAL																		
Table C																		
APPRENTICES																		
ON THE JOB TRAINEES																		

11. PREPARED BY: *(Signature and Title of Contractors Representative)*	DATE	REVIEWED BY: *(Signature and Title of State Highway Official)*	DATE

This report is required by law and regulation (23 U.S.C. 140a and 23 CFR Part 230). Failure to report will result in noncompliance with this regulation.

Form FHWA-1391 (Rev. 3-92) PREVIOUS EDITIONS ARE OBSOLETE

OMB NO. 2125-0033

U.S. Department of Transportation
Federal Highway Administration

STATEMENT OF MATERIALS AND LABOR USED BY CONTRACTORS ON HIGHWAY CONSTRUCTION INVOLVING FEDERAL FUNDS

ALL — *To be completed by Washington Headquarters Personnel* 2 4 5 8 9 12 13 15 16 18 19 27 28 30 31 33

PART A *To be completed by FHWA or State Highway Personnel (See instructions on reverse)*

STATE*	COUNTY	FEDERAL PROJECT NO.*	URBAN ( ) RURAL ( )

CARD A

ITEM	DESCRIPTION		ROADWAY	BRIDGE *(Over 20 ft)*	DATE STARTED*
	CONSTRUCTION TYPE CODES				
1	LENGTH OF PROJECT	MILES			DATE COMPLETED*
2	FINAL* CONSTRUCTION COST	DOL			TOTAL NO. BRIDGES

PART B *To be completed by; contractor – see instructions on reverse (REMARKS Attach a plain sheet of paper)*

3	**LABOR*** TOTAL PROJECT	TOTAL LABOR-HOURS	GROSS EARNINGS

	ITEM	DESCRIPTION	UNIT	PROJECT QUANTITY
CARD B	4	TOTAL COST OF ALL MATERIALS & SUPPLIES*	DOL.	
	5	PETROLEUM PRODUCTS*	GAL.	
	6	CEMENT	BBL.	
	7		LB.	
CARD C	8	AGGREGATES PURCHASED	TON.	
	9		CU. YD.	
	10	BITUMINOUS MATERIAL	GAL.	
	11	LUMBER	THSD. BD. FT.	
CARD D	12	REINFORCING STEEL	LB.	
	13	STRUCTURAL STEEL	LB.	
CARD E	14	READY-MIXED CONCRETE	CU. YD.	
	15	PREMIXED BITUMINOUS PAVING MATERIALS	TON.	
	16	AGGREGATES PRODUCED	TON.	
	17		CU. YD.	
CARD F	18	MISCELLANEOUS STEEL	LB.	
	19	NOISE BARRIERS	LIN. FT.	
	20	GUARDRAIL	LIN. FT.	
	21	BRIDGE RAIL	LIN. FT.	
CARD G	22	FINAL CONTRACT AMOUNT FOR SIGNS	DOL.	
	23	FINAL CONTRACT AMT. FOR LIGHTING	DOL.	
	24	FINAL CONTRACT AMT. FOR TRAFFIC SIGNALS	DOL.	

CULVERT ITEMS

CARD H — 25 CORR. STEEL CULVERT

SIZE *(In.)*	LGTH *(Lin ft)*

CARD J — 26 CONCRETE PIPE

SIZE *(In.)*	LGTH *(Lin ft)*

CARD K — 27 CLAY PIPE

SIZE *(In.)*	LGTH *(Lin ft)*

CARD L — 28 CORR. ALUMINUM CULVERT

SIZE *(In.)*	LGTH *(Lin ft)*

CARD M — 29 PLASTIC PIPE

SIZE *(In.)*	LGTH *(Lin ft)*

Blocks 48– 70 to be completed by FHWA Washington Headquarters Personnel 48 52 53 61 62 70

*MUST BE REPORTED ON ALL REPORTS REVIEWED BY DATE:

FORM FHWA-47 (Rev. 6–90) PREVIOUS EDITIONS ARE OBSOLETE

INSTRUCTIONS FOR PREPARING AND TRANSMITTING FORM FHWA-47

GENERAL REQUIREMENTS

Form FHWA-47 should be transmitted for each Federal-aid primary, urban and Interstate system project involving construction performed under contract awarded by competitive bidding, except projects for which the total final construction cost of roadway and bridge is less than $1,000,000 or projects consisting primarily of (1) the installation of protective devices at railroad grade crossings, or (2) highway beautification.

Form FHWA-47 should be transmitted with or, if data is already available,in advance of the Final Report required by Federal-Aid Highway Program Manual Vol. 6; CH. 4; Sec. 2; Sub. Sec. 8.

A separate form should be transmitted for each contract except that data for two or more contracts on the same project may be combined when such contracts are completed at approximately the same time. In case of a combination, the earliest starting date and the latest completion date should be reported. Where a single contract covers more than one project, one form may be prepared for each project or for the entire contract, provided none of the data are duplicated. A Form FHWA-47 should not be prepared for a contract covering only the purchase of material but the quantity of material should be reported when subsequently included in a construction project. In all cases, only the original of Form FHWA-47, typed or clearly lettered, and no carbon or photocopies, should be transmitted to the Washington Office.

If nonparticipating work is included in the contract, all data should be combined with the Federal-aid data in preparing the form. Data for any subcontract must be combined by the State or the division office with the prime contract if not so combined by the prime contractor. It will be the State's responsibility to see that all prime contract and subcontract costs, material, and labor-hours have been reported for each contract, and no duplication of data are involved. Quantities of State-furnished materials should be included with contract quantities. and costs of STATE-furnished materials should be added to Item 2 "Final Construction Cost" and also to Item 4 "Total Cost of All Materials and Supplies." All quantities should be reported to the nearest whole unit and only in the units specified . All costs should be reported to the nearest dollar.

Check urban or rural to indicate whether the major cost is for work within an urban area or in a rural location.

All figures should be verified for reasonableness by State highway department and Federal Highway Administration division office engineers. The total material cost and the total labor-hours and gross earnings should bear reasonable relationships to the final construction cost. Also the quantity of each material reported should be reasonable with respect to the size and nature of the contract and with respect to the quantities of other materials. For example, if a large quantity of reinforcing steel is reported with no cement or ready-mixed concrete, an error of omission in reporting would be indicated.

Generally, the total cost of materials, supplies, and labor should be substantially less than the final construction cost, as the latter also includes costs of equipment ownership, overhead, and profit which are not required to be reported. If the final construction cost is less or only a few percent more than the total cost of materials, supplies and labor, the indication is that the contractor suffered a loss on the project or that there is an error in reporting. In such case, if it is determined that the figures reported are correct, a statement should be made on a plain sheet of paper marked "Remarks" to the effect that the contractor actually did suffer a loss, (verify with contractor).

Part A– INFORMATION TO BE SUPPLIED BY FEDERAL HIGHWAY ADMINISTRATION OR STATE HIGHWAY PERSONNEL (FEDERAL-AID HIGHWAY PROGRAM, VOL. 6: CH. 1; SECT. 1; SUB. SEC. 11)

Item 1– "Length of Project." – Report official roadway mileage and official bridge mileage.

Item 2 –"Final Construction Cost" – Show best estimate of Federal and State costs incurred to date for contract items, extra work performed by contractor, and State-furnished materials.

PART B–INFORMATION TO BE SUPPLIED BY CONTRACTOR IMMEDIATELY UPON COMPLETION OF CONTRACT OR PROJECT

Specific Instructions for the Following Numbered Items:
Item 3 – Report total labor-hours worked and earnings of all contractor's employees on the project, including those on operation and maintenance of equipment.
Item 4 – This should be the total cost, at the jobsite, of all construction materials and supplies purchased for and used on the project, including the cost of materials for signing and lighting and the cost of any materials and supplies not specifically listed hereon. Costs of equipment or equipment rental and the cost of operating the equipment, except the costs of fuel and lubricants, should not be included in this item. Small items of equipment such as jackhammers, handtools, repair parts, tires, etc., are not considered to be supplies. Costs of such items and also overhead costs should not be included. The amount included here for aggregates produced should be only the cost paid by the contractor for the aggregates and should not include the costs of excavating, processing, loading and hauling. Wages and labor-hours for aggregates produced should, of course, be included with Item 3.
Item 5 – Report total number of gallons of all gasoline, diesel oil, lubricating oil, and grease for equipment and trucks. For conversion purposes use factor of 8 pounds of grease per gallon.
Items 6 and 7 – Report quantity of cement used on project. Do not report here the cement included in Item 14.
Items 8 and 9 – Report quantity of aggregates purchased from commercial producers, such as sand, gravel, crushed stone, etc. Do not report here aggregates included in Items 14 and 15. Aggregates produced by the contractor shall be reported as Items 16 and 17.
Item 10 – Report number of gallons of bitumens such as asphalt and tar. Do not report here bituminous materials included in Item 15.
Item 11 – Report all lumber products purchased for and used on the project, including plywood and pressed wood, but excluding timber piling, lumber in fencing, guardrail, and signs, and lumber purchased for or used on previous projects and previously reported. The quantity of lumber should be reported as the number of thousand board feet and not as the number of board feet.
Item 12 – Report total number of pounds of reinforcement (plain or coated) for both structures and pavement. Include estimated quantities of reinforcing and prestressing steel in purchased precast units, except concrete pipe reinforcement.
Item 13 – Report total number of pounds of structural steel, steel H-piling, and sheet piling.
Item 14 – Report total number of cubic yards of ready-mixed concrete plus estimated quantity of concrete in purchased precast units, excluding Item 26.
Item 15 – Report total number of tons of bituminous paving mixtures that are purchased in a prepared condition ready for placement as they reach the job.
Items 16 and 17 – Report total quantity of aggregates such as sand, gravel, crushed stone, etc., produced by the contractor.
Item 18 – Report estimated total weight of steel products not appropriate for Items 12, 13, and 25, such as joint devices, tubular piling, etc.
Items 19, 20 and 21 – Report total lengths, in linear feet, of all types of noise barriers, guardrail and bridge rail.*
Item 22 – Report final contract amount for all types of signs including foundations, posts, structural supports, etc. Do not include traffic signals.*
Item 23 – Report final contract amount for highway and bridge lighting including foundations, conduits, standards, wiring, switches, luminaires, etc. Do not include traffic signals.*
Item 24 – Report final contract amount for traffic signals.*
Item 25 – Report, by size, regardless of class, type, gauge or coating, number of linear feet of corrugated steel pipe, structural plate pipe, pipe-arches and arches.
Item 26 – Report, by size, regardless of class, type, gauge or coating, total number of linear feet of plain and reinforced concrete drain and culvert pipe.
Item 27 – Report, by size, total number of linear feet of clay pipe.
Item 28 – Report, by size, total number of linear feet of corrugated aluminum culvert.
Item 29 – Report, by size, total number of linear feet of plastic pipe.

*Quantities of steel, concrete and lumber used in connection with Items 19, 20, 21, 22, 23 and 24 should not be reported unless difficulties are encountered in segregating such quantities from total quantities.

FORM FHWA-47 (Rev. 6-90)

★U.S.GPO:1990-0-261-335/16519

Washington State
Department of Transportation

Summary Report of Acceptance Sampling & Testing

INSTRUCTIONS TO USER:

1. Use separate form for each aggregate type.
2. Form may be used for successive days until full.
3. Indicate evaluation (pass/fail) of results and failing attributes by X.
4. Complete test results shall be included if required by Project Engineer.
5. Circle Independent Assurance Samples.
6. Submit to OSC Materials Laboratory.

SR	Section	Contract No.	Page of
Material Produced from Pit or Quarry Site No.			
Aggregate For	Project Engineer		Region

Complete if required by Project Engineer

Date										
Time										
Tons Produced to Date										
Acceptance Sample No.										
Assurance Sample No.										
	Specs.									
% Passing 63.0 mm										
50.0 mm										
37.5 mm										
31.5 mm										
25.0 mm										
19.0 mm										
16.0 mm										
12.5 mm										
9.5 mm										
4.25 mm										
3.35 mm										
2.36 mm										
2.00 mm										
1.18 mm										
0.60 mm										
0.425 mm										
0.300 mm										
0.180 mm										
0.150 mm										
0.075 mm										
Dust Ratio										
S.E.										
Fracture										
* Sample Passed Y/N										

Indicate failing attributes by X

Copies to:

- ☐ OSC Mats Lab
- ☐ Region Mats } As directed by Region
- ☐ Region Const. } As directed by Region

Inspector Signature _____ Date _____

DOT Form 350-114 Metric
Revised 11/95

Distribution: Original - Project Engineer; Duplicate - Retained

Washington State
Department of Transportation

Certification of Materials Origin

(Required for acceptance of Steel or Iron Construction Materials)

Contact	SR
Section	
Contractor	
Subcontractor / Supplier	
Materials: Bid Item	Quantity
Description	

The following Certification of Materials Origin is made for the purposes of establishing materials acceptance under Contract Provisions entitled "American-Made Materials." Materials as described above are furnished for use in compliance with the certification as noted in 1 or 2 below. Manufacturing processes for the materials are defined on the back of this form.

☐ 1. The materials covered by this certification are American-made with all manufacturing processes entirely within the United States of America.

☐ 2. The materials furnished for this project under this certification contain steel or iron manufactured, all or in part, outside the United States of America.

The description and country of origin of these materials is as follows:

_____

_____

The invoice cost for the above described foreign-made materials is:

_____

_____

_____

I declare under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct.

_____
Contractor / Subcontractor / Supplier (Name)

_____ / / _____
Authorized Corporate Official (Signature) Date Place

DOT 350-109
Revised 8/92 Frame

Side 1 of 2

Washington State Department of Transportation

Order to Suspend Work

Contract No. _____ F.A. No. _____

Highway No. _____

Section _____

Date _____

TO: _____

_____

_____

Dear Sir:
You are ordered to suspend work operations on (date) _____
on the items of work and for the reasons as stated below:

This order is in accordance with Section 1-08.6 of the Standard Specifications.

Very Truly Yours,

_____
Project Engineer

Contractor – White
District Operations Engineer– Canary
Project Engineer – Pink
Maintenance – Goldenrod

DOT 421-006
Revised 8/92 Frame

Washington State Department of Transportation

Order to Resume Work

Contract No. _____ F.A. No. _____

Highway No. _____

Section _____

Date _____

TO: _____

_____

_____

Dear Sir:
You are ordered to resume work operations on (date) _____ on the following items of work and for the reasons as stated below, on which work was suspended (date) _____ :

Number of working days in this suspension period _____

Number of unworkable days and suspension previously reported _____

Total authorized suspensions and unworkable days to date _____
(to be reflected on the next weekly statement of working days)

This order is in accordance with Section 1-08.6 of the Standard Specifications.

Very Truly Yours,

_____
Project Engineer

Contractor – White
District Operations Engineer– Canary
Project Engineer – Pink
Maintenance – Goldenrod

DOT 421-007
Revised 8/92 Frame

NOTE: This Training Program shall be submitted to the Engineer at the Pre-Construction Conference. Failure to provide this Training Program may result in the withholding of progress payments.

TRAINING PROGRAM

If you have assigned training requirements to your subcontractor(s), a separate Training Program must be completed and submitted for each subcontractor. Subcontractor(s) programs must be submitted and reviewed by the prime.

☐ **PRIME** ☐ **SUB** **Contractor Name:**	Federal Employer's I.D. No.*	WSDOT Contract No.

Address	City	State	Zip	Date

Federal-Aid Project No.	Project Title	Trainees Assigned	Trainee Hours Assigned

*If no Federal Employer's I.D. no., use owner's social security number.

I. APPROVAL : Approval is requested to provide training, per Section 1-07.11(7) of the Standard Specification in the following areas:

A Apprenticeship/ Trainee Craft	B Number of Trainees Projected	C Hourly Assignment Per Trainee	D Total Hours Assigned to Craft	E BAT or JATC Approved? Yes/No*	F Estimated Start Date

* IF YOUR ANSWER IS NO, PLEASE REFER TO SECTION III . Apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprentice and Training (BAT), or with the Washington State Department of Labor and Industries Joint ApprenticeshipTraining Council (JATC) will be considered acceptable.

II. AFFIRMATIVE ACTION — This training commitment is not intended and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not. However, the training and upgrading of minorities and women toward journeyman status is a primary objective of this training provision. Accordingly, the Contractor shall make every effort (documentation will be required if non-protected persons are proposed) to enroll minority trainees and women to the extent that such persons are available within a reasonable area of recruitment.

III. PROGRAMS NOT APPROVED BY BAT OR JATC — A detailed breakdown of the hours assinged to the various skills of the trade must be submitted for other than apprenticeship trades. In addition to completing Section I, the Contractor must provide the following standards:

A. Minimum Qualifications — The Contractor shall establish minimum qualifications for persons entering the training program. (No employee shall be employed as a trainee in any classification in which he/she has successfully completed a training course leading to journeyman status or in which he/she has been employed as a journeyman.)

B. Work Skills — An outline of the work processes in which the trainee will receive supervised work experience and training on-the-job and the allocation of the approximate time to be spent in each major process shall be set forth in these standards.

C. Terms of Training — The term of training (the number of hours required for completion to journeyman status — not to exceed 1,000 hours for any one individual) shall be stated in hours.

D. Program Monitoring — The method for recording and reporting the training completed shall be stated herein.

E. Ratio of Trainees — A numeric ratio of trainees to journeyman shall be established. It shall be consistent with proper supervision, training, safety and continuity of employment. The ratio language shall be specific and clear as to application in terms of job site and workforce during normal operations (considered to fall between 1:10 and 1:4).

I understand and will comply fully with the plans and specifications under which this training is being performed, and will report subsequent revisions to the training program as changes occur.

Primecontractor's Signature Date Subcontractor's Signature (If applicable) Date

THIS AREA FOR DEPARTMENT OF TRANSPORTATION USE ONLY		
DISTRICT APPROVAL ☐ APPROVED ☐ DISAPPROVED	DATE	TITLE

The District may approve pre-approved training and apprentice crafts programs if all other Training Provision Program criteria are met.
NOTE: FHWA concurrence is required for final approval of programs proposed under Section III on Interstate contracts only.

FEDERAL HIGHWAY ADMINISTRATION CONCURRENCE		
FHWA APPROVAL ☐ APPROVED ☐ DISAPPROVED	DATE	TITLE

DOT FORM 272-049 REVISED5/90 DISTRIBUTION: White - Hdqtrs. Copy Canary - Dist. Copy Pink - Contractor Copy

Apprentice/Trainee Approval Request

NOTE: This form shall be submitted for each trainee intended for utilization per the Special Training Provision. The Prime Contractor is required to review and submit this form for approval of its subcontractor(s) trainees.

Prime Contractor	Federal Employer ID N(*	WSDOT Contract No.
Subcontractor (If trainee is not employed by prime)	Federal Employer ID N(*	Federal-Aid No.

* If no Federal Employer ID, use owner's Social Security N

APPROVAL REQUEST - Approval is requested to provide training, per our approved Training Program, to the following apprentice/trainee:

Trainee		Job Classification of Trainee	
Social Security Number	Employee Status ☐ New Hire ☐ Up-grade	Hours To Be Trained This Projec	Trainee Start Date
Wage rate	Type of on the job training ☐ Apprenticeship ☐ Other (describe)		

NOTE: MINIMUM WAGE - Trainees shall be paid in accordance with the provisions of RCW 39.12.021, which reads as f

Apprentice workmen employed upon public works projects for whom an apprenticeship agreement has been registered and approved with th State Apprenticeship Council pursuant to chapter 49.04 RCW, must be paid at least the prevailing hourly rate for an apprentice of that trade Any workman for whom an apprenticeship agreement has not been registered and appproved by the State Apprenticeship Council shall be considered to be a fully qualified journeyman and therefore, shall be paid at the prevailing hourly rate for journeymen.

Ethnic Group	☐ Black	☐ Asian	☐ American Indian	☐ Spanish American	☐ Other	Sex ☐ M ☐ F

Good faith effort documentation is REQUIRED if a non-protected person is proposed for training.

Summary of previous training. (Enter amount and type of training previously received by trainee. If known, please indicate other WSDOT contract(s) trainee has been utilized, per the Special Training Provision.) _____

Prime Contractor's Signature Date (Sub) Contractor's Signature Date

THIS AREA FOR DEPARTMENT OF TRANSPORTATION USE ONLY

☐ APPROVED ☐ DENIED

REMARKS: _____

District Approving Authority Date Title

DOT Form 272-050 Revised 5/90 DISTRIBUTION: White - Contractor Canary - District Pink - Headquarters Goldenrod - Trai

FEDERAL-AID HIGHWAY CONSTRUCTION CUMULATIVE TRAINING REPORT

INSTRUCTIONS: This report is to be completed annually by the District EEO Officer summarizing the data found on Form DOT 272-060. This report is due at Headquarters by June 20th. A computer generated report providing the same information as requested may be submitted in lieu of this report.

DIST. _____

REPORTING PERIOD
JUNE 1, 19____ TO MAY 31, 19_____

NUMBER RECEIVING TRAINING DURING REPORT PERIOD

TRAINING CLASSIFICATION	TOTAL EMPLOYEES		TOTAL MINORITIES		BLACK *NOT OF HISPANIC ORIGIN*		HISPANIC		AMERICAN INDIAN OR ALASKAN NATIVE		ASIAN OR PACIFIC ISLANDER		WHITE *NOT OF HISPANIC ORIGIN*		**TOTAL HOURS**
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
EQUIPMENT OPERATORS															
MECHANICS															
TRUCK DRIVERS															
IRONWORKERS															
CARPENTERS															
CEMENT MASONS															
ELECTRICIANS															
LABORERS, BAT/JATC															
LABORERS, NON BAT/JATC															
OTHER SKILLS															
TOTAL															

NUMBER STARTING TRAINING DURING REPORT PERIOD

TRAINING CLASSIFICATION	TOTAL EMPLOYEES		TOTAL MINORITIES		BLACK *NOT OF HISPANIC ORIGIN*		HISPANIC		AMERICAN INDIAN OR ALASKAN NATIVE		ASIAN OR PACIFIC ISLANDER		WHITE *NOT OF HISPANIC ORIGIN*		**TOTAL HOURS**
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
EQUIPMENT OPERATORS															
MECHANICS															
TRUCK DRIVERS															
IRONWORKERS															
CARPENTERS															
CEMENT MASONS															
ELECTRICIANS															
LABORERS, BAT/JATC															
LABORERS, NON BAT/JACT															
OTHER SKILLS															
TOTAL															

NUMBER COMPLETING TRAINING DURING REPORT PERIOD

TRAINING CLASSIFICATION	TOTAL EMPLOYEES		TOTAL MINORITIES		BLACK *NOT OF HISPANIC ORIGIN*		HISPANIC		AMERICAN INDIAN OR ALASKAN NATIVE		ASIAN OR PACIFIC ISLANDER		WHITE *NOT OF HISPANIC ORIGIN*		**TOTAL HOURS**
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
EQUIPMENT OPERATORS															
MECHANICS															
TRUCK DRIVERS															
IRONWORKERS															
CARPENTERS															
CEMENT MASONS															
ELECTRICIANS															
LABORERS, BAT/JATC															
LABORERS, NON BAT/JATC															
OTHER SKILLS															
TOTAL															

NUMBER OF PROJECTS UNDER WAY DURING REPORTING PERIOD AND CONTAINING TRAINING SPECIAL PROVISIONS

NUMBER OF NEW HIRES	NUMBER OF UPGRADES
NUMBER IN APPRENTICESHIP TRAINING	NUMBER IN OTHER ON-JOB-TRAINING

REPORT PREPARED BY (SIGNATURE) AND TITLE OF STATE OFFICIAL	DATE

DOT FORM 272-061 5/87

FOR USE ON CITY/COUNTY
AD AND AWARD PROJECTS

FEDERAL-AID HIGHWAY CONSTRUCTION
ANNUAL PROJECT TRAINING REPORT

SEE INSTRUCTION REVERSE

Prime Contractor _____ State Aid Contract # _____ Federal Aid # _____

Subcontractor (If applicable) _____ Project Engineer _____ Percent Training Complete as of _____

Reporting Period JUNE 1, 19_____ TO MAY 31, 19_____	No. of Trainee(s) Assigned	Training Hours Assigned	*ETHNIC CODE: (B) Black (A) Asian (H) Hispanic (NA) Native American (O) Other (specify)

1 NAME (Last, First)	2 Social Security Number	3 Job Classification	4 Gender Male/ Female	5 * Ethnic Group	6 New Hire Yes/No	7 Hours Assigned	8 Trainee Start Date	9 Apprentice Yes/No	10 Training Hours Completed This Period	11 Training Complete Yes/No
COMMENTS								TOTAL TRAINING HOURS		
REPORT PREPARED BY (SIGNATURE) AND TITLE							DATE			

DOT FORM 272-060A
5/88

PLEASE USE ADDITIONAL PAGES AS NEEDED

Page _____ of _____

Washington State Department of Transportation

ASPHALT CONCRETE PAVEMENT RANDOM SAMPLE WORK SHEET

Region	Date	Contract No.	SR No.	Gauge No.	Project Engineer

Section

Length of Control Lot

Note: Formula used for calculation: $L = \frac{1000}{RW}$

Where: L = Linear meters covered by one tonne of material
R = Rate of spread, kg/m^2
W = Width of spread, meters

Length of Pavement _____ Width = _____

Beginning Station _____ Ending Station _____

Use last 2 digits from todays standard count to enter the random number chart _____

(Refer to WSDOT Test Method No. 716, Construction Manual chapter 9)

(x value)		(length)			(y value)		(width)		
_____	X	_____	=	_____	_____	X	_____	=	_____
_____	X	_____	=	_____	_____	X	_____	=	_____
_____	X	_____	=	_____	_____	X	_____	=	_____
_____	X	_____	=	_____	_____	X	_____	=	_____
_____	X	_____	=	_____	_____	X	_____	=	_____

Beginning Station		Length		Test Station	Offset
_____	+	_____	=	_____	_____
_____	+	_____	=	_____	_____
_____	+	_____	=	_____	_____
_____	+	_____	=	_____	_____
_____	+	_____	=	_____	_____

INSPECTOR _____

DOT 421-026X Metric
Revised 5/95

Washington State
Department of Transportation

Public Liability and Property Damage Insurance Certification

Contract No. _____ F.A. _____ S.R. _____

Name of Project _____

I certify that my costs to provide insurance for the State (and for the State's portion only) as required by Section 1-07.18 of the Standard Specifications for this project: (check one)

☐ Are at no additional cost.

☐ Are _____

☐ Are not identifiable.

I declare under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct.

Date _____

Signature _____

Title _____

Firm _____

To be submitted on all Federal-aid projects.

Distribution: Original - Olympia Service Center Construction Office Copy - Region Construction Office Copy - Contractor

DOT Form 421-025 EF
Revised 11/94

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