# Publications Transmittal

**Transmittal Number** | **Date**  
--- | ---  
09-003 | January 2009  

**Publication Distribution**  
To: All *Construction Manual* holders  

**Publication Title**  
*Construction Manual* - Revision 2009-1  

**Publication Number**  
M 41-01.06  

**Originating Organization**  
Washington State Department of Transportation, and Construction Office through Engineering Publications

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Additional copies may be purchased from:  
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Chapter 1

1-1 General Information

1-1.1 Purpose and Scope of Manual

This manual is published by the State Construction Office primarily as a resource for construction engineering personnel. It is intended as instruction for administering Washington State transportation projects. The manual recognizes established standards and describes accepted engineering practices. The instruction provided by this manual is intended to identify desired results, establish standardized requirements, and provide statewide uniformity in the administration and construction of transportation related contracts.

Construction engineering staff responsible for work on construction contracts will want to be familiar with the guidance and instructions included in this manual. The guidance presented by this manual is intended to complement the requirements of the Standard Specifications and the contract provisions and to promote uniformity of results among all Regions of the Washington State Department of Transportation (WSDOT).

Suggestions for corrections, additions, or improvements to this manual, and to the Standard Specifications or General Special Provisions are welcomed and encouraged. Any means of communication with the Construction Office will be accepted and reviewed promptly.

1-1.2 Definition of Terms

In using this manual, the interpretation of words or terms should be considered the same as set forth under “Definitions and Terms” in Section 1-01 of the Standard Specifications. If a conflict should occur between the guidance or instructions offered by this manual and the specifications or provisions identified in the contract, the latter should always prevail.

1-1.3 WSDOT State Construction Office

The State Construction Office strives for consistent, cost-effective, quality construction through direct support of WSDOT’s Regional construction program. The Construction Office coordinates the development of policies and standards, provides training, guidance, oversight, technical expertise and advocacy, introduces innovation, and coordinates and shares information on construction issues.

1-1.3A State Construction Engineer

The State Construction Engineer reports to the Director of Environmental and Engineering Programs and is assigned the responsibility for all WSDOT contract construction projects, except those contracts executed by the Director of Washington State Ferries Division. The State Construction Engineer is responsible for all matters pertaining to contract administration and represents the Director in managing the performance of these contracts. In addition, the State Construction Engineer acts for the Director in approving increases or decreases of work, changes in the work, changes in materials incorporated into the work, authority to accomplish work by force account, extensions of time, and the assessment of any liquidated damages. The State Construction Engineer is responsible for providing guidance and direction to the Regions and State Construction Office personnel who are investigating construction claims and is responsible for the approval of all claim settlements. The State 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 State Construction Engineer is assisted by three principal assistants for construction as outlined in the Table of Organization shown in Figure 1-1.

1-1.3A(1) Administration

The Construction Engineer, Administration, acts for the State Construction Engineer in setting requirements for contracting, policy, and responding to questions from the regions on all issues pertaining to 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, other public agencies, and at the legislature regarding public contracting issues.

The Construction Engineer, Administration, is assisted by:

- The Assistant Construction Engineer, Administration, who reviews time extensions and liquidated damage assessments, represents the Construction Office on external civil rights issues, and the monitoring of the Apprentice Utilization program. The Assistant Construction Engineer for Administration also acts as liaison to various external stakeholders and suppliers.

- The Documentation Engineer, who provides guidance for contract documentation and contract payments, as well as providing support to Region Documentation Engineers. The Documentation Engineer resolves issues of material documentation deficiencies for all federal aid projects, is responsible for prevailing wage issues, and is also responsible for evaluating the contract for Acceptance.

- The Specification Engineer, who is responsible for maintaining the Standard Specifications, and General Special Provisions, and provides guidance and review in the writing of Special Provisions.

- The Construction Administration Specialist, who is responsible for the Construction Manual. The Construction Administration Specialist also supports the Assistant Construction Engineer, Administration in matters concerning goal setting.

- The Construction Administration Support Engineer, who is the CCIS System Manager, the Construction Office Liaison to MIS, supports the Region and Project Engineer offices by providing training in the use of CCIS, the CCIS Sequel Database, and the Construction Data Mart. This position also maintains the Equipment Rental Rate Blue Book.
1-1.3A(2) Roadway

The Construction Engineer, Roadway, acts for the State Construction Engineer in matters of highway construction such as:

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For the purpose of establishing uniformity between the Regions, the Construction Engineer, Roadway, is responsible for establishing accepted practices for construction, construction engineering, and contract administration for work performed within these fields. Some of these responsibilities 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 State Construction Engineer.

The Construction Engineer, Roadway, is assisted by three professional engineers.

1-1.3A(3) Bridges

The Construction Engineer, Bridges, acts for the State Construction Engineer in such matters as:

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<tr>
<td>Signal Structures</td>
<td>Bridge Approach Slabs</td>
<td>Other Projects As Assigned</td>
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For the purpose of establishing uniformity between the Regions, the Construction Engineer, Bridges, is responsible for establishing accepted practices for construction, construction engineering, and contract administration of work performed in construction of bridges and other related structural construction. Some of these responsibilities include inspecting projects, evaluating reasons for contract changes, approving change orders, conducting or assisting in contract negotiations, acting as a resource to the Regions for resolving construction related problems, investigating complaints and claims, and providing recommendations on major changes to the State Construction Engineer.

The Construction Engineer, Bridges, is assisted by three professional engineers.

1-1.4 Materials

The Materials Engineer acts for the Director of Environmental and Engineering Programs by directing the materials testing, inspecting, and acceptance functions of WSDOT. Subject to the approval of the Director of Environmental and Engineering Programs, 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 Construction Manager 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.

1-1.5 Region Organization

1-1.5A 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 administration, and maintenance of the transportation system within the Region. For the purposes of this manual, the Administrator of the Urban Corridors Office is considered to be a Regional Administrator.

1-1.5B Regional Construction Manager

In supervision of construction, the Regional Administrator is assisted by a Regional Construction Manager. The Regional Construction Manager assigns Project Engineers with appropriate supporting personnel and provides training and guidance to the Project Engineers. It is the responsibility of the Regional Construction Manager to ensure that sufficient personnel are provided on all projects at all times to ensure adequate inspection, documentation, and quality controls. For the purposes of this manual, the Deputy Administrator of the Urban Corridors Office is considered to be a Regional Construction Manager.

1-1.6 Relationship With Other Agencies

1-1.6A Federal Highway Administration

The Federal Government provides transportation funding to Washington State through the Federal Highway Administration (FHWA), a division of the United States Department of Transportation. These funds are subject to applicable Federal law, Executive Orders, regulations, and agreements.

The WSDOT contact with FHWA for Construction Administration matters is the State Construction Office. In preparing and approving Standard Specifications, general special provisions, and this manual, the Construction Office seeks the review and approval of FHWA. Use of approved provisions and meeting the required outcomes described in the manual become the basis of federal reimbursement.
FHWA provides oversight of WSDOT work on some projects and has delegated that responsibility to WSDOT on others. A full discussion of WSDOT responsibilities under Stewardship is included in this Manual (Section 1-3.4).

1-1.6B Local Agencies
Cities, counties, and other municipalities within the state may also perform work funded with Federal dollars. When this happens, the money is passed through the Department of Transportation and we will have entered into agreements with the local agencies to provide services. For example, WSDOT will allow the use of testing facilities by a local agency.

1-1.6B(1) Project Engineer Administering Local Agency Project
Occasionally, a WSDOT Project Engineer may be assigned to provide engineering and inspection services on a local agency project. The duties of the Project Engineer will be determined by the actual contract provisions and by any specific agreement made between the Region administration and the local agency. The provisions of this manual may or may not apply, depending on the situation.

1-1.6B(2) Local Agency Administering Its Project on State Right of Way
In some cases, WSDOT may grant approval for a local agency to construct a facility on State Right of Way using local agency staff and contractors. (For example, a city funded overpass of an interstate). When this happens, a Project Engineer will be assigned to provide oversight of the local agency work. The Project Engineer is expected to assure that the local agency provides the same level of engineering and inspection that State employees would accomplish. While the Local Agency may have different administrative provisions with respect to risk-sharing and submittal requirements, all of the technical aspects of the Standard Specifications and this manual must be met.

1-1.6C Other Federal, State, and Local Agencies
The design and construction of transportation improvements often incorporates locations and features that fall within the jurisdiction of other agencies. It is the policy of WSDOT to cooperate with all agencies as partners in the completion of each project, recognizing and complying with each agency’s legal requirements. The Project Engineer shall cooperate with local authorities to help ensure that the contractor complies with local laws, ordinances, and regulations. However, unless specifically allowed in the statutes and the contract documents, no WSDOT employee shall engage in any kind of enforcement of laws, rules, regulations, or ordinances which are the responsibility of other agencies. As WSDOT attempts to earn confidence and build trust with resource agencies and the public, it is critical that we take the proper actions when we are aware of an issue. When WSDOT employees observe something which is questionable or appears to not be in compliance with local laws, ordinances, and regulations, it shall be brought to the Project Engineer’s attention. The Project Engineer is responsible for bringing it to the Contractor’s attention for proper action. Rely on the Regional and Headquarters expertise and the appropriate agencies when dealing with complex issues such as environmental compliance, safety, or hazardous materials.

1-1.6C(1) Highways over National Forest Lands
WSDOT has entered into a Memorandum of Understanding (MOU) with the United States Forest Service (USFS) and the Project Engineer is required to do the following when performing work on National Forest Service Lands:
1. Represent the department in all matters pertaining to the project.
2. Confirm that the USFS has been notified of the project advertisement and award.
3. Notify and obtain approval from the USFS for any changes in the project that will affect National Forest System Lands, beyond that of the original contract.
4. Notify the USFS when the project nears completion, at which time the USFS will indicate if they choose to participate in the final review of the project.

1-1.7 Relating to the Public
Public confidence is enhanced by WSDOT personnel being responsive to reasonable requests for information, providing timely advanced notice of possible impacts, and reducing inconvenience to traffic while maintaining worker safety. When possible, the Project Engineer should rely on resources such as Regional Public Information Officers and the State Office of Communications and Public Involvement. If there is concern or reason to question the confidentiality or sensitivity of the information requested, consult with your supervisor or seek the advice of the Attorney General’s office.

1-1.8 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 or other regulatory agencies.

The Secretary of Transportation’s Executive Order E 1033.01 provides direction to all WSDOT employees to adhere to the following basic safety provisions in every work activity:
• Participate in your work group safety plan (or Safety Management System for WSDOT Ferries Division employees).
• Look for ways to prevent accidents.
• Immediately identify hazards and safety concerns.
• Always use personal protective equipment.
• Promptly report all injuries.

The Order also states that all employees at WSDOT Ferries Division are already covered and shall continue to be covered by the existing Ferries Division Safety Management System. Therefore:
• All Ferries Division employees will refresh their knowledge of existing Safety Management System procedures and shall follow them accordingly.
Chapter 1

- A concerted effort will be made to address existing and new Safety Management System safety reports in a timely manner.
- All Ferries Division employees shall address issues of concern with existing safety procedures using the existing Safety Management System reporting program.

All other WSDOT employees are covered and continue to be covered by the policies and procedures in the WSDOT Safety Procedures and Guidelines Manual M 75-01, and other related policy documents. Therefore, a pre-activity safety plan is required prior to performing any new field work.

Office staff will conduct a hazard assessment and mitigation plan for all office environments.

Since WSDOT employees on transportation construction projects are routinely exposed to a variety of hazards, they must take adequate safety precautions at all times. The following items represent common activities that workers or work crews may encounter, and should be addressed in pre-activity safety plans as needed.

- 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.
- Aggregate production and material processing plants should be inspected for safety hazards. Corrective measures should be called to the attention of the Contractor or producer. Corrections 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.
- Parking WSDOT vehicles too close to the path of construction equipment, behind standing equipment, or in other hazardous locations is not permitted.
- Where traffic is maintained in work zones, care must be taken to avoid approaching traffic when it is necessary for inspectors and others to step onto or cross the traveled portion of the roadway. Whenever possible, work activities, ingress and egress, should be conducted within the relative safety of the work zone.
- WSDOT employees working on foot in the highway right of way and other areas exposed to vehicular traffic must comply with the high visibility clothing requirements of Section 4.2, Chapter 3, of the Safety Procedures and Guidelines Manual M 75-01.10.
- Where the engineering crew is working adjacent to traffic, without positive barriers, the work area should be marked with proper signs and traffic control devices as shown on the appropriate Traffic Control Plan (TCP). The crew may be protected by a certified flagger or spotter as needed.
- When the engineering crew is working under the protection of the Contractor’s flaggers and signs, other signs may not be needed, but a “STOP”/“SLOW” paddle should be available for use in special situations.

Good communication with the Contractor and Flagger is needed to ensure that they are aware of crew activities within the work zone.
- A survey crew is typically exposed to traffic hazards and should conduct survey work under approved TCPs from the Work Zone Traffic Control Guidelines (M 54-44).
- The Region Traffic Office will assist survey crews with TCPs for situations not covered in this publication.
- During blasting operations, employees are instructed to seek cover at least 500 feet from the location of the blasting.

In addition to the above requirements for workers and work crews, supervisors also have the following responsibilities:

- 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.
- The Division of Occupational Safety and Health requires that every foreman, supervisor, or other person in charge of a crew have a valid first aid card.
- 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.
- When traffic control measures are necessary, approved Traffic Control Plans (TCPs) should be used in conformance with the Manual on Uniform Traffic Control Devices, as adopted by WSDOT. Supervisors should ensure that the appropriate TCP is used and that the necessary signs, devices and equipment are available.

1.1.9 Archaeological and Historical Objects

It is both National and State policy to preserve historical or prehistorical objects and ruins. These objects and ruins may include sites, buildings, artifacts, fossils, or other objects of antiquity that may have particular significance from a historical, cultural, or scientific standpoint.

If provisions for archaeological and historical salvage have not been made in the contract and it appears that significant historic or prehistoric objects or ruins have been or are about to be encountered, the Project Engineer should immediately take steps to preserve and protect the objects or ruins. Once the objects or ruins have been sufficiently protected, the Project Engineer should immediately notify the Region Construction Manager, who will provide any necessary initial assistance to the Project Engineer. Where the Region determines appropriate, the Project Engineer will contact and inform through existing Region environmental staff, the cultural resources consultant, the State Historic Preservation Officer (SHPO), FHWA, and affected tribes of the discovery. The Project Engineer will also help facilitate any on-site meetings for the appropriate parties should either FHWA, SHPO, or the cultural resources consultant believes it necessary.
1-1.10 Construction Work in International Boundary Strip

The International Boundary Commission of Washington, D.C., by treaty with Canada, has the exclusive jurisdiction of the 20-foot boundary strip, 10 feet on each side of the International Boundary. Any construction work within this strip must be with the exclusive permission of the International Boundary Commission (IBC). Boundary monuments are not to be moved or disturbed in any manner without the expressed approval of the IBC. It is expected that permission for all work within the boundary strip will be obtained from the IBC during the design stage of a project. However, it is the Project Engineer’s responsibility to ascertain that permission has, in fact, been obtained from the IBC for all work performed within the boundary strip. The Region shall be immediately notified if, upon construction, it is found that permission has not been obtained to relocate boundary markers or perform construction work in the 20 foot boundary strip.

1-2 Contract Administration

1-2.1 Proposal and Award of Contract

1-2.1A Contract Proposal and Bids

When the design phase of a project is completed and funding has been secured, the public is then notified that WSDOT is ready to accept bids for completion of the work involved. This notice is accomplished by publishing an advertisement for the project, along with an invitation to bid the work, in the “Daily Journal of Commerce”. The advertisement includes a specific date and time for the opening of bids along with the necessary information for obtaining plans, specifications, and bid documents. Once advertised, these plans and specifications are then made available to all contractors who wish to study the project. Contract proposal forms or bid documents are also furnished, but only to those prospective contractors who have been prequalified to bid on the types and quantities of work involved. Once bids have been opened, an announcement in the “Daily Journal of Commerce” will also be made identifying the “Apparent Low Bidder”. Specific information regarding the advertisement phase and bidding procedures can be found in the Ad & Award Manual, M 27-02.

If the Project Engineer determines that prospective bidders may have difficulty locating the project or determining the project limits, the Project Engineer may choose to post the project limits. If this is determined necessary, signs similar to those illustrated in Figure 1-3 should be used.

Section 1-02.4 of the Standard Specifications requires that all requests for explanation or interpretation of the contract documents be submitted in writing. Anytime the answer to a question from a prospective bidder would provide additional information that would not be available to all bidders, the Project Engineer should immediately contact the Region Construction Manager or Region Plans Office in order to facilitate the preparation of an Addendum. Answers to such questions must be provided to all bidders in the same manner. If the question has to do with generic issues such as office procedures (for example, methods of payment calculation or handling requests for information,) the answer may be provided directly to the questioning party without involving other bidders.

All questions from prospective bidders regarding an advertised project should be referred to the Project Engineer listed in the “Notice to All Planholders” for a complete response. The Project Engineer will coordinate the effort to determine if any requested information needs to be addressed by an addendum.

1-2.1B Award and Execution of Contract

Bids for the contract are opened at a public meeting where each prospective bidder’s proposal is read and the Apparent Low Bidder is announced. Within 45 calendar days of bid opening, the proposals will be closely reviewed and the contract will be awarded to the lowest bidder deemed responsive. In accordance with Section 1-03 of the Standard Specifications, the successful bidder is then allowed 20 calendar days to return the signed documents that are necessary to enter into a contract with WSDOT.

The Contract Administration and Payment System (CAPS) Unit of Accountability & Financial Services (AFS) sends the awarded contract to the Contractor for execution within 3 days of award. Additional copies go to the Region, State Construction Office, Bridge and Structures Office, other internal WSDOT divisions and railroads as needed.

After these documents are returned to WSDOT, the contract must be approved and executed. No proposal submitted by a Contractor is binding upon WSDOT prior to the date of execution by WSDOT. No work is to be performed within the project limits or WSDOT furnished sites prior to the execution of the contract by WSDOT. Any work that is performed by the Contractor outside of these areas, or any material that is ordered prior to WSDOT execution, is done so solely at the risk of the Contractor.

In order to ensure 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 CAPS Unit of AFS or (for Region Ad & Award projects) the Region Plans Office will e-mail notification to the office administering the contract (the Regional Construction Manager’s Office, the Director of Terminal Engineering, or the Architecture Office). The CAPS Unit of AFS also notifies, by memorandum, the National Association of Credit Management, and internal interested parties that the contract has been executed and/or the work may proceed.

2. The Regional Construction Manager or a representative should contact the Project Engineer’s office as soon as notification is received. The Project Engineer should then contact the Contractor and provide notification of the execution date. The date, time, and method of notification in all instances should be recorded in the project diary.

3. Following the initial contact, the CAPS Unit of AFS will return fully executed copies of the contract to the Contractor.
1-2.1C Preconstruction Meetings, Discussions

The Project Engineer is required to communicate with the Contractor for the purpose of discussing the project and exchanging a variety of information. Depending upon the complexity of the project, this information can be exchanged 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

If the Project Engineer decides that a formal meeting is necessary in order to successfully begin work on the project, a meeting should be arranged as soon as practical after the contract is awarded and the Contractor has organized for the work.

In the case of a project that includes utilities to be adjusted, relocated, replaced or constructed by a utility, or their contractor, during the performance of the contract, the Project Engineer shall facilitate a mandatory utility preconstruction meeting with the Contractor, all affected utility owners and their contractors prior to any on-site work. The Project Engineer should request assistance from the Region Utilities Engineer for help in getting utilities to attend this meeting. This meeting should include a discussion of all utility work schedules, in order to enable the utilities and the Contractor to coordinate their work, resolve schedule conflicts, and eliminate delays.

All information exchanged should 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 are left to the Project Engineer. As a minimum, the following subject areas should be covered during the preconstruction time period:

- **CONTRACTOR WSDOT RELATIONSHIPS**
  
  The Project Engineer should begin to develop a positive and effective relationship with the Contractor as soon as the contract is awarded. This is also a good time to introduce the concept of “Partnering” if it has not already been introduced on the project. The Project Engineer should strive to create an environment that encourages a cooperative approach to completing the project. This can be helped by beginning the development of 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. The level of authority of each member of the Contractor’s staff, in particular regarding change orders, should be discussed. In addition the methods of establishing the Contractor’s Performance ratings can be reviewed (Manual M 41 40) (see Chapter 1-2.8F of this manual for additional information). The Contractor should also be informed that there is an opportunity to evaluate the WSDOT construction process as well.

- **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 also 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.

- **ORDER OF WORK AND TIME SCHEDULES**
  
  In order for the Project Engineer to set up the required crews, arrange for any special inspections, provide timely reviews of submittals, etc., the project office must be made aware of the contractor’s schedule of work. In addition the contract specifications may include specific requirements for sequencing or durations for some items of work. The contract requirements for progress schedule or time for completion in accordance with Section 1-08, or as amended by the special provisions, can also be discussed.

- **SUBCONTRACTORS AND LOWER-TIER SUBCONTRACTORS**
  
  In accordance with Section 1-08.1 of the Standard Specifications, the Project Engineer needs to become aware of the Contractor’s plans to delegate portions of the work to subcontractors. These plans must conform to the condition of award, if any, related to disadvantaged business enterprise participation. The Project Engineer should explain the requirements and process involved for subcontractor and lower-tier subcontractor approval, including the prevailing wage rate requirements outlined in the contract documents (see Chapter 1-2.6 of this manual), the requirement to verify that each subcontractor meets the responsibility criteria outline in 39.04 RCW and possesses any license required by 19.28 RCW or 70.87 RCW. WSDOT/Contractor/Subcontractor relationships should also be discussed. 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 for submittal to WSDOT or vice versa. Contractor representation should also be discussed. It will be necessary for the Contractor to be represented at the job site at all times, even when there is only subcontractor work in progress.

- **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
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**Preconstruction Communication Checklist**
Chapter 1

The Contractor's safety program should be discussed as outlined in Section 1-2.2l(3) of this manual. 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 workers and WSDOT personnel, such as safety zone requirements, vehicle intrusion protection, fall prevention, closed spaces, hazardous materials, work around heavy equipment, etc., should be addressed. The need for control of speed on all construction equipment should be emphasized.

The Project Engineer should describe WSDOT’s traffic requirements. The Contractor’s Traffic Control Manager (TCM), Traffic Control Supervisor (TCS) and WSDOT’s traffic control contact person should be identified and their responsibilities and authorities clearly stated. Any traffic control requirements that are unique or restrictive should be emphasized and addressed by the Contractor with respect to construction operations. Unacceptable delays to traffic should also be discussed.

The Manual on Uniform Traffic Control Devices, as adopted by WSDOT, is the legal standard for all signing, traffic control devices and traffic control plan requirements on the project. These standards have been incorporated into the project Traffic Control Plans (TCPs.) If the Contractor chooses to use these TCPs, they must be formally adopted in writing as required in Section 1-10.2(2) 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 and their intended locations must be included in the plans. When Flaggers are utilized, they must have a current flagging card and shall be equipped with hard hats, vests, and standard stop/slow paddles as required in Sections 1-07.8 and 1-10.3 of the Standard Specifications. Overuse of flaggers is not appropriate as "catch all" traffic control and should be discouraged. Safety of flaggers, through use of physical protection devices where practical, proper flagging methods and formulating an emergency escape plan, should be emphasized.

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.

If utilities are to be adjusted, relocated, repaired or constructed by the utility during the performance of the contract, the Project Engineer shall facilitate a separate, mandatory, utility preconstruction meeting with the Contractor, the utility, and their contractors.

• SAFETY AND TRAFFIC CONTROL

The Contractor should be reminded of Section 1-06.1 of the Standard Specifications, requiring the Engineer’s approval of all materials prior to their use. In order to expedite these approvals, the Contractor should be encouraged to make these requests as early as possible. The Project Engineer should provide the Contractor with a current copy of the Record of Materials (ROM) for the project. The Project Engineer should discuss the ROM with the Contractor, covering the various requirements for sampling, catalog cuts, shop drawings, certification requirements, etc., which may be needed for approval of materials prior to their use. If the project includes Federal funds, the Project Engineer should discuss the requirements of “Buy America” and WSDOT Form 350-109 EF, Certification of Materials Origin. The requirements of Section 1-06.2 of the Standard Specifications for ongoing acceptance of approved materials prior to their being incorporated into the work, should also be discussed. If fabricated items will be needed, the inspection process for fabricated materials, including shop drawing approvals and notification requirements for fabrication inspectors, should also be outlined. The requirements of Section 1-06.3 of the Standard Specifications that require manufacturer certifications prior to use of the materials should also be reviewed.

The Contractor should be reminded that, in order to avoid deferred progress payments for portions of work not completed, all necessary documentation for approval of materials and required certifications must be received and accepted prior to their use. A method of notification of intent to defer payment should be discussed with the Contractor, and an agreed upon method documented in the project files.

• OTHER SUBMITTALS

Discuss any other submittals that may be needed during the course of 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 Contractor and the Project Engineer should establish communication with the Washington State Patrol (WSP) and local law enforcement agencies. Law enforcement advice about traffic control should be considered. Arrangements for all law enforcement agencies to notify the project office about accidents near, or in, the construction area should be established, if possible. If WSP traffic control assistance is to be used, a general discussion of strategy and responsibilities should be included.

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.

• CONTROL of MATERIALS

The Contractor should be reminded of Section 1-06.1 of the Standard Specifications, requiring the Engineer’s approval of all materials prior to their use. In order to expedite these approvals, the Contractor should be encouraged to make these requests as early as possible. The Project Engineer should provide the Contractor with a current copy of the Record of Materials (ROM) for the project. The Project Engineer should discuss the ROM with the Contractor, covering the various requirements for sampling, catalog cuts, shop drawings, certification requirements, etc., which may be needed for approval of materials prior to their use. If the project includes Federal funds, the Project Engineer should discuss the requirements of “Buy America” and WSDOT Form 350-109 EF, Certification of Materials Origin. The requirements of Section 1-06.2 of the Standard Specifications for ongoing acceptance of approved materials prior to their being incorporated into the work, should also be discussed. If fabricated items will be needed, the inspection process for fabricated materials, including shop drawing approvals and notification requirements for fabrication inspectors, should also be outlined. The requirements of Section 1-06.3 of the Standard Specifications that require manufacturer certifications prior to use of the materials should also be reviewed.

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Advise the Contractor of the requirement to pay prevailing wage rates as identified in the Contract. Advise the Contractor that it is their responsibility to work directly with Washington State Department of Labor and Industries (L&I) for approval of the Statement of Intent to Pay Prevailing Wages. Remind the Contractor that all form submittals, including those of subcontractors, lower-tier subcontractors, and suppliers, should be routed through the Prime Contractor for submittal to WSDOT.

• SUMMARY

While these issues are to be discussed with the Contractor in some manner at the beginning of each contract, the Project Engineer is free to select the most effective method of doing so. A formal preconstruction conference may or may not be the best solution. Perhaps a single meeting is adequate or several meetings may be required. The entire preconstruction communication may also be covered in a short meeting between the Project Engineer and the Contractor. The Project Engineer is responsible to address these subjects, inform the Contractor in some manner and maintain a written summary of the preconstruction meetings or discussions for the contract files.

The Contractor and Project Engineer may be knowledgeable about those normal requirements listed above. In this situation, some items need only be listed in a mailing as a convenience to the Contractor’s staff. Unique features, constructability, and third party coordination should be focused on with as many of the interested parties as can be assembled.

The key is effective communication, getting the right message to the necessary people. Additional meetings may be required as people change, as new facets of the work become imminent, or as the project goes into a second or third season. In order to assist this process, a checklist has been developed as a tool for the project office’s use. It can be used to help identify the issues and track them for completion through the various preconstruction communications. See Figure 1-4.

1-2.2 Project Engineer’s Relationship and Responsibilities

1-2.2A Assignment

The Region will appoint a Project Engineer to act as the authorized representative of the Secretary of Transportation for each contracted project. After the contract has been executed by WSDOT, the Region may provide the Contractor with written confirmation of the name and address of the Project Engineer assigned. (The Region may rely on the special provisions and forego this letter, unless a change is made.) If a letter is sent, the Contractor should be reminded to send all correspondence and forms regarding the project to the Project Engineer.

The Project Engineer is then responsible for enforcement of the contract specifications and provisions and the completion of all 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 Plans, specifications, and all applicable WSDOT policies. The Project Engineer is responsible for keeping complete and accurate records of all construction data and work progress, preparing progress and final estimates, and preparing other records necessary for a complete documentation of the project, including a performance evaluation of the Contractor (see Chapter 1-2.8F).

Changes made to the project or substitutions for work detailed in the contract plans or specifications, must be made in accordance with the requirements of Section 1-04 of the Standard Specifications and the guidance provided by Chapter 1-2.4C of the Construction Manual. The Project Engineer should review the project on a regular basis with the Regional Maintenance personnel so they have an opportunity to present any maintenance problems that may arise.

The Project Engineer must, at all times, stay aware of the design implications of actions taken during construction. Change orders and undocumented field adjustments can affect the design standards utilized. If change orders or field adjustments affect the project design criteria, the changes must be documented, approved and incorporated into the Design Documentation Package. The Project Engineer shall contact the Region Project Development staff for guidance in documenting these design criteria changes.

1-2.2B Responsibility as a Public Official

The Project Engineer is responsible for a project that is affected by Federal, State, Tribal, and local laws, ordinances, and regulations. While no one could be familiar with every requirement, the Project Engineer should seek to understand as much as possible. Beyond that, the prudent Project Engineer will look for guidance and seek information related to whatever current issue is at hand. Legal requirements could affect State employees, those employed by the Contractor in performing the work, the materials to be incorporated, the equipment that is used on the project, or could otherwise affect the conduct of work.

If the Project Engineer discovers that any provision of the contract, plans, or specifications appears to be inconsistent with a law, ordinance, or regulation, the inconsistency should be investigated and, if appropriate, referred to the Region Construction Manager. The Project Engineer should, at all times, strive to comply with all laws, ordinances, and regulations.

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 must attend to any reasonable request of the Contractor, i.e., furnishing grades, stakes, plans, etc., whenever necessary and within reason. In general, the Project Engineer should do all things necessary to enable the Contractor to work to advantage and without delay. The Project Engineer should 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 must ensure that the Contractor performs the work in accordance with the contract provisions, plans, and specifications.

Integrity on the part of all employees is essential. The attitude of the Project Engineer and staff toward the Contractor and the Contractor’s personnel should be one of cooperation, consistent with the requirements of the specifications. It should be recognized that both the State and the Contractor have explicit rights under the contract and that both parties must respect those rights. 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 conflict should occur, the Project Engineer should make every effort to determine the cause of the conflict and make appropriate corrections.

1-2.2D Relationship With Other Government Agencies

Other agencies responsible for such things as flood control, land development, stream navigation, pollution, etc., may be affected by the work. The Project Engineer should attempt to determine that the Contractor has complied with all regulations known to be in effect. The Project Engineer is encouraged to obtain a copy of commitments from the project design file. This should be available from a region or project design office. This file should contain environmental permits, real estate commitments, utility commitments, design deviations, and other good important information. When the Contractor is specifically required by the contract to obtain an approval document from other agencies, the Project Engineer must confirm that the document was received. Other approvals required of the contractor, but not mentioned in the contract documents should be confirmed to the extent that the requirements are known and the confirmation is possible. If a representative of an agency visits the project, the Project Engineer or an inspector should accompany the representative on the visit.

In carrying out construction work in forested areas, the Project Engineer should encourage the Contractor to comply with all Federal and State forest rules and regulations governing the protection of forests and the prosecution of the work within both national and State forests. The Contractor must take all precautions necessary 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. In an agreement with the agency, for each project requiring a Hydraulics Project Approval (HPA) (RCW 75.20.100), the State Department of Fish and Wildlife will issue the permit to WSDOT only and not to its contractor. One representative of the State Department of Fish and Wildlife will be assigned to coordinate requirements with the Project Engineer. The permit is specific to the work provided for in the contract itself and will not cover other work in support of the project, such as operations in Contractor staging areas, material sources, or waste sites. When a Hydraulics Project Approval has been obtained for the project, and the permit has not been incorporated into the contract documents, 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 a new or revised one as appropriate.

The U.S. Department of Labor, Mine Safety and Health Administration, Metal and Non-Metal Mine Health and Safety Division, 3633 136th Place SE, Suite No. 206, Bellevue, Washington 98006, (206) 553-7037, 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 must 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.

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 State Bridge and Structures Engineer. 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 State Bridge and Structures Engineer.

1-2.2E Relationship With Public and Private Utilities

In some cases, utility adjustments will be completed prior to contract work. In other cases, adjustments are to be made concurrently with the work. The Project Engineer and the Contractor should meet with the public utility companies, individuals, and others owning or maintaining utility features within the limits of the highway right of way and confirm the relationship, the terms of the relocation agreements, and the relocation work schedule. Where the feature will require adjustment during construction, notice should be provided far enough in advance to allow the utility to perform the adjustment without affecting the Contractor’s work schedule.

Utilities 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 to their facilities in as timely a manner as possible. 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 and are not planned for relocation but may be affected by the Contractor’s construction activities, the Project Engineer and the Contractor should become familiar with the requirements of RCW 19.122, Underground Utilities. The Project Engineer may wish to obtain copies of the RCW for review at Preconstruction Meetings.

The approximate locations of most existing underground utilities are shown on the contract plans. However, the existence of some underground utilities may not have been known or detected during design. If a one number locator service is available, the Contractor must utilize it in an attempt to locate all affected utility features. If no one number locator service is available, notice shall be provided individually to those owners of underground facilities known to have or suspected of having underground facilities within the area of proposed excavation. Even areas covered by a one number service may contain utilities not included in the service. If the Contractor discovers underground facilities which are not identified, the Contractor shall cease excavating in the vicinity of the facility and immediately notify the owner or operator of such facilities, or the one number locator service.

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. Upon identifying that the contract involves work or involvement by a railroad, the Project Engineer should immediately obtain a copy of the Railroad Agreement or contact the Region Utilities Engineer to determine the status of the agreement and to 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 coordinate and monitor the development and processing of the agreement through the Region Construction and Region Utilities Engineers. Where notices are required, the Project Engineer should ensure that proper notice is provided to the railroad company and that such notice is acknowledged by them. The Project Engineer should work with the Region Construction Manager and Utilities Engineer to resolve any conflicts with the Railroad Company and prevent delays to the Contractor’s operations.
1-2.2G Responsibility for Railroad Encroachment Insurance

Projects which include work on railroad right of way generally require special insurance protection. Pay particular attention to the Contract Special Provisions for project requirements because they vary from project to project. It is the responsibility of the Project Engineer to enforce the provisions. The required insurance documents are to be furnished by the Contractor (usually through the Project Engineer) to the State Accounting Services 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 to the Project Engineer by the State Accounting Services 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 for this relief are specifically set forth in the special provisions of the contract. If the Contractor should make a request for relief, the Project Engineer should contact the Region Construction Manager and Utilities Engineer for guidance and assistance in coordinating this effort with the railroad.

1-2.2H Responsibility for Coordinating Work With Other Contracts

When two or more Contractors, including any utility or their contractor, are working in the same area, Section 1-05.14 of the Standard Specifications will apply. 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 a delay of work is experienced or extra costs are incurred as a result. If an adjacent project requiring coordination is known prior to holding a Pre-Construction meeting, it would be beneficial to invite principals from that project to the meeting.

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

1-2.2I(1) General

All contractors doing work for WSDOT must provide safety controls for the protection of life and health of the Contractor’s employees and other persons, for the prevention of property damage, and for the avoidance of interruptions in the performance of the work under the 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, but with full recognition as to the responsibilities and authorities of those agencies. The Project Engineer will cooperate fully with the responsible agency.

Any violations noticed by the Project Engineer will be brought to the attention of the Contractor for correction. The Project Engineer will also notify the responsible agency (if that action is deemed necessary by the Region Construction Manager) 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 law 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 up to the point where materials leave the quarry area or go into a batch plant. Inspectors from any or all of these agencies may review the Contractor’s operations at any time. (See Section 1-07.1 of the Standard Specifications.) in order to fulfill WSDOT obligations to monitor contract operations in accordance with the above, the following procedures should be followed on both Federal-aid and non-Federal-aid contracts.

1-2.2I(2) Precontract Preparation

- 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.

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

- The project site should be reviewed to identify those aspects of the location that present hazards such as limited sight distance, confined spaces, difficult terrain, extreme temperatures, illegal encampments, or exposure to biological and physical hazards associated with animals or humans.

1-2.2I(3) Preconstruction Duties

As part of the Preconstruction Meetings and Discussions (see Chapter 1-2.1C), the Contractor’s safety program should be discussed. Some of the things that the Project Engineer may want to consider are:

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

- The availability of the safety standards that apply to the contract.
• The accident prevention program of the Contractor — organization, staff, names of responsible individuals, meetings, training, reports, etc. A review of specific areas for which plans are required (especially those also affecting WSDOT personnel). These might include Fall Protection, Confined Spaces, Respirators, Hearing, and Hazardous Materials plans. Implementing a mechanism for employees to report “near misses” and/or work zone accidents.

• The Contractor’s responsibility for seeing that subcontractors comply with safety regulations.

• The Contractor’s plans for meeting specific safety requirements and for eliminating potentially critical hazards on the project for all Contractor employees, Contracting Agency employees, and the public.

1-2.2I(4)  The P.E.’s Role in Safety on the Project

It is difficult to generalize about safety. It’s a judgment call which is dependent on risk, knowledge, authority to direct corrections, etc. As people, professionals and representatives of the State, Project Engineers have an obligation to take action if they become aware of a situation that presents an immediate threat. Project Engineers should advise their employees on what the lines of communication are and what the procedures are for alerting the responsible agencies with regard to serious safety hazards.

Employees should be made aware that the Contractor is obligated to make the work-site safe, to their satisfaction, for inspection activities. Anyone who is uncomfortable with access for inspection should inform their supervisor of the situation and expect resolution. Project personnel should also be made aware of project specific hazards and be trained in specific areas as the project warrants. For example; fall protection, confined space requirements, respirator training, lead paint hazards, hazardous material training, and exposure to medical waste (sharps). It is suggested that the expertise of the Regional Safety Officers or Headquarters Safety Office be utilized as appropriate.

Be aware that the construction contract requires the contractor to perform any measures or actions the Engineer may deem necessary to protect the public, and that the Engineer may suspend work if the Contractor fails to correct unsafe conditions. Project staff should continuously monitor the Contractors’ work activities for potential violations of legal safety requirements, and for any condition that poses an immediate threat to the health of any person. Immediately notify the Contractor upon becoming aware of any such condition.

Additional information, such as safety regulations and Department of Labor and Industry (L&I) contacts, are available on the Internet at www.wa.gov/lni/. Keep in mind that many WSDOT employees are not trained to interpret and apply safety regulations; however, employees need to have a reasonable understanding of what hazards may be encountered on a project. Many, but not all, of the requirements are listed under Chapter 296-155 WAC, “SAFETY STANDARDS FOR CONSTRUCTION WORK” under the various “Parts A through V”.

State L&I offers consultation service (advise is given) and enforcement (assessment of a violation would result in a citation being issued). A listing of phone numbers for the various L&I field offices is as follows:

• REGION 1 Offices
  Bellingham Field Services Location  360 647-7300
  Everett Field Services Location  425 290-1300
  Mount Vernon Field Services Location  360 416-3000

• REGION 2 Offices
  Bellevue Field Services Location  425 990-1400
  Seattle Field Services Location  206 515-2800
  Tukwila Field Services Location  206 835-1000

• REGION 3 Offices
  Bremerton Field Services Location  360 415-4000
  Port Angeles Field Services Location  360 417-2700
  Tacoma Field Services Location  253 596-3800

• REGION 4 Offices
  Aberdeen Field Services Location  360 533-8200
  Longview Field Services Location  360 575-6900
  Tumwater Field Services Location  360 902-5799
  Vancouver Field Services Location  360 896-2300

• REGION 5 Offices
  East Wenatchee Field Services Location  509 886-6500
  Kennewick Field Services Location  509 735-0100
  Moses Lake Field Services Location  509 764-6900
  Yakima Field Services Location  509 454-3700

• REGION 6 Offices
  Colville Field Services Location  509 684-7417
  Pullman Field Services Location  509 334-5296
  Spokane Field Services Location  509 324-2600

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 should be given to their accommodation and safety. Pedestrians are more susceptible to personal injury in work 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 pathways for pedestrians, bicyclists, equestrians, and other non-motorists are safe and well defined. Where walks are closed by construction or maintenance, an alternate walkway should be provided where 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, pedestrians can be diverted across the street by placing appropriate signs at the construction limits and at the nearest crosswalk or intersection. 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. These accommodations for pedestrians and bicycles should be included in Traffic Control Plans.
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. Remember, however, that pedestrians like to “see what’s going on”. Simply denying them access does not, of itself, prevent their encroachment onto the worksite. Sometimes it is advisable to design and construct a pedestrian observation area for this purpose.

1-2.2I(6) Site Cleanup and Removal of Illegal Encampments

Site Cleanup

Some contracts contain specifications for site cleanup. This may include the removal of illegal encampments, unauthorized pedestrians, personal property, refuse, and other biological and physical hazards from the work area. The Contractor is required to perform all necessary work, and to take precautions to maintain the health and safety of all workers and the public, who may be in the work area. It is the responsibility of the Project Engineer to inspect the Contractor’s work and ensure compliance with the contract requirements and with all applicable laws. Each Project Engineer should appoint a contact for encampment removal issues.

The Contractor is required to have a Health and Safety Plan, and to submit the plan to the Project Engineer prior to commencing any cleanup work. The Project Engineer should ensure that the plan is prepared in accordance with contract provisions.

The Contractor will furnish and install “No Trespassing” signs in all areas where pedestrians may be encountered, except where pedestrians are legally allowed. “No Trespassing” signs must be posted no less than 72 hours prior to beginning site cleanup work or any other potentially hazardous work. If the site contains encampments, the signs should be posted at each encampment. The Project Engineer should conduct a site visit in order to verify that the signs are posted correctly and meet the requirements of the contract.

At the time the signs are posted the Contractor should provide written notification to the Project Engineer and local jurisdictions. When the work includes removal of encampments the Contractor should also notify local advocacy groups that site cleanup and removal is scheduled.

After the initial removal of encampments, the Contractor should revisit the area at regular intervals, and if encampments persist, permanently post the area with “No Trespassing” signs and proceed with removal activities.

Immediately prior to commencing cleanup and removal, brush clearing, or other potentially hazardous work, and periodically throughout the day, the Contractor should visually inspect the area to ensure that no unauthorized pedestrians are present. The Project Engineer should verify that the site is cleared of pedestrians and that periodic area checks are being done. Special attention should be given to areas hidden from view, such as in dumpsters or equipment, or under blankets. The Project Engineer may consider the use of non-invasive detection aids, such as infrared detectors, to ensure that no unauthorized persons are present.

Removal, Storage, and Return of Personal Property

Personal property that is not refuse will be removed from the work area, by the Contractor. Items should be placed in large transparent plastic bags, labeled, and stored for return to the property owner. The Project Engineer should ensure that personal property is handled and stored in accordance with the requirements of the contract and all applicable laws.

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. It is important that all key personnel become familiar with the environmental decisions considered during the design process. The contract documents should 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 contract work that may become necessary must also be reviewed to ensure conformance with the original intent, requirements, and commitments established during the environmental design of the project.

1-2.2J(1) Spill Prevention, Control, and Countermeasures (SPCC) Plans

Spill Prevention, Control, and Countermeasures plans are written by the Contractor to prevent, respond to, and report hazardous material spills in a safe and effective manner. SPCC Plans should include information regarding the project site and contractor activities as they relate to spill prevention, control, and response activities. Additionally, SPCC Plans should identify possible sources of hazardous materials, methods to prevent and control spills, and spill response procedures. Plans are written and maintained by the Contractor and are required on all WSDOT projects, regardless of the size or duration of construction activities.

SPCC Plans are applied to the life of a construction project and may need to be amended over time with changing conditions. Periodic inspections will ensure that the required preparation and preventative steps identified in the SPCC Plan have been taken to keep the site in compliance throughout the life of the project.

The Standard Specifications provide the complete list of required contents for the Contractors SPCC Plan in Section 1-07.15(1).
1-2.2K Responsibility for Environmental Compliance During Construction

The following procedure pertains to WSDOT personnel on all WSDOT contracts and contains duties and activities by persons other than the project staff, but all of which are related to construction contracts and affect the Project Engineer to one degree or another. The Project Engineer must stay aware of this procedure and follow it as written.

1-2.2K(1) Environmental Compliance Assurance Procedure

The purpose of the Environmental Compliance Assurance procedure is to recognize and eliminate environmental non-compliance events during the construction phase on Washington State Department of Transportation (WSDOT) construction sites, and to ensure prompt notification to WSDOT management and agencies. For purposes of this procedure, non-compliance events are defined as actions that are not in compliance with environmental standards, permits, or laws.

When any action (Notification Trigger) below occurs or if there are questions about compliance, the Project Engineer (PE) shall initiate this procedure to develop corrective actions to solve the identified problem. The Regional Environmental Manager (REM) will serve as a resource to the PE and give priority to addressing the actions, activities, or situations that stem from notification triggers. The PE and REM will work together on an appropriate response to the notification trigger to avoid or minimize environmental damage.

A. Notification Triggers: “Notification Triggers” (listed below) means an action, activity, or situation that requires the Project Engineer to implement the Environmental Compliance Assurance Procedure.

1. Notice from a resource agency that a violation has occurred;

2. Any action that, in the judgment of the REM, contractor or Project Engineer, may violate environmental permit conditions, agreements, or approvals for the project; or other environmental laws, ordinances, or regulations;

3. Any unauthorized work, activity, or fill in wetlands, shorelines, creek beds (including dry channels), other waters of the state, or critical habitat;

4. Any emergency protection activity that involves unauthorized placement of fill in wetlands, shorelines, creek beds (including dry channels) or waters of the state or for bank stabilization activities where fill or structures are placed on the bank;

5. Any action or project revision requested by an agency after a site inspection that may be in conflict with other permits;

6. Any spill, or release of hazardous materials, petroleum products, or chemicals to:
   - water or areas that have the potential to enter waters of the state (i.e. stormwater conveyances, ditches, swales, ground water).
   - land, when the spill or release is an immediate threat to human health or the environment (i.e. dangerously toxic, explosive or flammable situations that result in severe or substantial consequences, etc.).

7. Any evidence of a release from a buried underground storage tank.

8. Any situation that results in a fish kill, or if dead or dying fish are discovered in the vicinity of the project;

9. Activities that monitoring shows are out of compliance.

B. Notification and Resolution Process: In the event of a notification trigger, the following steps shall be taken:

1. If a notification trigger is observed first by the contractor or REM, the contractor or REM shall immediately notify the Project Engineer.

2. The Project Engineer must:
   - Step 1. Immediately notify the Contractor of the situation, implement emergency response procedures including agency notification, and suspend all non-conforming work on the site.
   - Step 2. Immediately notify the Regional Environmental Manager (REM). Consultation with the REM must occur before any remediation actions are taken.
   - Step 3. In consultation with REM assemble the following information
     - a. The activities that triggered the notification and why they occurred.
     - b. Location of the work.
     - c. Potential solutions to the problem, or if additional investigation is needed, the agreed upon course of action.
     - d. Any related site constraints or safety issues.
     - e. Urgency of the issue
   - Step 4. Notify his or her immediate supervisor.
   - Step 5. Notify the Regional Administrator.
   - Step 6. Consultation with the REM, determine the resource agencies having jurisdiction and who will notify them.
   - Step 7. Document all actions, conversations and activities.

Note: All spills need to be contained and disposed of and reported properly. Follow the procedures outlined in the project specific Spill Prevention, Control and Countermeasures Plan (SPCC).
3. The Regional Environmental Manager must immediately:
   Step 1. *Notify the Director of Environmental Services.
   Step 2. Notify his or her immediate supervisor.
   Step 3. Work with the Project Engineer to resolve the issue that caused the notification trigger.
   Step 4. Identify and obtain appropriate permits or permit revisions with the aid of the Project Engineer.
   Step 5. Document all actions, conversations, and activities. Communicate issues and send appropriate documentation to Regulatory and/or Resource Agencies.

4. *The Director of Environmental Services must immediately:
   Step 1. Notify Compliance Branch Manager and any other ESO Program Managers associated with the resource issue.
   Step 2. Notify Director of Environmental & Engineering Programs.
   Step 3. Notify the Regional Environmental Manager that the Director of Environmental & Engineering Programs has been contacted. Regional Environmental Manager must then notify the Project Engineer that the reporting procedure has been completed.

5. *The Regional Administrator will:
   Step 1. Coordinate with the Director of Environmental & Engineering Programs to contact the Assistant Secretary of Engineering and Regional Operations advising him or her of the situation, and provide updates as needed on the situation.
   Step 2. Ensure that the Project Engineer and the Regional Environmental Manager have the necessary resources, authority and organizational support to successfully resolve the Non-complying activity.

C. **Timing:** Due to costs of project delays, or risk of not acting quickly during emergency situations, the REM shall provide a 24 hour contact person for environmental consultation.

D. **Documentation:**
   1. The Project Engineer shall document the details of the notification and non-complying activity resolution in the contract records.
   2. The Regional Environmental Manager shall maintain a record of all regional non-compliance events. REMs shall collect and maintain, at a minimum, the following data on all non-compliance events:
      a. Project name and Location
      b. PE and Prime Contractor
      c. Incident Date
      d. Incident Description
      e. Permit/Regulation Violated
      f. Resource Agency(s) notified and date of notification
      g. Whether or not resource agency staff conducted site review in response to notification
      h. Record of Notice Of Violation and/or penalties issued

The REM shall provide all regional non-compliance tracking data to ESO Compliance Branch Manager for the purposes of annual reporting and review of compliance performance.

3. The Project Engineer and the Regional Environmental Manager shall coordinate and prepare the appropriate response to the regulatory and/or resource agency. The response shall include documentation about the non-compliance event and how it was resolved, including any preliminary mitigation solutions.

E. **Roles and Responsibilities:**
   1. “Project Engineer” is the person responsible for the project and administration of the construction contract. This responsibility may be delegated to a subordinate employee on site, but the ultimate responsibility for making sure these procedures are followed will be with the Project Engineer. The Project Engineer shall have a thorough knowledge of all of the environmental permit conditions and design requirements for the project, and have such certifications and other qualifications as may be required.
   2. “Regional Environmental Manager” is the person responsible for administering the regional environmental program. This responsibility may be delegated to a subordinate employee with knowledge of environmental permitting and procedures, but the ultimate responsibility for setting and interpreting regional environmental policy will be with the Regional Environmental Manager.
   3. “Contractor” is as defined in Section 1-01.3 of the *Standard Specifications* for Road, Bridge, and Municipal Construction.

*Denotes that the action is mandatory when the non-compliance event 1) results in agency enforcement staff coming on site to conduct enforcement review; and/or 2) there is a high likelihood the event will result in a Notice Of Violation or a monetary penalty.
1-2.2L Responsibility for Posting Required FHWA and State Labor and Industries Job Site Posters

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

- FHWA 1495 and 1495A — Wage Rate Information
- FHWA 1022 — Fraud Notice Poster
- OFCCP-1420 — Equal Employment Opportunity is the Law
- WISHA F416-081-909 — Job Safety and Health Protection
- F242-191-909 — Notice to Employees (L&I)
- F700-074-909 — Your Rights as a Non-agricultural Worker
- EMS 9874 — Notice to Employees (Emp. Security)
- Copy of approved Statement of Intent to Pay Prevailing Wages
- Copy of prevailing wage rates from the contract provisions

If Federal funds are involved, all of these posters are required. If only State funds are involved, the first three do not apply. After contract execution and before work begins, the Contractor should be given a package containing the appropriate required job site posters. This package should also be accompanied by either a written or verbal explanation of the contents and include notification that the Contractor, each subcontractor, and each lower-tier subcontractor will have to post a copy of the State L&I approved Statement of Intent to Pay Prevailing wages. This action shall be specifically noted in the project records.

1-2.2M Responsibilities When Working on Tribal Lands

Indian nations have the political distinction of being sovereign. This is different from being designated as having protected group status based on racial classifications. Being sovereign, tribes have the ability to create and enforce tribal ordinances such as Tribal Employment Rights Ordinances (TERO). These are legal requirements pertaining to work within the boundaries of the reservation which are enforced by the respective tribes. When a contract includes work on a reservation, the project should include a general special provision “Indian Preference and Tribal Ordinances” that alerts the contractor to the possibility that TERO requirements may apply and provides a contact person for the tribe. The provision also reminds the contractor to bid any costs associated with TERO compliance into associated items of work. TERO requirements may take a variety of forms, some of which are listed in the noted provision. The provision also notes that complying with TERO requirements shall not be a violation of the contract equal employment opportunity requirements. The end result is that the contractor is expected to comply with TERO requirements as they would any other legal obligations. The underlying intent is to reduce Indian unemployment and most tribes are willing to work with contractors to best meet this goal. We want to avoid creating any contractual requirements that interfere with their ability to do so. Our role is to assist in communication but not become involved in determining or paying the tax.

1-2.2N Responsibilities Following Unanticipated Discovery of Cultural Resources

Given the wealth of historical and archeological resources found in Washington, the Project Engineer should be familiar with the requirements of the National Historic Preservation Act (NHPA), Standard Specification 1-07.16(4), and any contract specifications regarding the discovery of cultural resources. The Project Engineer should discuss these requirements with the Contractor and WSDOT staff at the Pre-Construction Conference. These resources include, but are not limited to:

- Human skeletal remains,
- Anthropogenic soil horizons (areas showing the influence of humans on nature), occupational surfaces (areas showing evidence of human activity or habitation), midden (refuse heap), etc.,
- Areas of charcoal or charcoal-stained soil and stones,
- Stone tools or waste flakes (i.e. arrowheads or stone chips),
- Bones, burned rocks, or other food related materials in association with stone tools or flakes,
- Clusters of in cans or bottles,
- Logging or agricultural equipment more than 50 years old.

The Project Engineer will include a project-specific unanticipated discovery plan (UDP) in the project provisions for use by the Contractor. A sample of may be found at http://wwwi.wsdot.wa.gov/eesc/environmental/culres/default.htm. The Cultural Resources Office, at the Headquarters Environmental Services Office, will assist with completing the plan.

1-2.2N(1) Discovery of Human Skeletal Remains

The following guidance is given to assist the Project Engineer when construction activities cause disturbance to human skeletal remains. All human skeletal remains, which may be discovered, shall at all times be treated with dignity and respect.

Should any WSDOT employee, contractor, or subcontractor believe that he or she has discovered human skeletal remains; the following steps shall be initiated:

1. Ensure that all work adjacent to the discovery has ceased. The area of work stoppage shall be adequate to provide for the total security and protection of the integrity of the human skeletal remains.
Chapter 1

2. The Project Engineer shall:
   a. Notify the Region Construction Manager.
   b. Immediately notify the local coroner and the local sheriff, or other appropriate law enforcement official, requesting that a person who is competent and qualified to identify human skeletal remains be present. Do not call 911 or the media.
      i. No persons other than the coroner or proper law enforcement personnel, WSDOT Cultural Resources staff, SHPO (State Historical Preservation Officer), and DAHP (Department of Archeological and Historic Preservation) staff will be authorized direct access to the discovery location. This access must comply with all safety and security procedures.
      ii. The coroner will make a determination as to whether the human skeletal remains are forensic (evidence of a possible crime) or non-forensic (historical). If the human skeletal remains are determined to be forensic, the coroner will retain control of the human skeletal remains and the discovery site will be treated as a crime scene. If the human skeletal remains are determined to be non-forensic, the coroner will notify DAHP.
      iii. The DAHP state physical anthropologist will make the initial determination as to whether the human skeletal remains are of Native American ancestry. If the human skeletal remains are determined to be of Native American ancestry, DAHP will notify the affected tribe(s).
   c. Notify the WSDOT Cultural Resource Manager at HQ Environmental Services, who will notify:
      i. FHWA Area Engineer or Environmental Program Manager
      ii. State Historic Preservation Officer (SHPO)
      iii. WSDOT Tribal Liaison Office. The WSDOT Tribal Liaison Office will contact the affected tribe(s) and notify them of the unanticipated discovery.
      iv. Region Environmental Manager
3. If the human skeletal remains are determine to be of Native American ancestry, tribal access will be allowed to the designated representative(s) of the affected tribe(s). WSDOT and FHWA will make a good faith effort to accommodate requests from affected tribe(s) to be present, prior to implementation of mitigation measures. The Project Engineer, WSDOT Cultural Resources, SHPO, and the affected tribe(s), in consultation, will determine what treatment is appropriate. If disinterment of Native American remains becomes necessary, FHWA, WSDOT, SHPO, and the affected tribe(s) will jointly determine the final custodian of the human skeletal remains for re-interment.

1-2.2N(2) Discovery of Other Cultural Resources
The following guidance is given to assist the Project Engineer when construction activities cause the disturbance of cultural resources, other than human skeletal remains.
Should any WSDOT employee, contractor, or subcontractor believe that he or she has uncovered a cultural resource, at any point in the project, the following steps should be initiated:
1. Ensure that all work adjacent to the discovery has ceased.
2. Immediately notify the Project Engineer. The Project Engineer shall immediately notify:
   a. The Regional Construction Manager
   b. The WSDOT Cultural Resource Manager at HQ Environmental Services who will notify:
      i. FHWA Area Engineer or Environmental Program Manager
      ii. State Historic Preservation Officer (SHPO)
      iii. WSDOT Tribal Liaison Office.
      iv. Region Environmental Manager
3. Ensure that the area of work stoppage is adequate to provide total security and protection of the integrity of the resource. Vehicles, equipment and unauthorized personnel will not be permitted to traverse the site, nor will work resume, until treatment of the cultural resource is completed.
4. All archeological deposits discovered during construction are to be treated as if they are eligible for inclusion in the NRHP (National Register of Historical Places). Intentional disturbance of archeological sites without a permit from DAHP is prohibited by RCW 27.35. Disturbance of Indian burials, cairns and glyphs is prohibited by RCW 27.44.
5. If cultural resources are discovered, but additional project effects to the resource are not anticipated, project construction may resume, away from the site of the discovery, while documentation and assessment of the resource proceeds.

1-2.3 Construction Traffic Control

1-2.3A Public Convenience and Safety

1-2.3A(1) General
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 temporary and are, therefore, dangerous and difficult to deal with because they are unexpected and not in accordance 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. It is the Project Engineer’s responsibility to ensure that the Contractor complies.

1-2.3A(2) Work Zone Clear Zone (WZCZ)

When a project requires traffic control, a Work Zone Clear Zone (WZCZ) shall be established and will apply during both working and non-working hours. During non-working hours no equipment or materials shall be within the WZCZ, unless it is protected by permanent guardrail or temporary concrete barrier (location and installation to be approved by the Project Engineer). During working hours, unless protected as stated for non-working hours, only materials or equipment absolutely necessary to construction shall be allowed in the WZCZ or allowed to park on the shoulder of the roadway.

The minimum clear zone distance, measured from the edge of traveled way, shall be based on the posted speed as follows:

<table>
<thead>
<tr>
<th>Posted Speed</th>
<th>Distance From Traveled Way</th>
</tr>
</thead>
<tbody>
<tr>
<td>35 mph or less</td>
<td>10 Ft.</td>
</tr>
<tr>
<td>40 mph</td>
<td>15 Ft.</td>
</tr>
<tr>
<td>45 to 55 mph</td>
<td>20 Ft.</td>
</tr>
<tr>
<td>60 mph or greater</td>
<td>30 Ft.</td>
</tr>
</tbody>
</table>

Any deviation from these requirements shall only be allowed if the Contractor has requested the deviation in writing and the Engineer has provided written approval. The Region Traffic Office should be contacted to help evaluate the deviation and determine if the requested deviation is approvable.

1-2.3A(3) Temporary Breaks in Limited Access for Construction

The Federal Highway Administration (FHWA) cannot delegate its approval authority to add access points to existing limited access controlled Interstate facilities through the WSDOT-FHWA Stewardship Agreement. The FHWA has granted approval to break limited access in order to gain access to the worksite from adjacent properties. This approval was granted through the FHWA approval of Standard Specification Section 1-07.16. This approval does not extend to allowing the contractor to use this access to merge construction vehicles and equipment with public traffic in the traveled way, auxiliary lanes or shoulders. It is therefore necessary to seek approval from the FHWA when proposing to break limited access and merge construction vehicles with public traffic in the traveled way, auxiliary lanes, or shoulders.

Standard Specification Section 1-07.16 allows the contractor to access the worksite from adjacent properties but does not allow the contractor to merge construction vehicles or equipment (including contractor workforce vehicles of any type) from that access with public traffic. Standard Specification Section 1-07.23 allows the Interstate highway system to be accessed through existing facilities or through access points allowed within the contract only. These access points allowed in the contract will either be in the form of site specific traffic control plans or by contract provisions included in the contract documents.

A General Special Provision (GSP) to allow the contractor to merge construction vehicles with public traffic in the traveled way, auxiliary lanes or shoulders may be included in the contract provisions. Consultation with Region and Headquarters Design and approval by the FHWA must occur prior to deciding to include this GSP in a contract on Interstate facilities.

If the contractor proposes to merge construction vehicles with public traffic in the traveled way, auxiliary lanes or shoulders and the contract contains the GSP that allows this access, then the contractor shall submit a site-specific plan for traffic control in accordance with the MUTCD Part VI. The Region Traffic Engineer should review this plan and it should be submitted to FHWA.

During construction on Interstate projects the Project Engineer will notify the FHWA Area Engineer by sending them a copy of the approved vicinity map showing the location of the access break and site-specific traffic control plan. FHWA approval of a PS&E containing this GSP constitutes approval of access from adjacent properties to the traveled way, auxiliary lanes or shoulders.

While some contracts may not contain provisions for breaking limited access for construction and for merging of construction vehicles with mainline and/or interchange ramp traffic, the contractor may request one. If the Region agrees and the project is on limited access controlled Interstate, the FHWA Area Engineer shall be contacted for approval. The contractor shall submit a vicinity map showing the location of the access break, a site-specific plan for traffic control in accordance with the MUTCD Part VI, and the duration for which the accesses will be in operation. On non-interstate limited access controlled facilities, approval will be required by the Region. If approval is granted and the facility is a limited access facility, the GSP will be added to the contract by change order. On all other roadways the Project Engineer may approve the access with Region concurrence.

1-2.3B Public Information and Customer Focus

Most drivers still have the expectation of proceeding to their destination with little or no delay even though traffic conditions on many of our highways are deteriorating, primarily due to increased traffic volume. This increased volume may create congestion, delays, accidents and aggressive driving during normal daily operation. Highway construction will usually require a more restricted roadway to accommodate work zones and can further reduce traffic mobility and safety. Even some of our lower volume rural highways can present a challenge due to factors such as drivers not expecting construction work and seasonal/recreational traffic increases. Construction and user delays present significant costs in addition to costs associated with crashes and worker safety. These delays and costs can be minimized by implementing a traffic control strategy based on traffic conditions and construction requirements, and which includes public information and customer focus considerations.
Our goal on every highway construction project should be to provide the best overall balance of work zone safety and traffic mobility while constructing quality highway projects. Much of our effort is directed at engineering responses to safety and mobility issues and is generally included in the contract requirements. Recent customer focused highway construction studies have shown that accurate and timely project information is a valuable element in an overall traffic control strategy. Advance planning and coordination between the project engineer and contractor is necessary to ensure that there is an opportunity to provide public information for all phases of the project that impact traffic. Proper use of public information and customer focused techniques will provide safety and mobility benefits that would not otherwise be gained, as listed below:

- Alert drivers to potential delays by advance notice through project signing and the news media that would allow drivers to take alternate routes, adjust scheduled trips and have better awareness of traffic impacts and how to avoid them.
- Provide benefits to the Contractor from reduced traffic volume and better driver awareness through fewer crashes, less material delivery delay, better worker safety, fewer complaints and overall public acceptance of the project.
- Achieve better driver acceptance, reduced aggressive driving and improved work zone credibility by minimizing delays and providing accurate and timely information.
- Consider innovative construction techniques and shorter term intense work stages with more severe traffic restrictions, such as weekend closures, if possible.
- Closely monitor traffic conditions when traffic is restricted to determine the need for any traffic control or work hour adjustments that would improve traffic flow. Specified working hours and the accompanying traffic restrictions are critical elements of the project traffic control strategy and should not be adjusted without proper traffic analysis.
- Maintain ongoing communication during the life of the project with local law enforcement, emergency services, local agencies, transit groups, affected local businesses, etc.
- Continue use of innovative devices such as portable, changeable message signs, project information signs with information phone number and highway advisory radio systems.

The Regional Construction Manager, Traffic Engineer, and Public Information Officer should be involved in the project traffic control strategy and may be able to offer assistance.

1-2.3C Work Zone Traffic Control

1-2.3C(1) General

The primary function of work zone traffic control is to move vehicles and pedestrians safely through or around work zones while protecting on-site workers and accommodating the contractor’s construction operations. All work is to be performed by the contractor under the contractor’s control and supervision. All resources are to be provided by the contractor unless the Special Provisions of the contract specifically states that the department will provide some resource(s), what those resources will be and how they are to be utilized. Such provided resources will be placed in the contractor’s control to be used in the contractor’s operation. Any additional resources provided to the contractor during the project should be accompanied by a change order to the contract and, where appropriate, a price reduction.

The “General” requirements for traffic control (Section 1-10.1) address the responsibility to provide adequate traffic control measures at work zones as follows:

- No work shall be done until all necessary signs and traffic control devices are in place and/or conflicting and confusing signs are covered.
- If the Contractor does not provide necessary traffic control, WSDOT may do it and deduct the cost from the Contractor’s payments.
- The Contractor is responsible regardless of whether or not WSDOT orders, furnishes, or pays for necessary traffic control.

It is important for the Project Engineer to ensure that the Contractor has an approved traffic control plan in place and implemented providing all necessary signs and other traffic control devices so that the traveling public is aware of all deviations from the normal traffic conditions and is furnished adequate direction and guidance to permit safe travel through the construction area.

WASHINGTON STATE PATROL (WSP) TRAFFIC CONTROL ASSISTANCE

Washington State Patrol (WSP) troopers may fulfill two roles on a construction project. In the first case, troopers may be dispatched to participate in the Contractor’s traffic control activity, perhaps as Flaggers or Spotters, perhaps to operate a vehicle during one-way piloted operations or rolling slowdowns. The WSP role will be defined in the contract provisions.

WSDOT has an agreement, GC9131, with the Washington State Patrol (WSP) for that agency to provide troopers and vehicles to help with traffic control on construction projects. WSP traffic control assistance is considered an enhancement to the required work zone traffic control and should be reserved for those work zones that have unusual hazards or a high degree of worker exposure to traffic, which cannot be addressed by traditional traffic control means.
The Project Engineer should ensure that good communication is maintained with WSP troopers assigned to the project and that the appropriate traffic control strategy is applied. On each shift of WSP traffic control assistance, Form 421-045, WSP Field Check List, shall be filled out. WSDOT will fill out the top portion of the form and give it to the WSP trooper on the project to complete. At the end of the officer’s shift, the completed form shall be returned to WSDOT.

The Contractor shall direct the activities of the WSP troopers assigned as a labor resource provided by the State.

Instructions for WSP assistance are in Instructional Letter “IL 4008.00” and the Traffic Manual M 51-02.

The second case of WSP involvement is in the area of enforcement. In this case, the troopers are not considered to be a State-provided resource and do not participate in the Contractor’s traffic control work. When this situation occurs, WSP is present (at WSDOT expense) to provide enhanced, increased and visible enforcement of all traffic regulations, including those installed by the Contractor in the course of the work.

Enforcement officers are simply doing more of what they usually do. Their presence or lack of presence is due to administrative decisions by the department and WSP that are completely independent of the contract. They are not to be considered a provided resource, there shall be no entitlement to their services and neither the Contractor nor the Project Engineer shall direct their activities.

As stated above, a mid-project decision to provide troopers would be a change order. To be fair to unsuccessful bidders, such a change would need a price adjustment if nothing else had changed.

1-2.3C(2) Traffic Control Management

GENERAL

“Traffic Control Management” (Section 1-10.2) addresses the requirements and duties of the Contractor’s management personnel responsible for traffic and the Traffic Control Supervisor (TCS). The Contractor has the responsibility for managing traffic control and providing safe traffic control measures that are appropriate for the type of work and consistent with the requirements of the contract plans and specifications. The Contractor’s traffic control work is a contract activity. Just like other contract activities, it is associated with pay items. The activity must be inspected for adequacy and conformance with the contract. Once it is performed and inspected, associated contract items must be measured and paid. Traffic management actions affect not only the Contractor’s work operations, but also those of subcontractors. The process for coordinating and approving those actions must be well defined and consistent with the contract requirements.

Contractor management and the TCS work together with the Project Engineer and WSDOT’s traffic control contact person to address traffic control issues as the work progresses. Planning and coordination of the Contractor’s work efforts with appropriate traffic control measures are the primary responsibilities of contractor management. It is also the responsibility of management to ensure that any adopted State-provided or approved Contractor-proposed Traffic Control Plans (TCPs) needed to implement the contract work operations are provided to the TCS and that any necessary resources to implement the TCP are available.

TRAFFIC CONTROL SUPERVISOR

The TCS ensures that the traffic control measures shown on the approved traffic control plans (TCPs) are properly implemented, operating, and documented on the project. The Contractor’s TCS may not be required full time on the project, but is required to perform all the duties required by the specifications. When the Contractor is working multiple shifts, it may be necessary to have more than one person assigned to the role.

In addition to the Contractor’s responsibility to designate a Traffic Control Supervisor, WSDOT may designate a DOT employee who is qualified, but not necessarily certified, to serve as the State’s traffic control contact. It is intended to have qualified, trained representatives from both the Contractor and WSDOT work together to achieve safe traffic control operations on the project.

Among the duties of the Project Engineer in the area of Traffic Control are the following:

- **Communication:** About the planned work, traffic control needed and adjustments to the approved Traffic Control Plan. During the work, to stay aware of changes, events and issues.
- **Monitoring:** The activities of the Contractor TCS and traffic control workers. The status of signs and control devices. Conformance with specifications and requirements.
- **Documentation:** Obtaining and reviewing daily reports. Handling Traffic Control Plans and their approvals.
- **Coordination:** With adjacent projects, with DOT Traffic offices, notices to the media.

The Project Engineer may assign these duties in any manner. It would make sense to include the State’s traffic representative in these activities.

When reference is made to the “Traffic Control Supervisor (TCS)” in these provisions or in the Standard Specifications, it shall mean the Contractor’s Traffic Control Supervisor unless stated otherwise.
TRAFFIC CONTROL PLANS

“Traffic Control Plans” (Section 1-10.2(2)) addresses the requirements of Traffic Control Plans (TCPs). The Contractor must either adopt the TCPs appearing in the contract or propose modified TCPs to be used for the project. The Contractor must submit proposed modifications to plan TCPs or alternate plans at least ten calendar days in advance of the time the traffic control will be required. Approval of these plans must be obtained before the work can begin.

The possibility of alternate plans is covered by the contract. No change order will be needed because of that reason. However, if a price adjustment is needed then a change order will be necessary to accomplish that. We would allow additional payment, either through added units or revised lump sums, only if the original contract TCP was shown to be inadequate or in the case of traffic control needed for another change in the work. If the proposal is only for contractor convenience or preference, then a discussion of no pay for added traffic control or a credit for less traffic control would be appropriate. If the contractor should balk at this, the response could be “build according to plan.”

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/or substantial revisions are needed, a revised TCP shall be submitted for approval through the TCM to the Project Engineer. The Regional Traffic Office should be consulted when this situation occurs. Again, changes may call for a formal change order.

Traffic Control Plans should not only address all work zones and standard devices and signs but should also address issues such as:

- Conflicting or temporary pavement markings
- Maintaining existing operational signs and covering conflicting signs
- Staging requirements
- Temporary vertical or lateral clearance restrictions
- Temporary work zone illumination
- Consistency with any existing work hour restrictions
- Position of positive barriers for traffic hazards or worker protection
- Vertical drop-offs
- Work zone access
- Intersection or access control (traffic signals, road approaches)
- Pedestrians and bicycles
- Work zone capacity and related mobility impacts

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’s previously designated and adopted by the Contractor, the Contractor shall submit a proposed modification of the TCP for approval. If the Contractor’s proposed modifications comply with the MUTCD requirements and are consistent with contract requirements as well as State and Region policy, the Project Engineer may approve these proposed modifications (perhaps utilizing a change order, if appropriate.) If the Contractor’s proposed modifications do not comply with the MUTCD requirements, the Project Engineer should consult with the Region Traffic Engineer.

Any Contractor proposed TCP or modifications to an existing TCP should be evaluated for their affects on work zone safety and mobility. The Project Engineer should refer to the guidance in the Design Manual Chapter 810 Work Zone Safety and Mobility when evaluating how the new TCP works within the projects overall Transportation Management Plan (TMP).

If there is any doubt that the proposed TCP complies with the MUTCD or provides for the safe movement of traffic, the Project Engineer shall consult with the Region Traffic Engineer or the Region Construction Manager.

CONFORMANCE TO ESTABLISHED STANDARDS

“Conformance to Established Standards” (Section 1-10.2(3)) addresses the requirements for standards and condition of flagging, signs, and all other traffic control devices. In addition to standards established in the latest adopted edition of the “Manual on Uniform Traffic Control Devices” (MUTCD) and/or as specified in the contract plans, the “National Cooperative Highway Research Project, 350” (NCHRP 350) has developed requirements for safety of four categories of traffic control devices. Category 1 devices consist of small lightweight devices that generally do not present a hazard. Typical Category 1 devices are cones, tubular markers, and plastic drums with no attachments. Conformance to NCHRP 350 for Category 1 is described in Section 1-10.2(3). The Contractor is required to keep the manufacturer’s certification document on file and available for inspection if needed. Inspection of certification documents by WSDOT is not routinely required but should be considered if operational or safety issues are observed.

Category 2 contains devices that are more hazardous due to their rigid construction, such as barricades, portable sign stands, intrusion alarms, and drums with lights. The collision test certification rules apply to all new Category 2 devices. The Inspector should verify, and document, that all portable sign stands have an identifying label affixed. The label will display the FHWA approval letter designation and will appear similar to the image below.

![Traffic Control Device Example](image-url)
Category 3 devices are fixed or substantial in mass and could cause significant damage to a vehicle or its occupants. Devices such as barriers, fixed sign supports, and TMAs are included in this category. WSDOT approved devices in this category currently meet NCHRP 350 standards.

Category 4 devices are typically trailer or truck mounted and could cause significant damage if impacted by an errant vehicle. Devices such as arrow boards, PCMS, portable signals, and portable fighting units are included in this category. Crash testing is not required for these devices.

1-2.3C(3)  Traffic Control Labor, Procedures and Devices

1. TRAFFIC CONTROL LABOR

All traffic control labor must be trained with a video about safety in the work zone. Flaggers and spotters have additional requirements concerning flagging cards and apparel.

All flaggers and spotters working on WSDOT construction projects must have a valid State of Washington flagging card or a flagging card issued by the states of Oregon, Montana, or Idaho. Flaggers and spotters are required to wear high visibility clothing as specified in Section 1-07.8 of the Standard Specifications. Other workers involved in traffic control may certainly use this type of clothing, but doing so is not a contract requirement, unless they are performing work on foot within the right-of-way of a Federal-Aid highway.

Flaggers used as spotters to protect an exposed work crew may be considered appropriate if other worker safety measures are not feasible. Before the Project Engineer approves the use of a spotter not shown on a contract plan, careful evaluation of the hazards involved should indicate that the spotter could actually provide a safety benefit to the work crew without undue risk to the spotter.

FLAGGERS AND SPOTTERS

Typically, flaggers have the highest exposure to traffic hazards and are more frequently injured or killed than other workers. Flaggers should only be used when all other forms of traffic control are inadequate to control traffic. When flaggers are used, flagging stations must be shown on the TCP along with the required illumination, warning signs and devices. Flagger stations should be protected with a positive barrier, if possible. The flagger should also have in mind an “escape plan” to avoid errant vehicles. It is not recommended to use flaggers at locations, such as freeways, where their primary function of warning or directing traffic is ineffective or not intended. Use of flaggers to exclusively display the “SLOW” message is also not recommended and is, in fact, not required by the contract. The provisions call for a flagger with intermittent responsibilities to direct traffic to step back from the flagging station between tasks. Additional guidance on the use of flaggers is located in the “Traffic Manual” and the “Work Zone Traffic Control Guidelines Book.”

OTHER TRAFFIC CONTROL LABOR

For some projects, labor in addition to the assigned Flaggers and Spotters is needed for a variety of traffic-related tasks. Some of these tasks are listed in the provisions. Hours for this item are measured only for work on certain defined tasks (see Section 1-10.4(2)).

2. TRAFFIC CONTROL PROCEDURES

ONE-WAY TRAFFIC CONTROL

The major points to note in Section 1-10.3(2)A are:

- The provision does not limit one-way traffic control to treated bases, surface treatments, and pavements. This type of configuration can be used in other operations, such as grading, when appropriate.
- Line of sight is important in coordination of side roads and approaches with the limits of the one-way operation.
- 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
  - Contractor vehicles and equipment may utilize the closed lane in any manner. The one-way controlled open lane is for public traffic and, should the contractor use that lane, all rules and procedures applicable to public traffic will apply to the contractor. There will be no “wrong-way” travel in the open lane, no heavy equipment will join the public traffic and any additional traffic control will be performed according to approved plans only.
  - The contractor is required to plan and conduct operations so that the roadway can be reopened to two-way traffic at the end of the shift. If the nature of the work prevents this, or if the work area is left in a condition unsafe for public two-way traffic, then the contractor must continue the one-way operation throughout the off-shift hours.

ROLLING SLOWDOWN

This can be a useful method of creating gaps in traffic for very short-term activities. The key is planning and communication. If all goes well, the gap will arrive at the site and be of long enough duration that the activity can be completed. If this breaks down, the contractor must undertake the most expeditious method of restoring the open roadway. If demobilizing and pulling off is faster than finishing the task, then demobilizing is the path that will be followed, without regard to cost, efficiency or schedule.

LANE CLOSURE SETUP/TAKEDOWN

The use of truck-mounted attenuators with arrow boards is required by the provisions. This combination is to be used during the transition from open lane to closed lane. Once a lane is closed, the TMA may be removed, leaving the arrow board alone.
3. TRAFFIC CONTROL DEVICES

CONSTRUCTION SIGNS

The standard of these provisions is that the contractor provides all signs, posts and supports. If the special provisions do not promise that some or all of these will be furnished by the State, then the contract requires the contractor to do it all.

“Do Not Pass” and “Pass With Care” signs are the responsibility of the Contractor. The provisions explain how to determine the number of these and that determination is to be made by the Contractor as well.

Construction Signs (Section 1-10.3(3)) divides construction signs into two categories, Class A and Class B, and lists the work required for 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 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 completely covered with metal or plywood during the hours they are not needed, either before or after working hours and on nonworking holidays or nonworking weekends.

Signing for nighttime traffic is more difficult than that required for daylight hours. A review of the project signing should be made and recorded during the hours of darkness.

SIGNS AND DEVICES

The key to this operation is to keep the traffic control equipment effectively close to the work and moving to match the work operation. Two traffic protection devices are used. One is a TMA/Arrow Board combination upstream of the work. The primary purpose of this device is to protect the errant vehicle from fixed object collisions. The second device is immediately adjacent to the work area. Its purpose is to protect the workers from the errant vehicle.

PATROL & MAINTAIN TRAFFIC CONTROL MEASURES

This activity is to observe, repair and maintain traffic control devices and layout. The provisions require an hourly visit to each device and layout. Depending on the extent of the control measures, more than one patroller may be required.

1-2.3C(4) Measurement

Measurement is the key element of the new provisions, which now contain lump sum bid items. The provisions will define one of several pay item strategies, which will determine the measurements to be made.

First, the “normal” project with these provisions will contain items. The items are different from previous contracts and are non-standard, although several have very similar item names. Each of these is described below.

Instead of items, the project may be designated as a “Total Project Lump Sum.” This will be the case if the item “Project Temporary Traffic Control, Lump Sum” is included in the proposal. If this is the strategy of the project, then all measurement and payment provisions for all other pay items are deleted from the contract. When this occurs, then all temporary traffic control costs of whatever nature (everything defined in Section 1-10) are included in the lump sum.

The project may be a lump sum hybrid. In this case, the Total Project Lump Sum item will be present, but the provisions will reinstate one or more of the deleted standard items. If that happens, the measurement and payment of the reinstated item(s) will be separate from and not included in the lump sum.

These are the items and a discussion of the features of the measurement spec for each:
Traffic Control Supervisor (lump sum). Previously paid by the hour, this item is now a fixed cost. Overtime is not considered, a second TCS for a night shift makes no difference. This lump sum status will likely cause TCS to become a part of change order negotiations. If the change does, in fact, require additional TCS work, then there would be entitlement. This will also apply to extended contract duration, as the TCS can be considered part of on-site overhead.

Flaggers and Spotters, (per Hour). This contract activity is separated from other kinds of traffic control labor. It is measured according to the hours that an approved flagging station is manned. We will not count minutes and seconds; time will be rounded up to the half hour as specified in Section 1-09.1. If a station is manned, but full-time presence of the flagger is not necessary (trucks entering roadway, equipment crossing) then the flagger is expected to step back out of harm’s way until the next event. No deduction will be made for this stepping back, provided the flagger can not be assigned to other duties while waiting. In measuring flagging, disregard overtime, split shifts, union rules for show-up time, the trade classification of the flagger and any other payroll issues. The flagging is a service that is provided and paid for by the hour. It is only peripherally related to the flagger’s paycheck.

Spotters may be used and are encouraged. Spotted stations must be shown on the TCP and approved. Once approved, the item will be measured when the approved station is manned. The same rules apply to the non-relationship between Spotter payment and the paycheck of the spotter employee.

Other Traffic Control Labor (per Hour). There are other duties for traffic control labor besides flagging and spotting. Some of them are included in this item for separate measurement. If one of the activities listed in the provision is provided, then measurement of that activity is appropriate. Only the hours that the activity is performed will be measured. Again, this is not a payroll measurement.

Note the limit under patrolling and maintaining. No matter how many people are involved in this activity, measure only one hour for each hour that each approved route is operated. Another little feature shows up under the last bullet (Installing and removing devices). Time spent ahead of the setup marking layout points on the shoulder or getting signs ready in the yard will be measured under this item.

Do not succumb to pressures to add other hours to this item. As the payment spec for “Other Temporary Traffic Control” states, all costs not compensated by other items are covered there.

Construction Signs, Class A (per sq. ft.) to qualify for payment under this item, the sign must be designated as Class A on an approved TCP or be directed installed by the Engineer and designated as Class A at the time of direction. After-the-fact re-designations of signs that have been originally thought to be Class B should not be considered.

Other Unit Price Items. The new traffic control provisions limit unit items to major devices. These include Sequential Arrows, Changeable Message Signs and Truck Mounted Attenuators. The measurement and payment requirements for these are similar or identical to those which have been in use for some time and are relatively straightforward.

One point to make is with the force account item for “Repair Truck-Mounted Attenuator. Because this is a temporary installation and not a part of the permanent work, the Third Party Damage item does not apply and that is why a separate force account is established. If the damage was caused by a third party, the department may well be able to recover the costs paid to the Contractor under this item. The Project Engineer should take steps to protect the department’s interest and involve the Maintenance, Accounting and Risk Management offices to initiate the efforts to recover costs.

1-2.3C(5) Payment

The payment provisions of the new specifications are intended to provide a mechanism that accounts for all of the Contractor’s costs for temporary traffic control. The total project lump sum item is self-explanatory. There is no additional payment unless there is a change order.

If the job contains items, the pay definition for each describes the limited portion of the Contractor’s costs that are covered by each item. The summary lump sum item (Other Temporary Traffic Control) is written to be a catchall cleanup that lets nothing escape for “additional compensation” discussions.

Watch out for change orders. A principal concern over lump sum items is that work will be added that is not required by the original contract and no mechanism exists to increase traffic control payment. This can be straightforward in identified changes, merely becoming an additional aspect of the negotiation. More troubling are constructive changes, which are not written, but which do end up in negotiation. An “overrun” of asphalt pavement to add a few driveways may be a convenient way to do field decisions, but may also cause a dispute over the related traffic control costs (not to mention the dispute about the changed nature of the paving.).

1-2.3C(6) Construction and Maintenance of Detours

Construction zone detours will normally be detailed in the plans. When detours not shown in the plans are required, the design will likely be done by the construction office under the direction of the Project Engineer and requirements of the MUTCD. If the detour is a full-fledged roadway, design and traffic reviewers should check the design. Short-term minor detours may be installed and operated without formal review, but the Project Engineer must be satisfied that the facility is suitable and safe for traffic use.

Existing pavement markings on asphalt pavement should never be merely blacked out with oil or paint. Rather, the striped and adjacent areas should be sandblasted or ground 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. Temporary pavement marking tape, either for temporary lane marking or marking of existing markings may offer another option.
Barricades and barriers are inherently fixed object hazards. Therefore, they should not be used unless the combined hazard for the motorist and the workers of operating without barriers is greater than the hazard of striking the barriers themselves. 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(7) Road/Ramp Closures

When it is necessary to close a road, street, or ramp, the Project Engineer shall submit a request that includes the appropriate closure/detour plan to the Region Traffic Engineer in advance of the need. Per RCW 47.48.010, the Regional Administrator may close a road, street, or ramp.

With proper planning and implementation, road/ramp closures can be an effective and safe method of traffic control. As required by RCW, 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. Advance notice using local radio, portable changeable message signs or HAR may be effective in diverting traffic from the closed or impacted locations.

Coordinate with the Region Public Information Officer for assistance with public notification.

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.

1-2.3D Speed Reductions

If speed reductions are considered, the Project Engineer shall consult with the Regional Traffic Engineer in advance of the need. Per RCW 47.48.010 and Directive D55-20, the Regional Administrator may post advisory speeds and/or establish a reduced regulatory speed limit. Speed reductions must be determined in accordance with standard traffic engineering practice by the Regional Traffic Engineer.

- ADVISORY SPEED

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 should 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 5 miles per hour, a safe speed for normal conditions of weather and lighting. Advisory speed signs should only be used in conjunction with appropriate warning signs.

- REGULATORY SPEED LIMITS

Traffic controls that are designed and implemented for site specific work zone conditions, including actual traffic speed, are generally more effective than a speed limit reduction. Speed limit reductions should be considered at work zones where conditions reduce operational safety to a point where other traffic control measures are not effective.

Directive D55-20 describes the appropriate conditions and requirements to implement advisory speeds and reduced regulatory speed limits.

1-2.3E Records of Construction Signing, Collisions, and Surveillance

Due to the increased damages being awarded by the courts for improper signing, it has become more important 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 recommended procedures and methods of recording the signing on the project:

- Use extensive photographic, digital or videotape records.

- 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.

- Documentation of the Contractor’s activity for traffic control, including signing, should be 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 for this purpose.

The Summary report will typically contain a brief description of the daily activities of the TCP with expanded details of any important happening such as traffic collisions, 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.

- 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, location of the signs, location of flaggers, location of the work zone, the time it was set up, and the time it was removed. Additional information includes cone layout, if used, comments about piloted traffic, and comments about the relationship of the setup to an approved traffic control plan.

The Project Engineer should make an effort to become aware of any traffic collisions that occurs within the project area. Where possible, thorough records should be maintained about the collision, including site conditions and the status of signing and other traffic control measures. In case of an incident investigated by the WSP, do not move signs until released to do so by the trooper. When inspections are made of the work zone, either by project or region personnel, the documentation of these inspections should be maintained in the project files. The 1997 report on Highway
Work Zone Reviews contains recommendations for review procedures and reporting format. The report emphasizes the following points:

- Each Region should designate an office or individual responsible for oversight of traffic control issues.
- Regions should conduct regular reviews of traffic control with management involvement and document results.
- Expand discussion of work zone traffic control within the Region.
- Regions will take the lead in scheduling statewide annual traffic control reviews.
- State Traffic Office will prepare an annual summary of the statewide traffic control reviews.

1-2.3E(1) Work Zone Safety and Mobility

In keeping with the above recommendations, the Project Engineer should utilize the information obtained from traffic control reports, collision reports, and other field observation in order to better manage Work Zone impacts. This will allow the Project Engineer to implement any necessary changes to traffic control in order to increase safety and to enhance mobility through the work zone.

At the completion of each project, the Project Engineer should review the traffic control used on the project in order to identify trends, etc. that may be used to improve Work Zone practices or strategies. This information should be summarized and provided to the Region Traffic Office for inclusion in annual reports.

1-2.3F Resources for Traffic Control and Work Zone Safety

The following information may provide additional guidance and more specific detail. Also, this list includes the staff, reference documents and manuals mentioned throughout Section 1-2.3 of this manual.

- Work Zone Traffic Control Guidelines, M 54-44
- Traffic Manual, Chapter 5, M 51-02
- MUTCD Part VI
- Work Zone Safety Task Force Recommendations
- Quality Standards for Work Zone Traffic Control Devices (ATSSA)
- Work Zone Traffic Control Supervisor’s Notebook
- Highway Work Zone Reviews, 1997 (Work Zone Safety Task Force)
- Planning and Scheduling Work Zone Traffic Control (FHWA-IP-81-6)
- Directive D 55-20, Reduced Speed in Maintenance and Construction Zones
- Instructional Letter IL 4008.00, “WSP Traffic Control Assistance in Work Zones”
- Traffic Control Supervisor Evaluation - Final Report
- Region Construction or Traffic Office and Public Information Officer (Traffic Engineer or Work Zone Traffic Control Specialist)
- State Traffic Office (Traffic Specialist or Traffic Control Engineer)

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

1-2.4A Construction Contracts Information System (CCIS)

The CCIS system is a mainframe application designed to track contract information and generate reports for all WSDOT administered construction projects. The initial setup of contract information into CCIS is done automatically by using information in the CAPS system. However, after the initial setup, the project offices must enter the majority of the contract information into the CCIS system. The data entered is then maintained and stored on the mainframe.

Among other things, CCIS generates the Weekly Statement of Working Days and Change Orders, and tracks this information. The system creates the forms for these reports so a preprinted form is not needed. Following is a list of data that needs to be entered into the CCIS database over the life of the project:

A. Contract Information

This part of CCIS will contain general contract information.
- Region administering contract
- Region the contract is located in
- Regional Administrator
- Operations Engineer
- Project Engineer/PE Org code
- Begin and End mile post
- County
- Prime Contractor’s local address, if applicable
- Prime Contractor contact person
- Prime Contractor D/M/WBE type if applicable
- Prime Contractor ethnic code if applicable
- Date of Statement of Intent to Pay Wages - Prime
- Date of Contractor and Subcontractor/Agent Cert. for F.A. Projects
- Date of Affidavit of Wages Paid - Prime
- Date of Preconstruction Meeting Minutes
- Date time started
- Date work started
- Date Orig. Progress Schedule approved
- Date Last Supplemental Progress Schedule approved (if applicable)
- Date of Substantial Completion (if no Substantial Completion granted, use Physical Completion date)
- Date of Physical Completion
- Final Estimate to Contractor
- Date of Completion
- Final Estimate to Headquarters (filled in by Region office)
- Contract time – Original Authorized Working Days
B. Contractor Information
This part of CCIS tracks information about Request to Sublet and Affidavits of Amounts Paid.

Request to Sublet
Affidavit of Amounts Paid
C. ECR Tracking
This part of CCIS tracks the Contractor’s training program, trainees, and MDWBE reviews

Training Program
Apprentice/Trainee Approval Request
DMWBE and EEO reviews
D. Change Orders
Change orders are created, printed and tracked in this part of CCIS. It is very important to keep the information current to facilitate correct tracking and reporting.

Approval (to proceed when granted)
CRIP Amount (if the change order is a CRIP)
A brief description of the change order (if the change order is a CRIP)
Date sent to Contractor
Date received from Contractor
Is there Surety consent
Date of Surety consent
Dates of approval and execution Note: Line 4 “Date Executed” should only be used by Region or HQ.

Change Order Voided (if applicable)
E. Weekly Statement of Working Days
The “Weekly Statement of Working Days” is a report generated by CCIS, based on information entered into the system by the project office. This report details the number of workable/unworkable days charged to a project, the reason a day is charged as unworkable, daily weather codes, the current status of contract days, and a summary or the week’s construction activity. The Project Engineer must ensure that the appropriate information is entered into CCIS on a weekly basis, a “Weekly Statement of Working Days” is generated, and a copy of the report is sent to the Contractor. Weekly statements shall cease when physical completion is granted, or when substantial completion is granted and all working days are expended.

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

1-2.4B Order Lists
Contract language requiring an order list can be found in Section 6-05.3(2), which addresses piling other than cast in place concrete and steel piles, and in Section 8-21.3(1), which addresses the determination of lengths of wood and steel sign posts. In other types of work, such as drainage, guardrail, etc., the actual layout will often result in quantities and lengths that vary from the plan estimates. A project engineer could choose to communicate this information in several ways, one of which could be the development of a formal order list. If an order list is used, extra care should be taken to ensure its accuracy. An alternate method of notice could also be a walk through with the contractor representative after staking.

1-2.4C Changes in the Work
• INTRODUCTION
WSDOT reserves the right, under Standard Specifications 1-04.4, to make changes to the work, work methods, working days, or quantities, as necessary to satisfactorily complete the project as originally intended.

Adding work beyond the original scope is, in essence, entering into a contract to perform work without the benefit of a competitive bid. There is a statutory (RCW 47.28.050) exception from the competitive bid requirement for work up to a value of $7,500. If the value of the work is in excess of $7,500 it is necessary to go through the competitive bidding process.

Change order work may impact the design criteria used to develop the project. The Project Engineer must be alert to this, and ensure that the Design Documentation Package is revised to reflect any such changes. The Project Engineer must contact the Region Project Development staff to obtain approval for the change, and for guidance in documenting and incorporating the change into the Design Documentation Package.

1-2.4C(1) Types of Changes
There are several categories of changes that may occur during the course of the work. A change may warrant additional payment to the contractor or a credit for the contracting agency. A change may also warrant an increase or decrease in the working days. Every situation is different. The Standard Specifications are very specific on what additional costs are eligible for adjustment. The balance of this discussion of types of changes is intended to help describe and explain the various categories of changes.

(I) VARIATIONS FROM ORIGINAL BID QUANTITIES
Contracts are set up with estimated quantities. Contractors provide unit prices and actual measured quantities are paid using those unit prices. What happens when the actual measured quantity varies from the estimated proposal quantity? The WSDOT Standard Specifications (Section 1-04.6) require that variations of less than 25% be performed without changes in the bid price, but that variations greater than 25% may qualify for a payment adjustment of the contract bid. This distribution of estimating risk is a policy of WSDOT and is also a Federal requirement for any project with Federal funds.

Variations may occur because field conditions cause a different quantity for the planned work than was envisioned during the estimating. Other variations may occur when work is added or deleted by change order and original contract unit items are included as the method of pricing the change order. Finally, quantity variations occur when work is added, deleted or revised without a formal change order (constructive change) and units with unit prices are
the only measure of the revision. The work represented by a constructive change order is in fact work not anticipated at the time the contract was bid and executed, and as such would be outside of the requirements of Standard Specifications Section 1-04.6. In other words, you cannot deny a payment adjustment based solely on the fact that the accepted quantity of a bid item is within 25% of the original proposal quantity.

As discussed below, quantities included in formal change orders are excluded from consideration of quantity variations. The project engineer who allows constructive changes without formal documentation may find an additional negotiation waiting when final adjusted quantities are calculated and compared with the original proposal quantity.

A unit bid price consists of four different parts. First, and most obvious, are the costs of labor, equipment, materials and services needed to accomplish the work. These are the “direct costs” involved and they vary directly with the amount of work. Second are the variable overhead costs, such as field supervision, field support items (phones, computer rental, payroll clerks, sanicans, etc) whose amounts will vary along with the direct costs. Third, and more difficult to assess, are unavoidable, distributed, fixed overhead costs. These are typically long term and exist whether the quantity varies or not. They include things like home office costs, field trailer setup, long term equipment rentals and other fixed costs. These are typically distributed to the project by allocating them to the plan quantity. Fourth, and finally, the unit price will include some amount for profit.

[1] Section 1-04.6

The standard contract provision calls for the calculation of an adjusted final quantity. This is the method of revising the final measured quantity to allow for proposal item quantities included in agreed change orders. Unit prices as originally bid will be utilized if the adjusted final quantity is more than 75% of the original proposal quantity and not more than 25% greater than the original proposal quantity.

If the final adjusted quantity is outside these limits, then either party to the contract may initiate a renegotiation. If neither party does so, then unit prices will apply to the entire measured quantity of the item. Neither of these actions would be a change to the contract, as the provisions already allow a price change. A formal change order document might well be initiated to show the agreement, however, and would be the mechanism to create new prices.

If a negotiation is initiated, the provision calls for a new price for the quantity in excess of the 25% overrun or a contract price adjustment to compensate for costs and losses associated with an excessive underrun. The renegotiated price for the overrun portion is not an equitable adjustment and this is an important distinction. The new price is based upon actual costs experienced and is completely unrelated to the old bid price. The typical discussion about “what’s different from the bid work and what number should be used to modify the bid price?” does not apply in this type of negotiation. The underrun compensation is an equitable adjustment, however, and much of the negotiation is related to the bid price and discussions of the actual work costs as opposed to the planned costs.

Other features of the provision include an exclusion of force account items and other items where an amount has been entered solely to provide a common proposal for the bidders. Consequential damages and lost profits are specifically excluded. The effect of any unbalanced allocation of overhead costs is also excluded from compensation under the provision.

Force accounts and calculated quantities are already taking actual costs into account for overruns. Because of the nature of these items, contractors are unable to allocate unavoidable fixed costs to them except as a share of the allowed markup. The contractor is aware of this provision at the time of bid and knows that this item will not be eligible for renegotiation in the case of an underrun.

Consequential damages are those which are separated from the project and which might be presented as part of a negotiation. “Because of your overrun, I was unable to start work on my other project and had to do that other work in the wintertime.” This consequence of the quantity variation is not compensable because of the wording of the provision. Similarly, the profit that the contractor might have made on some other work but for the need to perform the extra work in an overrun is also not compensable.

Unbalanced bidding might result in a significantly higher or lower price for an item than normal. It means that too much or too little of allocated overhead or other costs is assigned to the item. This is not a problem in a low bid situation when all items come in at plan quantity. The problem would arise if an unbalanced item were to be involved in an excessive underrun. This provision allows the project engineer to evaluate this possibility during an underrun negotiation (remember that the overrun pricing takes care of the problem automatically by assessing cost and ignoring the bid price.)

Contract time may be affected by the first unit of overrun or underrun. It may be appropriate to add or delete working days; depending on how the quantity variation affects critical activities, as shown on the Contractor’s approved progress schedule.

[2] Negotiation Guidelines

[a] Adjusted Final Quantity The Standard Specification language is quite clear on this subject. Start with the final measured quantity, the number that would be included in the final estimate for the item. Review all change orders that have been approved and have been accepted by the Contractor (see Section 1-04.5 for a definition of contractor acceptance of change orders.) Identify change order increases in the item and subtract these from the final measured quantity. Identify change order decreases in the item and add these to the result of the previous subtraction. The result of these calculations is defined as the Adjusted Final Quantity.

Compare the Adjusted Final Quantity to the original proposal quantity. If the Adjusted Final Quantity is greater than 1.25 times the original proposal quantity, then the item is eligible for an overrun renegotiation. If the Adjusted Final Quantity is less than 0.75 times the original proposal quantity, then the item is eligible for negotiation of an equitable adjustment due to underrun.
Chapter 1  Administration

[h] Renegotiation for Overruns: The first analysis should be to determine, if possible, where and when the overrun took place. This is not necessarily the work done after the quantity of 1.25 times proposal was reached. In many cases, a review of the work will disclose which part of the project actually experienced the low estimate and the resulting extra quantity. This is more common in physical items that are visible and can be measured by weight or physical dimensions (Roadway Excavation, Culvert Pipe, Select Borrow, etc.) These are often detailed in the plans to the extent that actual work can be compared with the relevant portion of the proposal quantity. When actual overrun work can be identified and when records exist showing the resources utilized for that work, then those records can form the basis for the revised payment amount. In other cases, the item is a support function, often measured by time, where the plan segments cannot be separated for analysis. This is common in Flagging, Pollution Control items, etc. To analyze these, the only choice is often to look at the actual work that occurred after the threshold was reached and price it. A third method, where records are adequate, is to evaluate the actual costs for the entire item, and apply those only to the overrun units.

Regardless of method of determining direct cost, markups will be allowed. A good place to start would be the force account percentages described in Section 1-09.6. If the contractor is providing other records for overhead and profit, these can be used, if they are reasonable. Any overhead items that are unavoidable, distributed fixed costs should be excluded. Remember that the Contractor has already been compensated for these one and a quarter times over.

The revised price will apply only to the units measured in excess of 1.25 times the original proposal quantity. The overrun units between the proposal quantity and the threshold will be paid, according to the terms of the contract, at the bid price.

[c] Equitable Adjustment for Underruns: The adjustment for an underrun is limited by the contract terms to three factors. The first of these is an adjustment for any increase or decrease in direct costs that result solely from the reduction in quantity. The most common example of this type of cost is the learning curve. “By the time my crew learned how to do this work at this site with these specifications, we were done. They should have been able to apply these skills to an additional 30, 40 or 50 percent of the plan quantity. I experienced the least efficient units and missed out on the most efficient.” in negotiation, this might be demonstrated by production rates, by inspectors’ reports or by the agreed judgment of the negotiators. If such a condition did exist, then an agreed amount for inefficiency during the learning curve could be included in the adjustment.

The second factor has to do with the nature of the work actually done, when compared with the work shown in the plans. The most common manifestation of this is “You deleted the easiest units and left me with the most difficult,” or “You added units that were much more difficult than those shown in the plan.” Compensable, if true. Logic dictates that, if all of the work shown in the plans was performed and, if no work was added except by formal change order, then this factor can have no value. The work that was performed was what was shown in the plans and was what the Contractor bid. If, on the other hand, the project engineer has allowed constructive changes without formal documentation, then this factor could well come into play.

Finally, the negotiation should include a look at reallocation of undistributed unavoidable fixed overhead costs. The contractor has allocated these to 100% of the proposal amount. The bid price is firm as long as 75% of the units are measured and paid. If the final adjusted quantity is less than 75%, then the anticipated contribution of the units not performed (up to 75%) can be identified, negotiated and included in the equitable adjustment.

One final aspect of underruns: There is a reality that, if more units were paid up to the 75% threshold, then there would be no eligibility for negotiation. Because of this, there is a limit to the equitable adjustment. The total paid for the item, including units actually performed and the equitable adjustment cannot exceed 75% of the original proposal quantity, multiplied by the unit bid price.

(II) DELETION OF ITEMS

[1] AUTHORITY to DELETE: As provided in Sections 1-04.4 and 1-08.10(2) of the Standard Specifications, WSDOT may cancel all or portions of work included in a contract. When deleting work that is condition of award (COA), be sure to also delete that work from the COA requirements by completing the condition of award portion of the change order in CCIS. An adjustment in working days may also be appropriate.

[2] PAYMENT FOR REMAINING WORK: There are some limitations to payment that should be noted under Standard Specification 1-09.5. When work is decreased or deleted by the contracting agency, payment will only be for the costs actually incurred for partially completed work. No profit will be allowed for work that was not completed. CONSEQUENTIAL damges are also not allowed. CONSEQUENTIAL damages may include such things as: loss of credit, loss of bonding capacity, loss of other jobs, loss of business reputation, loss of job opportunities, etc. In the case of a portion of a lump sum item or partially completed unit items, the value of this work will need to be determined. It may also be necessary to negotiate a price adjustment for the work that was performed and paid using a contract unit price if there is a material difference in the nature of the accomplished work when compared to the nature of the overall planned work. Under certain circumstances when the contractor says “you eliminated all the easy work and left the difficult,” there may be entitlement to an adjustment.

In the event that the deletion impacts the critical path for the project, an adjustment in working days may also be appropriate.
[3] PAYMENT FOR MATERIALS 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 controls.

(a) contractor restocks the first and best method for disposing of the materials is to request that the contractor attempt to return the materials to the supplier at cost or subject to a reasonable restocking charge. If the materials are restocked then, in accordance with Section 1-09 of the Standard Specifications, the contractor’s actual costs incurred in handling the materials may be paid.

(b) contractor purchases If WSDOT cannot utilize the materials, the contractor may elect to retain them for other work. Once again, in accordance with Section 1-09 of the Standard Specifications, the contractor’s actual costs incurred in handling the materials may be paid.

(c) state purchases and disposes As a last resort, if the materials can not be disposed of at a reasonable cost to WSDOT, the Department may choose to purchase the materials from the contractor. There are some limitations that come with the use of federal funds that may require that the materials be purchased with state funds depending on the situation. The State construction office may be contacted for advice. If possible, such materials may be provided to a future contractor (work with Design) or to Maintenance (work with the Regional Maintenance Office). If the materials cannot be used, they shall be disposed of as described in the manual for Disposal of Personal Property (M 72-91). Once again, in accordance with Section 1-09 of the Standard Specifications, the contractor’s actual costs incurred in handling the materials may be paid.

(III) CONTRACT MODIFICATIONS

Changes in Materials, Work Method, or Work Sequence may or may not be a change to the contract. The determining factor is if the change is a modification of a specific contract requirement. If the contractor includes language such as “recommends”, “suggested”, or “approved equal” associated with the item or allows the engineer to approve changes, then a change order is probably not required. In essence, this would not be a violation of the contract and therefore, does not require a change to the contract. A common situation is when the contractor proposes a change to a submitted manufacturer’s recommendation, drawing or plan such as a falsework drawing or erection plan. Changes to those drawings/plans may be made by the same authority that approved them the first time. Once again, it is not a change to the contract.

(IV) COST REDUCTION INCENTIVE PROPOSAL (CRIP)

It is the policy of WSDOT to encourage our contractors to be innovative in planning and performing the work when a 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 containing Cost Reduction Incentive Payments. The Project Engineer should encourage CRIPs and seriously consider the mutual benefits of these proposals brought forth by the contractor as a partner in the contract.

[1] IS IT A CHANGE/CRIP? A proposal may include material and/or product substitutions, work method changes, work sequencing changes, etc., that normally take place during the construction of a project. Contractor proposals do not require change orders nor qualify as CRIPs when the change does not require modification of the contract. See the previous section “contract modifications”.

[2] AGENCY CREDIT OR NO COST CHANGES (NOT A CRIP) the contracting agency is not obligated to accept a proposal which is not equivalent or superior to what is required by contract. However, if a contractor proposed change is acceptable and desirable to WSDOT, but is not equivalent or superior to what is specified by contract, then a credit should be considered as part of the change order. This type of change would not be considered a CRIP. The credit required would normally be 100 percent of the cost or time savings. If it is determined that contract time is not affected and that the cost differential is negligible or to the state’s advantage, then the change might require a “no cost” change order. If, in the opinion of the evaluator, the State is not harmed and there is no windfall savings for the contractor, then a no-cost change would be appropriate.

[3] IDENTIFYING A TRUE CRIP

A CRIP might exist if:

• the change is the contractor’s idea
• it offers, in effect, the same end result as what is specified in the contract
• savings will be achieved in dollars or time by its implementation

Qualifying actions by the contractor:

• accepts design risk of temporary features
• accepts risk of constructability
• makes a significant effort to develop the proposal
• employs an engineer to assist in development (indicator, but not required)
• prepares all documentation, presentations, and plans
• invests an appreciable amount of time

[4] DEVELOPMENT OF CRIPs 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. In the interest of uniformity, the following guidelines are to be used for the evaluation of CRIP submitted by the contractor:

General Requirements and Principles Applying to CRIPs:

• The proposed change must alter a contract requirement.
• The proposed change must result in a product that meets the intent of the original design.
Additional Requirements for Time Reduction CRIPs:

• 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 is inappropriate).

[a] 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 further 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.

A separate copy may be sent to the Headquarters 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. Depending on the nature of the proposal, the review could include Region and Headquarters 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.

[b] 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.
• 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.
• Contractor’s Engineering — 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.
• Schedule Analysis — If the CRIP is related to time savings, a partial progress schedule showing the changed work. A discussion comparing this schedule with the approved progress schedule for the project.
• Plans and Working Drawings — All drawings and supporting calculations necessary to accomplish the work. 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.

[c] Step 3: Preparing and approving The change order itself shall be prepared and processed in the same manner as any other change order. Accordingly, the change order must incorporate the terms of the agreement into the contract. Along with all of the components of a change, all CRIP change orders shall include the following:

• A statement that the Contractor accepts design risk of temporary features of the changed work.
• A statement that the Contractor accepts risk of constructability of the changed work.
• A statement providing WSDOT with the right to use all or any part of the proposal on future projects without further obligation or compensation.

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.*
• 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.
• The contractor’s share of savings from deleted work.

The final sum of these shall ordinarily be the savings to WSDOT. However, in some cases, savings may be offset by any increased inspection and administration costs, or augmented by intangible benefits, such as user benefits, or by indirect benefits, such as overhead and engineering savings in time reductions, or by theoretical savings, 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.

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

\[
\text{(gross cost of deleted work) - (gross cost of added work)} = \text{(gross savings)}
\]

\[
\text{(gross savings) - (contractor’s engineering costs)} = \text{(WSDOT’s engineering costs)} = \text{(net savings)}
\]

\[
\text{(net savings)/2} = \text{(incentive pay)}
\]

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.

Cost to Achieve Time Savings:

\[
\text{(cost of added work) + (contractor’s engineering costs)} = \text{(cost to achieve time savings)}
\]

\[
\text{(cost to achieve time savings)/2 = (WSDOT’s Share of Added Cost)}
\]

If the timesaving 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.

\{d\} Authority to Proceed with Changed Work The need may arise to proceed with changed work before the change order is executed. WSDOT is willing to provide an 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.
• 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.

\{e\} Problems Arising After the Agreement the contractor assumes the risk of constructability. 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 solution.

\{f\} 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 and any other factors, shall be provided to the Region Construction Manager and the Headquarters Construction Office.

1-2.4C(2) Equitable Adjustment

(1) PRICING

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

• This is an important point, for unchanged work, the contractor is entitled to the profit bid or a windfall, if the work turns out to be easier than expected.
• On the other hand, for unchanged work, the contracting agency is not obligated to make the contractor well for an under bid item.

Consequential damages are never allowed as part of a negotiated equitable adjustment. Consequential damages may include such things as: loss of credit, loss of bonding capacity, loss of other jobs, loss of business reputation, loss of job opportunities, impacts to another project, etc.
[1] UNIT PRICES An appropriate price may be established using average unit bid prices, citing similar unit bid prices, a determination of market value, by estimating the cost to perform the work, or a combination of these methods. Unit bid price is one indication of an equitable price, however the contracting agency should be prepared to support the price by other means.

[2] FORCE ACCOUNT When added work is paid by force account, a change order shall be prepared detailing the added work to be performed and the estimated cost. Standard Item Number 7715 is to be used for all force account items that do not have an assigned standard item number. Force account should be a last resort used only if the work can’t be clearly defined.

[3] OVERHEAD There are two basic types of overhead as follows:

- DISTRIBUTED FIXED COSTS: Offsite “home office overhead” is the cost of running a company. These costs are assumed to be distributed among all the projects performed by the company. Onsite overhead is incurred as a function of time needed to accomplish the project. Onsite costs are assumed to be evenly distributed among contract items. This category of overhead is eligible under an equitable adjustment if working days are added to the contract as part of the adjustment.

- VARIABLE FIXED COSTS: these costs are directly associated with performing an item of work on the project and therefore vary with the quantity, the contractor is entitled to recover these costs as a part of an equitable adjustment.

(II) FORWARD PRICING AND RISK

The first and best option for an equitable adjustment is agreement in advance between the contractor and WSDOT on the increased or decreased cost and time for performance of the changed work. The Project Engineer should expend every effort possible to obtain a satisfactory negotiated equitable adjustment prior to submitting the change order to the contractor for endorsement. The Project Engineer must remember that the contractor is a full participant in the contract and retains all the rights and privileges during a negotiation. When bidding a job, the contractor must be optimistic and take appropriate risks. When negotiating, it is understandable and acceptable for the contractor to be pessimistic and avoid risk, unless compensated. Some key points to remember are:
### CHANGE ORDER — CHECKLIST

<table>
<thead>
<tr>
<th>Cont. #: __________</th>
<th>Cont. Title: ____________________________________________</th>
<th>If Yes, State Construction Office Approval Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change Order #: _____</td>
<td>C.O. Title: ______________________________________________</td>
<td></td>
</tr>
</tbody>
</table>

#### I. Executed by the State Construction Office

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A cost or credit equal to or exceeding $500,000.*1</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. A change in the contract documents beyond the scope, intent, or termini of the original contract.²</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Any proposed revision or deletion of work that affects the condition of award requirements.</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

#### II. Executed by the Region

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. A cost or credit greater than $100,000 but less than $500,000. *1</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. A change in contract time greater than 10 and less than or equal to 30 working days must be related to changes implemented by change order.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. A change in contract time greater than 30 working days or a change in contract time unrelated to any change order.</td>
<td>☐</td>
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</table>

#### III. Executed by the PE

<table>
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<tr>
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<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. A determination of impacts and/or overhead.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8. Specification change, involving Headquarters generated specifications. (Includes Region Generated specification requiring State Construction Office Approval)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>10. Material or product substitution.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>11. A structural design change in the roadway section. (Requires State Materials Lab approval)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>12. A determination of changed condition. (Section 1-04.7 of the Standard Specifications)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>13. Settlement of a claim submitted; Section 1-09.11(2) of the Standard Specifications</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>14. Repair of damage regarding “acts of God” or “acts of the public enemy or of government authorities”. (Section 1-07.13 of the Standard Specifications)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>15. A structural change for structures (see BTA authority as shown in the Construction Manual).</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

**Approvals Obtained:**

- Project Engineer (Required): ___________________________ Date: __________
- Region (Required if yes marked): ___________________________ Date: __________
- State Construction Office: ___________________________ Date: __________
- State Materials Lab: ___________________________ Date: __________
- Other (Local Agency, FHWA, Surety, etc.): ___________________________ Date: __________

**To be completed by Project Engineer:**

- CO Reason(s) (see CCIS “Browse Reasons” or HQ Const. SharePoint): ___________________________

- Change order prepared by: ___________________________ Date: __________

- Has change been entered in lessons learned? Yes ___ No ___ Has design documentation been updated: Yes ___ No ___

- Is this project under full FHWA stewardship oversight? *¹ Yes ___ No ___

**To be completed by Region:**

- Is the change eligible for Federal participation where applicable? Yes ___ No ___

- Change order reviewed by: ___________________________ Date: __________

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*¹ Change (Cost or Credit) greater than $200,000 or greater than 30 days or Full Federal Stewardship Oversight requires FHWA approval (see Ch. 1-2.4C(3) Ch. 1-3.4 and http://www.wsdot.wa.gov/biz/construction/Stewardship/Stewardship.xls).

*² Per RCW 47.28.050, any change beyond $7,500 that is beyond the original scope shall go through the competitive bidding process.

This form represents the minimum information required by State Construction. If you wish to supplement this information, you may do so on a separate sheet of paper.

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*Figure 1-5*
• A negotiated price will likely be higher than a competitive bid price.
• A proposal which assigns extensive risk to the contractor will likely be more costly yet.
• The contractor may be willing to take on this risk if the price is a bit higher
• The significant advantage of reaching a price agreement before the work is started (forward pricing) is that the contractor assumes the risk of the accuracy of the pricing assumptions and predicted duration for performing the work.
• (when forward pricing) the Project Engineer may utilize the high end of the estimating range in justification.
• (when forward pricing) an audited overhead rate may be substituted for the markups described in Section 1-09.6.
  Contractors can usually provide an estimated home office overhead rate which may be checked by an annual audit, if warranted.

(III) PRICING AFTER FACT

When establishing prices after the work has been performed, actual costs should be used to the extent they are available. The following are key points to keep in mind:

• Costs for equipment cannot exceed the rates established by the AGC/WSDOT Equipment Rental Agreement for an equitable adjustment.
• When pricing after the fact, the markups described in Section 1-09.6 are appropriate for measuring time and materials because there is no risk involved in after the fact pricing.

(IV) UNILATERAL PRICING

In the interest of being timely, the change order should be a tool to document agreement and not a negotiation tool back and forth. Ideally we will have agreement with the contractor when pricing the work. On occasion, however, due to time constraints and difference of opinion, we can’t always come to agreement. The difference of opinion may be for only a small portion of the work. Standard Specification 1-09.4 (2) provides, “If the parties can not agree, the price will be determined by the Engineer using unit prices, or other means to establish costs”. This is not to say that the contractor is obligated to honor unit bid prices for work that qualifies for an equitable adjustment. This allows us to proceed with changed work prior to reaching an agreement on the price. In the interest of being timely, and provided the Project Engineer is comfortable that the included price can be supported, there’s nothing wrong with issuing a change order to the contractor unilaterally. This orders the work to proceed, establishes the State’s position on cost, and puts the decision to continue negotiations in the contractor’s hands as detailed under 1-04.5. The contractor is obligated to endorse, write a separate acceptance, or protest as described in the specification and a timeline is provided for these actions.

(V) TIME

The completed equitable adjustment should include provisions for any increases or decreases in contract time based on impacts to overall contract duration. The decision on time should be supported by an analysis of the project schedule. Analyzing time in advance encourages communication between the parties allowing the contracting agency to make an informed decision on the true costs. It also enables the contracting agency to mitigate time impacts if that is in the agency’s best interest.

1-2.4C(3) Approval of Changes/Checklist

In addition to noting who can execute a change order, the checklist (see Figure 1-5) further indicates who must approve the change prior to execution. The completed checklist shall accompany the change order when it is transmitted to Headquarters, and represents the minimum information required to process the change order. If the Region wishes to supplement the checklist, they may do so on a separate sheet. Written approval constitutes agreeing with the general nature of the change and can be granted by memorandum or e-mail. The checklist works as follows: for any item marked “yes”, approval from the State Construction Office must be obtained if indicated by the column with the “Xs”. The Project Engineer and the Region Construction Office have the authority to decide not to proceed with the change. This approval does not constitute authority to proceed with the work. That authority must come from the person who will execute the change order (see prior approval) in an emergency; the Region Construction Manager may authorize work to begin on any change order if the State Construction Office cannot be contacted for the required approvals within a reasonable amount of time.

(I) STATE CONSTRUCTION OFFICE

[1] FHWA APPROVAL - On a project with federal funding and for which the stewardship responsibility has not been delegated (full FHWA oversight), written FHWA approval, or other less formal prior approval if the public interest is served by the more timely action, is required prior to beginning work on change orders that will:

• involve new construction on the Interstate
• alter the termini, character, or scope of work
• increase or decrease the project cost by more than $200,000 (except for changes prepared in accordance with Standard Specification Section 1-04.6)
• add more than 30 days to contract time

[a] who does what? The State Construction Office will formally submit this type of change order to FHWA for approval.

Projects with full FHWA oversight are listed on the State Construction Office web site at: http://www.wsdot.wa.gov/biz/construction/Stewardship/Stewardship.xls.
BRIDGE TECHNICAL ADVISOR (BTA)

Region may approve the change order.

CHECKLIST ITEM #11: the State Materials Lab plays a major role in:
- Assessment of Liquidated Damages; Contract D/M/WBE, EEO, and Training Programs (i.e., Division 1 of the Standard Specifications).

CONSTRUCTION ENGINEER, BRIDGE

- Areas of responsibility: Division 6 of the Standard Specifications (See Chapter 1-1.3A(3)).

CONSTRUCTION ENGINEER, ROADWAY

- Areas of responsibility: Divisions 2, 3, 4, 5, 7, and 8 of the Standard Specifications (See Chapter 1-1.3A(2)).

MATERIALS LAB

- Areas of responsibility as you will notice from the checklist, the lab plays a major role in:

- The BTA is an on call advisor to the Project Engineer on issues related to structural design. The BTA's role is to act as a resource for the Project Engineer in answering questions relating to design, plan clarifications and "minor structural changes".

- Assignment of BTA: After the contract has been awarded, the Region may send a written request to the Bridge Design Engineer in the State Bridge and Structures Office for the assignment of a Bridge Technical Advisor (BTA).

- Delegation of executing authority if BTA is assigned: When a BTA has been assigned to the project, the Region may execute certain "minor structural" change orders provided: 1) 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 structural concurrence from the BTA; and 2) the magnitude of the change is within the Region's authority to execute. All other requirements of the change order checklist apply with the exception that for "minor structural" changes under item #15 the BTA's recommendation may substitute for the State Construction Office approval. A "minor structural" change is not easy to identify, therefore when in doubt, contact the State Construction Office for advice. Changes involving specifications, materials, work method changes, repairs and major design changes should be referred to the State Construction Office. The BTA would never become involved in contract administration issues such as payment, determining the existence of a change to the contract or directing the contractor. These would be construction issues. Structural questions which require support analysis exceeding field capabilities or questions regarding geotechnical or hydraulics issues should be referred to the State Construction Office. Any redesign of significance will be managed through the State Construction Office.

- BTA duties: the Region and the Construction Office have agreed that "minor structural" questions may be referred to the BTA. Those "minor structural" questions which can be resolved on site may be handled directly by the BTA. Documentation will be provided to the Project Engineer in support of the recommendations. The BTA also takes on the responsibility of keeping the Bridge and Structures Engineer advised of any changes, as appropriate.

- BTA guidelines: Specific guidelines for the BTA's role on site are as follows:
  - Be alert to the need for technical advice to the Project Engineer and be available and responsive to the Project Engineer's requests.
  - Develop solutions in accordance with the best structural interest of the project.
  - Recommendations should generally be made in writing to the Project Engineer and should include an assessment of the approximate cost of the change.
  - Provide the Project Engineer with written documentation to support the recommendations for changes. The Project Engineer will consult with the State Construction Office, as appropriate.
  - The BTA has the authority to approve and endorse the structural changes on behalf of the State Bridge and Structures Engineer.
  - Keep a written record of activities and recommendations pertaining to the assigned project (project diary).
  - Refer/leave contract administration issues to the Project Engineer.
  - Conform to the field safety requirements of the Region and the contractor.
  - Give the construction project priority but 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 State Bridge and Structures Engineer.

BTA summary: in conclusion, it is the role of Bridge Technical Advisors to advise the project engineer in their area of expertise, which is structural design. The project engineer has the responsibility and authority to administer the contract. Therefore, when it comes to contract issues of payment, work methods, material substitution, etc., it will be the Project Engineer's responsibility to get the proper approval of those aspects of structural changes.
1-2.4C(4) Delegation of Execution Authority

(I) HIGHWAY CONSTRUCTION

The Change Order Checklist (Figure 1-5), in addition to
describing the approval requirements previously described,
also outlines who has authority to execute a change order.
The State Construction Engineer (or designee) executes the
change order:

- if any one of 1, 2, or 3 is true (checklist item # 1, 2, or 3
  is yes)

The Region (Regional Administrator or designee) may
execute a change order provided:

- 1, 2 and 3 are not true of the change (checklist item # 1,
  2, and 3 are no)

The Regional Administrator’s authority to execute change
orders may be:

- delegated to the Regional Construction Manager
- further delegated to the assistant to the Regional
  Construction Manager

The Region’s (Regional Administrator or designee) authority
to execute a change order may be delegated to the Project
Engineer provided:

- items 1 through 6 are not true of the change
  (boxes 1 through 6 are marked no)

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

(A) LIMITS OF EXECUTION AUTHORITY

<table>
<thead>
<tr>
<th>Executing Authority</th>
<th>Dollar Limit</th>
<th>Time Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Construction</td>
<td>Greater than</td>
<td>Greater than</td>
</tr>
<tr>
<td>Engineer</td>
<td>$1,000,000</td>
<td>60 days</td>
</tr>
<tr>
<td>Construction</td>
<td>not to exceed</td>
<td>not to exceed</td>
</tr>
<tr>
<td>Engineers</td>
<td>$1,000,000</td>
<td>60 Days</td>
</tr>
<tr>
<td>Assistant</td>
<td>not to exceed</td>
<td>not to exceed</td>
</tr>
<tr>
<td>Construction</td>
<td>$750,000</td>
<td>45 Days</td>
</tr>
<tr>
<td>Engineers</td>
<td>$500,000</td>
<td>30 Days</td>
</tr>
</tbody>
</table>

(II) WASHINGTON STATE FERRIES

The Director and CEO of WSDOT Division of Washington
State Ferries is authorized to approve all changes for terminal
construction projects and may consult the State Construction
Office for advice. This authority to execute change orders
may be:

- Delegated to the Director of Terminal Engineering
  provided the change does not include a cost or credit
  exceeding $500,000 nor does it change the condition of
  award requirements.
- Authority may be further delegated to the Manager of
  Terminal Maintenance and Construction provided the
  change does not exceed $100,000 and does not include
  a time extension exceeding 10 days.
- In the absence of the Manager of Terminal Maintenance
  and Construction, that Manager’s execution authority
  may be further subdelegated to the Assistant.

(III) LOCAL AGENCY PROJECTS

When the project being administered includes local agency
participation, the project engineer should coordinate with
the Regional Local Programs Engineer and the local agency
to establish an approval process acceptable to all the parties.
Any funding constraints and timelines for reviews and
approvals should be established and specified in the contract,
if appropriate.

1-2.4C(5) Prior Approval

The best business practice is to have a signed change order
in place prior to proceeding with the work. Prior approvals
should be the exception. A prior approval might be warranted
if it will provide a cost/time benefit to WSDOT or minimize
a cost/time disadvantage to the contractor. In the event
that the Project Engineer determines that it is in the State’s
best interest to proceed with the work prior to having a
signed change order, the permission “prior approval” of
the executing authority to proceed with the change under
these circumstances must be documented in the file. The
executing authority is the person who will ultimately execute
the change order. The project engineer must have either an
executed change order or a prior approval in place prior to
proceeding with the work

1-2.4C(6) Documentation

(I) STATE CONSTRUCTION OFFICE ROLE

The State Construction Office will review Region executed
change orders and provide appropriate feedback. Four main
areas the Construction Office will review are:

- whether the change is appropriate and there is
  entitlement
- determine compliance with the change order checklist
- check for existence of supporting documentation
- determine if eligibility for federal-aid participation has
  been addressed

(II) PROJECT FILES

[1] CCIS INPUT The Project Engineer shall ensure that the
following information is input into CCIS accurately and in a
timely manner:

- Contract No.: (in 6-digit format)
- Proposed By: C(Contractor), E(Engineer), or
  B(Both)
- Order Date: Date change order entered into CCIS
- Unilateral Change: Y/N
- PE Stamp required: Y/N
- Short Description: Descriptive title for change
  order
- Is this a MINOR CHANGE? :Y/N

- Page 2 – (Use only if approval to proceed is requested)
  - Approval Date: The date approval given
  - Estimated Amount:
  - Requested By: Who requested approval
  - Approved By: Who gave approval
• Estimated Amount: The estimated dollar amount of the change order
• Narrative: Description of why approval is needed

Page 3 – (Use only if this change order is a CRIP)
• CRIP Amount
• Commentary on CRIP

Page 4
• Sent To Contr: The date the change order was sent to the contractor for signature/concurrence
• Rec’d From Contr: The date the change order was returned from the contractor
• Surety Consent: Was surety consent obtained
• Surety Date: Date surety consent obtained
• PE Recom: Is PE recommending approval by Region or HQ
• Exec: Initials of PE if executing change order
• Date: Date that PE executed or recommended execution (Note: the date field on line 4 is for Region or HQ use only)
• By Whom: Who voided change order (if applicable)
• Date: Date change order was voided (if applicable)

Page 5
• Phase: Contract phase affected by change order (if days added/deleted)
• Description: Phase description (if days added/deleted)
• Net Change: Number of days added/deleted by change order

Page 6
• What Section of contract changed?
• Describe the Detail Change:
• What created the need or caused the change?
• What is the purpose of this change order?

Page 7
• Description: Change order text (uploaded from MS Word)

If new items are created, contract items modified, or Condition of Award is modified by the change order, this information must be input into CCIS as well.

It is important that CCIS input be accurate and timely. CCIS is used by internal and external customers to monitor project changes and costs. Information on change orders (including minor changes) is readily accessible through a numbering process and must be adequate so that everyone involved will understand the need for the change. Some key items to remember are as follows:
• Is there a clear description of the work?
• Is the origin and purpose of the change being entered using at least two of the reasons listed in the system?
• Was there an order, other than a signed change order, by the engineer for the contractor to proceed?
• Is there a reference to any key documents in the change order file?

• Are any increases or decreases in contract time associated with the change order entered in the appropriate field enabling the Weekly Statement of Working Days to be automatically updated?
• For condition of award change orders, are the appropriate fields filled in to generate the change order and automatically update the condition of award items?
• Are any disclaimers included in the change order and are any agreed upon disclaimers included in the text?
• Are all the appropriate dates entered?

[2] Memorandum: The memorandum transmitting the change order and attachments should include an explanation in sufficient detail so that everyone involved will understand the need for the change, will see that the price is appropriate and that appropriate checks and consultations have been made. The following is a list of items to consider for inclusion in the transmittal when putting together a change order:

{a} describe the change
• what is required by contract?
• what is the change?
• how does it solve the problem?
• reason for entitlement/why is this not paid under the contract?
• is there time associated with the change?
• did the contractor concur/if not why?
• is FHWA participation appropriate?
• does the change affect COA?

{b} evolution of the change
• how did the change evolve?
• discussions with associated offices (maintenance, utilities, environmental, budget, design, etc.)
• alternatives considered
• BTA involvement
• design approval necessary
• COA substitutions authorized by State Construction Office
• approvals in accordance with the checklist/date

{c} payment
• any increase or decrease in cost
• how it was established (see equitable adjustment)
• force account must include estimate

{d} time
• does the change impact the critical path?
• how was any change in working days established?
• note if a change in contract time affects the amount of liquidated damages

{e} prior approval
• was the change order executed by the appropriate WSDOT authority prior to proceeding with the work?
• if not, prior approval by whom and when
All contracts will have a standard item for “Minor Changes”. This item will be established in every group as a calculated lump sum. Credits, debits, changes in working days and no cost changes may all be processed under the minor change method subject to the listed criteria.

(II) CRITERIA FOR USE

Keep in mind that although the change meets the criteria for using the minor change process, the Project Engineer may decide that this process is not appropriate. The use of this item is at the Region’s and the Project Engineer’s discretion. Also keep in mind that the limitations and approvals required by the change order checklist still apply as well as all other change order criteria not modified by this Minor Changes section. The Minor Changes process is limited to changes that satisfy all three of the following criteria:

- non-structural changes (checklist item #15 is no) and,
- the value of the change (credit or debit) is estimated at $15,000 or less and,
- any change in working days not greater than ten days.

(III) ENDORSEMENT

In the interest of being timely, the change order should be a tool to document agreement and not a negotiation tool back and forth. The contractor’s authorized signature on the change order is desirable but not mandatory. A phone call or a verbal agreement with the project superintendent may be appropriate if payment is to be made by “Minor Changes”. This may be a good discussion item at preconstruction meetings. The Project Engineer should determine when the Contractor’s signature is required based on when it is in the State’s best interest to document agreement prior to proceeding with a change order. Some situations that may warrant the Contractor’s signature are as follows:

- The contract includes substantial incentives.
- There are mutual benefits associated with the change.
- The change might include impacts to time or other work.
- The change is proposed by the contractor.
- The change is a claim settlement.

In any case, a copy of the Minor Change must be sent to the contractor. If the contractor does not agree with the terms or conditions of any change order and has not endorsed the change, then the contractor is required to follow the procedure outlined in Section 1-04.5 of the Standard Specifications. This orders the work to proceed and puts the decision to continue negotiations in the contractor’s hands as detailed in that section. The contractor is obligated to endorse, write a separate acceptance or protest as described in the specification, and a timeline is provided for these actions.

(IV) EXECUTION

Due to the criteria for the application of minor changes, the Project Engineer has the authority to execute these change orders.

(V) PAYMENT BY LUMP SUM

The negotiation of prices for payment under “Minor Changes” is intended to be the same as any other change order. The focus, as always, should be forward pricing such that the contractor controls the work and assumes the risk. However, situations occur where it makes sense to measure portions of the work in a variety of ways such as units, force account and/or lump sum. The method for
establishing, measuring and monitoring the total may be by any combination of methods however, the payment will only be by a lump sum under the item “Minor Changes”.

(VI) PROJECT FILES

[1] CCIS INPUT “Minor Change” change orders must be entered into CCIS, however the required input is slightly abbreviated. Since a formal change order document as described in Chapter 1-2.4C(6) is not processed, the Work Description section in CCIS requiring a detailed upload of text is not required. However, the Short Description is required and should provide enough detail to identify the content of the “Minor Change” change order. All other information requested by CCIS, including changes to working days, is required.

[2] TRANSMITTAL Under the Minor Change process, the “Change Order - Minor Changes” form # 421-005A EF substitutes for the transmittal included in the more formal process described above. The information on the Minor Changes form should at a minimum briefly document three key items:

- A description of the change
- Reason for entitlement/why this is not paid by bid items.
- Any increase or decrease in cost and time and briefly how it was established.

[3] DISTRIBUTION When utilizing the “Minor Change” process, the “Change Order - Minor Changes” form shall be submitted to HQ. In the case of rented equipment, the Engineer may ask for the equipment to be used. The cost per hour for the equipment to be used. 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 the additional work. The cost for this type of activity is presumed to be included in the Contractor’s markups for overhead and profit. However a foreman or, in some cases, a dedicated superintendent 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, these employees may be utilized in force account work.

In the case of some Emergency Contracts (see Emergency Relief Procedures Manual M3014.01) which will be measured and paid by Force Account, it is appropriate for the Engineer to consider payment for mobilization of equipment to the site of the emergency, including all staff time employed to procure and coordinate the mobilization. It may also be appropriate to include the labor payment for a dedicated superintendent and foremen employed solely to oversee the emergency work. On emergency contracts the mark ups may not be enough to cover the cost of performance bonds; the Project Engineer may consider payment for performance bond costs when making payment under emergency force account contracts.

The Project Engineer should consider a decision to direct force account work with the same degree of caution that would be applied to directing any other work on the contract. The Contractor should have the expertise to schedule the work and determine what equipment is required. In most cases, it is best that we allow the Contractor to propose the method and approach to the work. Our most effective role would be to concur or approve of the Contractor’s proposal or suggest modifications to it. Before any work is performed by the Contractor on a force account basis, the inspectors should review and agree with the Contractor 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. This agreement will be closely tied to the development of the Labor List.

2. 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. For materials representing a significant cost, or where the industry experiences fluctuations in price, the contract allows for shopping and the Contractor may be directed to obtain quotations. If time permits and the situation seems appropriate, the Project Engineer may want to do this.

3. 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. In the case of rented equipment, the Engineer may ask for competitive quotations, provided the request is made in advance and there is time to obtain them.

1-2.4D Force Account

1-2.4D(1) General

When it is difficult to provide adequate measurement or to estimate the cost for certain items of work, force account may be used in order to pay the Contractor for performing the work. Some contract items may be set up to be paid by force account. Some change orders may require payment by force account. Section 1-09.6 of the Standard Specifications describes the boundaries for payment of work performed by the force account method. In any case, the purpose of force account is to fully reimburse the Contractor for costs incurred on the work. These costs may also include indirect segments, such as travel, per diem, safety training, industrial safety measures, overhead, profit and other hidden costs. The objective is to minimize the inclusion of any “contingencies” included in the contract bid in anticipation of costs that may be incurred during force account work and not reimbursed.

When work is added to the contract and is to be paid by force account, a change order will have been prepared describing the added work to be performed. The change order package will also contain an independent estimate of the cost to perform the added work. All non-standard force account items are assigned the Standard Item Number 7715.
Payment for force account work should be made 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. The procedure for record keeping and payment of 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.

1-2.4D(2) Payment Procedures for Force Account Work

1. Labor. The specifications require the Contractor to prepare and submit a “Labor List” in advance of force account work. Once approved by the Project Engineer, this list provides the hourly rate for force account calculations until a new list is approved. New lists will not be approved retroactively and calculations previously made from an approved list will not be changed when a new list is approved. If the Contractor fails to submit a list before the first force account calculations are made, then the Project Engineer will determine the rates from the best data available (payrolls on this job, payrolls on other jobs, prevailing wage requirements, union information, etc). Labor list rates will include all the pieces of wage expense — base rates, benefits, assessments, travel, with allocations shown where necessary. Examples of Labor List entries might be:

<table>
<thead>
<tr>
<th>Generic Laborer</th>
<th>John Doe, Teamster</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Straight Time)</td>
<td>(Overtime)</td>
</tr>
<tr>
<td>Basic Wage/hr $21.36</td>
<td>Basic OT Wage/hr $32.81</td>
</tr>
<tr>
<td>FICA (7.65%)</td>
<td>FICA (7.65%)</td>
</tr>
<tr>
<td>FUTA (0.80%)</td>
<td>FUTA (0.80%)</td>
</tr>
<tr>
<td>SUTA (5.42%) Total = 2.96</td>
<td>SUTA (5.42%) Total = 4.55</td>
</tr>
<tr>
<td>Indus Ins $1.01/hr</td>
<td>Indus Ins $1.01/hr</td>
</tr>
<tr>
<td>Indus Ins $1.01/hr</td>
<td>Indus Ins $1.01/hr</td>
</tr>
<tr>
<td>Benefits/Hr $30.78/hr</td>
<td>Benefits/Hr $46.37/hr</td>
</tr>
<tr>
<td>Travel Expense</td>
<td>Travel Expense</td>
</tr>
<tr>
<td>$250/40 hrs $6.25/hr</td>
<td>$250/40 hrs $52.62/hr</td>
</tr>
<tr>
<td>Total $37.03/hr</td>
<td>Total $52.62/hr</td>
</tr>
<tr>
<td>Use $37/hr Use $53/hr</td>
<td></td>
</tr>
</tbody>
</table>

These examples show the rate rounded to the nearest dollar, which is permissible. If either party would prefer to use the unrounded amount, that is also acceptable. When deciding how many hours require compensation, the specification allows all hours that are a contractual obligation or are customary payments made to all employees. This means that, if a labor contract calls for 4 hours of pay for any call out, then that is a contractual obligation and the 4 hours would be eligible for reimbursement. (As always, the Contractor is expected to reassign the employees, if possible, to avoid the penalty.) In the same vein, a non-Union contractor, who has made call out payments to all employees for years, would be eligible for reimbursement for similar payments in a force account.

2. Materials. Materials also work from a list, but the list is generated in a different fashion. The Project Engineer provides the basic list of materials observed by the inspector. This is done in a timely manner (daily, unless the Contractor agrees otherwise). The Contractor adds prices to the list and attaches invoices or affidavits to support the prices. Once the list is returned and checked, payment can be made. If a shipment of material is only partially consumed during the force account reporting period, the inspector may choose to include the entire amount in the first report or to estimate the amount consumed during each reporting period. The decision should be based upon the amount of the shipment, the nature and cost of the shipment and the security of the stockpile. A case of empty sandbags to be utilized throughout the winter for pollution control would adapt well to a single report, while a stockpile of galvanized conduit should probably be reported piecemeal as it is used in the work. The Contractor may use copies of the original invoice when the material is reported incrementally. If the Contractor has to restock unused material, restock charges can be reimbursed if the original order was reasonable for the work planned.

Along with supplying prices and invoices, the Contractor may suggest additions or corrections to the Materials List. These suggestions will be reviewed by the Project Engineer and, if appropriate, added before payment is made. If the Contractor does not have an invoice, as in the case of stockpiles or some warehouse stock, then an affidavit will suffice. The Engineer may review the affidavit and, if it is an unreasonable price that cannot be supported, the Engineer may substitute another price, utilizing the best data available. The reasonableness of the price must consider the circumstances of the purchase and all costs associated with obtaining material from another source.

The specifications allow the Engineer to require competitive quotations, if this is done before the work is started and sufficient time is available. If the Contractor has to divert an employee to obtain the quotations, then that employee may be included in the labor reimbursement for the force account.

3. Equipment. The Project Engineer should review and comply with the rules governing payment for equipment as outlined in the most current AGC/WSDOT Equipment Rental Agreement. This agreement was developed as a supplement of the specifications and is relatively self-explanatory.

There are three methods of acquiring equipment for use on a force account. “Owned” means that the Contractor controls and operates the equipment. A long term lease arrangement would be the same as ownership. Owned equipment is priced according to the Blue Book. “Rented to Operate” means that the Contractor has obtained a piece of equipment through a short term rental and will operate that equipment with its own employees. Rented to Operate equipment is priced according to the invoice from the rental agency. “Rented Operated” means that the Contractor has obtained a service from an individual or a company to provide a piece of equipment with an operator. An operated rental is not paid as equipment, but rather as a Service. In some cases, the Service will be reclassified as an entity performing in the manner of a subcontractor (see below).
Damage waivers are compensable. The Engineer has the discretion to reimburse for a damage waiver when it makes good business sense. Upon request, the Contractor should be able to demonstrate that the purchase of the damage waiver is consistent with their standard business practice. Consideration should be given to the potential risk of damage to the equipment versus the cost of paying for the damage waiver. In most cases, the cost of the waiver is minimal. The damage waiver does not cover damage caused by operator negligence, nor should the Department reimburse the Contractor for repair of any damage caused by operator negligence.

Normal wear and tear on equipment is included in the Blue Book rental rates. The ownership rates include major overhaul of the equipment. The Blue Book defines major overhaul as the periodic rebuilding of the engine, transmission, undercarriage, and other major equipment components. The operating rates include the cost of daily servicing of the equipment, including the replacement of small components such as pumps, carburetors, injectors, filters, belts, gaskets and worn lines. The operating rates also include the cost of expendables such as fuel, lubricants, filters, tires, and ground engaging components, such as pads, blades bucket teeth, etc.

The costs of extraordinary operating expendables are not covered in the operating rates due to their highly variable wear patterns. These extraordinary operating expendables may include certain ground engaging components, such as hammer and drill bits, drill steel, augers, saw blades, and tooth-bits. The cost for these items will normally be recovered separately, based upon invoices for their cost.

Repair of damage is considered a risk of providing equipment. The cost of this risk is assumed to be in the markup for overhead and profit. Costs for repair of damage should not be included in the force account direct charges. A common event is the offer of a Damage Claim Waiver by a renting agency. If such a charge appears on an invoice, it may be considered for inclusion when payment is calculated.

As with Materials, the Engineer may require competitive bids for equipment rentals. Normally, this requirement must be made in advance, before the work is started. However, if the rental is not made in an “arm’s length” transaction, for example when the invoice comes from a subcontractor without sufficient effort to find competitive prices, then after the fact quotations may be obtained from independent service providers and the lowest such quotation may be used in place of the service invoice.

5. Mobilization. Mobilization and demobilization are reimbursable expenses for assembling equipment, materials, supplies and tools for any force account item and then returning those items to the previous location when the work is finished. Demobilization can include restocking costs for materials not utilized. Force account mobilization applies to original bid item force accounts as well as force accounts added through change orders. The standard bid item “Mobilization” is assumed to not include mobilization activities on the project unless the mobilization effort would be reimbursed.

Mobilization may occur within the project limits if special efforts are required to assemble needed items to the force account location. For example, if a lowboy is required to move a bulldozer from one end of a project to the other, then that mobilization effort would be reimbursed.

If off site preparation work is needed, the Contractor must notify the Engineer in a timely enough manner that the work can be observed, if that is desired. Without such notice, that preparation work will not be reimbursed.

The AGC Agreement allows for pro-rating mobilization costs for equipment that will be used in both force account and bid item work. This will be done by negotiation and agreement. For example, if the Project Engineer and Superintendent agree that a mobilized backhoe will be used three hours on regular work for each hour on force account, then 25 percent of the mobilization costs would be paid on the force account.

All mobilization activities can be categorized as Labor, Equipment, Materials, or Services and will be listed under those categories for payment.
6. Other Payments

Permits or Fees

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, these costs are reimbursable and may be included in the “Services” section of the force account payment.

Sales Tax

How retail sales tax is handled on the overall project depends on the ownership of the property upon which it rests. Keep in mind that a project may span more than one type of ownership.

STATE AND PRIVATELY OWNED LANDS

Work performed on state or privately owned land falls under Section 1-07.2(2) of the Standard Specifications and Department of Revenue Rule 170. Retail sales tax is required on the total contract amount. The Contractor is required to pay retail sales tax on all purchases regardless of use (“consumable” or not). For contract work, this expense is incidental and therefore included in the individual contract items as a part of the bid amount.

When calculating or estimating the cost of force account or change order work, sales tax should be included on all invoices. As stated previously, the fact that taxes are shown or not shown on invoices is not a reliable indication of what the contractor is obligated to pay. The contractor may receive reimbursement later or be required to pay additional taxes when the contract is complete. The contractor’s books are audited by the Department of Revenue upon completion of each project to ensure compliance.

Exceptions

Construction of the following facilities has been specifically exempted from Department of Revenue rule 171. Work on these facilities falls under Department of Revenue rule 170 even if they are on non state 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
- Other conduits or lines

Conclusion

Most of the time, retail sales tax on invoices is required. In turn, we need to reimburse the contractor for the tax (paid or deferred) on force account invoices and include the costs when estimating the value of change order work.

The one exception is “resale” items if the contract falls under Department of Revenue rule 170. “Resale” items under this rule do not require that retail sales tax be paid at the point of purchase.

These rules should be adhered to regardless of whether retail sales tax is shown on the invoice.

Subcontractor Markup

If work is being performed by a subcontractor (or by a service supplier acting in the manner of a subcontractor), then a supplemental markup will be added. This supplement will be added one time for each payment, even if a lower-tier subcontractor is doing the work. The markup is a graduated step down rate, which gets smaller for each force account item as the amount of work increases.
The amounts on which the rate is determined will be tracked separately for each subcontractor on each force account item included in the original contract or added by change order. If two subcontractors work on the same force account, then the accumulated total will be tracked for each, and markup for work done by each will be according to the respective total. If a single subcontractor works on two force accounts, then there will be a running total of work done by that subcontractor on each account and the markup rate for the same sub on different force accounts could be different.

1-2.4D(3) Records and Source Documents

Accurate daily time records should always be kept when performing force account work. Form 422-008, “Daily Report of Force Account Worked”, is provided for the Project Engineer’s use to help facilitate timely, accurate, and complete records of the daily force account activities. Whatever method of record keeping is used, it is recommended that the document be signed by both the Inspector and a representative of the Contractor agreeing on the materials used and the hours noted for labor and equipment. A copy of the daily report must be provided to the Contractor. When the work is performed by a subcontractor, a copy should also be provided to the subcontractor.

The costs for force account work should be determined and entered into the CAPS system in as timely a manner as possible.

All calculations for determining force account costs should be checked, initialed, and dated. After the cost of the work has been computed in the office, a copy of calculations shall be furnished to the Contractor.

1-2.4D(4) Summary

To summarize, the purpose of force account is to fully reimburse the Contractor for costs incurred on the work. The objective of force account administration is to minimize the inclusion of any “contingencies” included in the contract bid in anticipation of costs that may be incurred during force account work and not reimbursed.

Items which are bid or negotiated with a unit price or a lump sum agreement will not be converted to force account unless a change (as defined in Section 1-04.4 of the Standard Specifications) has occurred. On the other hand, any work to be done or the remaining portion of work underway on a force account basis may be converted to unit prices or a lump sum at any time the parties can reach an agreement. Such a conversion is highly desirable and should always be a goal of the Project Engineer.

1-2.4E Differing Site Conditions (Changed Conditions)

There are two types of changed conditions. The first (Type I) is a hidden condition that is different from that indicated by the contract (the borings do not show this rock). The second (Type II) is a hidden condition that is not shown differently in the contract, but is unusual and different from what a reasonably prudent contractor would expect (I’ve never seen this before and nobody else has ever seen it, either). In either case, to qualify for renegotiation, the condition must have a “material” affect on the cost of doing work. In other words, there must be a definable difference in the way the work will now be done and that difference must be significant.

The contractual rules included in Section 1-04.7 are related to fair notice and to giving the State an opportunity to examine the condition and, perhaps, order a different approach to the work. If the contractor takes away this opportunity, then there may be grounds for denying compensation for the different approach to the work. In some cases, the changed situation is not recognized until much or all of the work has been done. In that case, the determining factor for notice is the time when the Contractor knew or should have known of the condition. Whenever notice is served, it must be written.

In a perfect world, a changed condition will be recognized, notice will be given and work will be stopped until all the interested parties can reach agreement on how to proceed. In the real world, we are often faced with traffic closures and safety issues. Contractors work on tight schedules with one activity interdependent on others and it is not in the public interest to stop work while a changed condition discussion takes place. As soon as possible, to the extent possible, and in any manner which accomplishes the intent, the Project Engineer is expected to consult with the Region Construction Manager and the State Construction Office to obtain the approval before agreeing that a changed condition exists or before entering negotiations for price adjustments.

The Department response to a contractor’s assertion of changed conditions, whether agreement or denial, must be written. The Project Engineer must keep accurate time and material records whether the response was negative or positive.

1-2.4F Termination of Contract

Contract termination is divided into two major categories, termination for default and termination for public convenience. Section 1-08.10(1) of the Standard Specifications defines the situations when a contract may be terminated for default (doesn’t happen very often.) Section 1-08.10(2) of the Standard Specifications defines the situations when a contract may be terminated for public convenience.

Keep in mind that the conditions of the termination may be negotiated in the event that the termination is in the best interest of both parties. An example would be if a major change is beyond the abilities of the contractor. Negotiations with regard to conditions of the termination may include pricing partially completed items, mobilization payment, or the State taking possession of fabricated/purchased materials.

In both categories, if federal funds are involved, FHWA needs to be notified and informed of the situation early in the process. Specifically, Federal participation eligibility should be discussed prior to making a decision on termination. Formal notification and discussion should use normal channels through the Region to the State Construction Office. Authority to terminate a contract rests with the same position that had authority to execute the contract.
1-2.4G Subletting Portions of the Contract

Requests by the Contractor for subletting are submitted on Form 421-012 EF (Request to Sublet) and are to be approved by the Regional construction manager or designee. The request must be approved prior to the performance of any work on the project by either the subcontractor or a lower-tier sub. A copy of the Statement of Intent to Pay Prevailing Wages, executed by the subcontractor or lower-tier sub and approved by Washington State L&I, must be provided to the Project Engineer by the Contractor prior to payment for any work performed by that subcontractor or lower-tier sub. In addition, for Federal-aid projects, Form 420-004 EF (Contractor and Subcontractor or Lower-Tier Subcontractor Certification for Federal-aid Projects), must be submitted with the Request to Sublet.

Section 1-08.1 of the Standard Specifications defines what is not considered to be subcontracting. By default, any entity performing bid item work on the project is a subcontractor, unless: (1) they are the Prime Contractor, (2) an Owner furnished resource (such as WSP, utility owner or its contractor or consultant), or (3) they are specifically excluded from consideration as a subcontractor in Section 1-08.1. Do not be confused by the distinction between Professional Services and Subcontractors in the markups for force account work described in Section 1-09.6. Those provisions apply only to how the markup for overhead and profit is applied to force account work, and they have no relationship to the requirement for a Request to Sublet.

If a subcontractor wishes to further sublet a portion of its work to a lower-tier firm, the Contractor must submit the name of the lower-tier firm along with the request to sublet the work to the subcontractor. If more than one subcontractor on a project wants to utilize the same firm as a lower-tier subcontractor, separate requests are required. Section 1-08.1 of the Standard Specifications sets limitations on the amount of work a lower-tier sub may perform for each subcontractor. Section 1-08.1 of the Standard Specifications also sets forth the procedure for subletting portions of the project, and the percentage of the contract which may be sublet. The dollar value to be used for determining the amount of work that must be performed by the Prime Contractor is the total original contract amount less the amount of any specialty items which have been subcontracted. In order to ensure proper tracking and reporting of sublet information, the Project Office shall enter data from each request to sublet into the CCIS database. When the Project Office is in a situation where the CCIS database is not utilized during the administration of a project (i.e. Emergency Contracts, State Aid Contracts, etc.), and requires the “hand calculation” of the percentage of amount sublet, the percentage will be calculated for all items except specialty items, using the amount shown on the Request to Sublet or the bid amount whichever is smaller.

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 letter and that the Condition of Award items will be 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 the request cannot be approved until the contract is changed.

1-2.4H 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 on for approval or further actions by others. A Change Order is required for any deviation from the contract plans. Any conflicts with the contract plans that have been detected or revisions that may be desired by the Project Engineer should be noted on one copy of the drawings being forwarded to Headquarters 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.

Figure 1-6 is a list of many of the most common shop plans and drawings, and includes references to the specifications that require them and the section of this manual that covers the procedures for processing them. Use Form 410-025 to transmit all listed bridge and structure plans to the Bridge and Structures Engineer.

The Project Engineer should maintain a log of all shop plans or other drawings received for each contract.

Shop plans for items that conform to the contract plans or a standard plan, except those listed in Figure 1-6, should be checked and approved by the Project Engineer.

1-2.4I Relief of Responsibility for Completed Work and Relief of Responsibility for Damage by Public Traffic

Section 1-07.13(1) specifically designates the Contractor as being solely responsible for the completed work or material until the entire improvement has been completed. All work and material, including change order work, is at the sole risk of the contractor and when damaged must be rebuilt, repaired, or restored. When these damages occur to either the permanent or temporary work, and have occurred prior to the contract Completion Date, the costs for these repairs shall be entirely at the Contractor’s expense. However, the specification does provide the contractor exceptions for causes that are generally beyond the contractor’s control.

While the Contractor is fully responsible for the work and materials, the section does provide the contractor some options for relief. Relief is broken into 2 categories. The first category being relief of maintenance and protection for portions of works that have been completed. The second category is for relief of damage caused by the public. When it is necessary that the public use the facility during construction. Both options for relief have specific criteria in order to exercise them. While a brief explanation of each option is provided, the Project Engineer should review the entire Section 1-07.13 of the Standard Specifications to ensure that the extent of responsibilities are understood and that any relief from responsibility is granted in accordance with those provisions.

Section 1-07.13(2) provides relief to the Contractor from maintaining and protecting specific portions of contract work as they are completed. The Contractor must submit a written request for relief to the Project Engineer. Before granting any relief, the Project Engineer will review the request to ensure
that the items of work noted conform to the requirements and limitations outlined in Section 1-07.13(2) of the Standard Specifications and have been fully completed in all respects of the contract. The Regional Construction Manager or designee may approve these requests for relief. Relief may be granted for several specific items, for example: “Item 17, Beam Guardrail, Type I; Item 18, Beam Guardrail Anchor Type I; etc.” Relief may also be granted for all work except certain items, for example: “All work except Item 38, Electrical.” the approval of the Contractor’s request must be in writing.

When it is necessary for public traffic to utilize a highway facility during construction, Section 1-07.13(3) of the Standard Specifications provides relief of responsibility to the Contractor for damage caused to the permanent work by the public traffic. When the conditions specified in this section are met, the Contractor is automatically relieved of this responsibility. However, this section does not provide relief for damage caused by vandalism or other causes. The Contractor will resume full responsibility for both temporary and permanent work if traffic is relocated to another section of roadway. This responsibility will again continue until contract completion unless the section is reopened to public traffic or the Contractor is granted relief under 1-07.13(2).

The first paragraph of Section 1-07.13(3) refers to damage to “permanent work”. This refers to work included in the contract that is being constructed in accordance with the requirements noted in the plans and specifications and is damaged. The intent is to exclude equipment, temporary facilities and temporary materials such as formwork and falsework. Contract features such as “Temporary Traffic Barrier,” are included if they have been constructed according to plan and are damaged by public traffic using an approved traffic plan.

### 1-2.4J Protested Work

Occasions may arise where the contract may not have fully or clearly defined a work activity or financial responsibility. In these cases, the Project Engineer may determine that, in order to avoid delay of other critical work, protect the traveling public, or other critical circumstances, it may be necessary to direct the Contractor to proceed immediately to complete the work. In some instances, this order may be against the Contractor’s wishes. While acknowledging the Contractor’s verbal protest, the Project Engineer should again direct the contractor to proceed with the work in accordance with Section 1-04.5 of the Standard Specifications. The Contractor should also be advised that, as a separate action, they should follow the guidance in this same section for protest and protest resolution. While these provisions require the Contractor to keep accurate records for completing the protested work, it is not advisable for the Project Engineer to rely on these records to determine what may have taken place when trying to verify costs for protested work many months later. In order to help document the Contractor’s work, the form “Report of Protested Work” (DOT Form 422-007) was developed as a tool for the Project Engineer’s use.

### 1-2.4K Metric Designed Projects Administered with English Standard Specifications

Some recent projects, whose plans were developed using Metric dimensions, are being administered utilizing the English version of the Standard Specifications. Any dimensions in the Standard Specifications, Amendments, or Special Provisions that are expressed in English terms are to be converted, utilizing a precise arithmetical “hard” conversion method, to equivalent Metric units, when necessary, to be compared to the contract documents, field conditions or Contractor’s equipment or operations.

The Department still has some Metric projects “on the shelf”. There are also Metric jobs being developed for other agencies, such as Sound Transit. Since there is no current Metric Standard Specification Book, those jobs will be administered using the English book. Several General Special Provisions will be included to accomplish this. These provisions require that, whenever an English dimension or value in the specifications needs to be compared with a contract plan or provision, a field condition or measurement or with the Contractor’s equipment or operation, the necessary conversion will be made utilizing a precise arithmetical “hard” conversion method.

To accomplish the conversion to English specifications, a series of General Special Provisions have been developed to replace those Metric specifications that contain soft conversions. In all cases, the English specifications have been left intact so that, if items must be added through change order, English units may be utilized with the reference to the Standard Specifications without including all the Metric specs in the change order.

The old Metric books contained provisions for “soft” or approximate conversions for a number of elements (bolts, re-steel, etc.). These have been converted to General Special Provisions which will be included with all Metric plan sets. This will allow these exceptions to the “hard” conversion rule noted above. Metric plan sets will have Metric pay units. Change orders on Metric plan set jobs will automatically reference the English specifications and will require English units.

When making payment to the contractor, the project office should measure and pay for the bid item, either Metric or English, indicated as the unit of measure in the contract plan or change order. For example, if the contract calls for “Clearing and Grubbing” to be paid for by the hectare, then the engineer should instruct his crew to measure and pay for the work performed in metric units. The opposite would apply if a change order was written for the project utilizing the English specifications for clearing and grubbing. In that case, the bid item would be measured and paid for in English units (by the acre).

If a situation arises when a conversion is required from English to Metric for an interpretation, a measurement or a payment, the conversion should be made utilizing a “hard” conversion factor. In the case of a payment, the level of precision of the factor will be such that the resulting payment will not vary from the true calculated value by more than one dollar.
1-2.4L Emergency Work Performed Under the Contract

When a natural disaster impacting a wide area strikes, WSDOT may utilize an existing construction Contract in order to restore essential travel, minimize damage or protect remaining facilities. RCW 47.28.170(2) allows WSDOT to contract this work on a negotiated basis provided (a) the cost does not exceed force account rates for the work performed and (b) the contract does not exceed thirty working days. There must be an emergency declaration by the appropriate authority, the Project Engineer must complete a Detailed Damage Inspection Report (DDIR) and the Project Engineer must contact the Regional Program Manager, since this work will initially be funded by state funds. The Project Engineer should follow the guidance provided in the Emergency Relief Procedures Manual, M 3014.01.

Emergency repair work, when performed by the Contractor under an existing Federal-Aid Contract, may be eligible for Emergency Relief funding. In order to qualify for Emergency Relief funding, the repair work must be the result of a natural disaster over a wide area, such as a flood, an unusually severe storm or a landslide. The work must be demonstrated to be beyond the Contractor’s responsibility and not work that has already been scheduled for repair or replacement of deficient structures. Only the work required to protect and open the roadway is eligible for Emergency Relief funding.

Adding emergency work to a State funded contract would require the addition of all Federal-Aid specifications, and is not practicable. It is however acceptable to hire the existing contractor to perform emergency work at the same location under a separate emergency force account contract which would include all the Federal requirements.

1-2.5A Contract Time

1-2.5A General

The contract duration specified for physically completing the contract is stated in the contract provisions normally under the general special provision “Time For Completion.” Although there are exceptions, the guidance in this chapter pertains to contracts in which time is accounted for in terms of working days.

The Contractor may begin work as soon as the contract is executed and shall prosecute the work diligently until physical completion has been reached.

The Region will be notified by telephone on the day the contract is executed by WSDOT. Because it can take several days for the executed contract to reach the Contractor, the Region should immediately provide the Contractor with verbal notification of the date of execution so that the Contractor may order materials and prepare to mobilize onto the project and begin work. The date the contractor actually begins work on the project is to be noted and entered into CCIS.

Between the execution of the contract and the acceptance by the State Construction Engineer, the Project Engineer will likely encounter time-related issues. These will be documented through Weekly Statements of Working Days (Section 1-08.5), Suspensions of Work (1-08.6), Protested Work (Section 1-04.5), and Time Extensions (Section 1-08.8).

Contract Completion Milestones

There are two milestones that establish the end of contract time. They are defined in Section 1-01.3 of the Standard Specifications as Substantial Completion and Physical Completion. These two milestones are discussed in greater detail later in this chapter.

1-2.5A(1) Progress Schedules

The requirements for progress schedules are specified in Section 1-08.3 of the Standard Specifications. A copy of the specified reference, Construction Planning and Scheduling, Second Edition, published by the Associated General Contractors of America, has been sent to each Project Office and each Region Construction Office. One of three progress schedules will be specified in the contract. Two types of progress schedules are identified in the Standard Specifications, Type A and Type B. A third type may be inserted in the contract as a General Special Provision specifying a Type C Progress Schedule. The three types of progress schedules represent levels of job complexity. Type A being the simplest and easiest to produce and Type C being the most complex. Application is such that the complexity of the project (whether it be timing, coordination or the work itself) will be reflected in the complexity of the schedule.

In addition, a preliminary schedule is required on contracts requiring Type B or C Progress Schedules. Preliminary progress schedules show the work to be accomplished within the first 60 working days. As always the contract provisions may contain requirements that add to, or supersede, all or parts of Section 1-08.3 to allow for special circumstances.

There are four basic reasons that we ask for a schedule:

- To better understand the contractor’s plan to deliver the project within the time allowed
- To plan our work force and other resource requirements
- To advise the public and executive staff of major milestones
- And to enable us to actively manage impacts to the contract

Progress schedules should have sufficient detail such that the progress of the work can be evaluated accurately at any time during the performance of the contract. The owner is obligated by contract to return the schedule for correction or approve it within 15 calendar days of receipt. Approval requires that the schedule complies not only with Section 1-08.3 but it demonstrates compliance with other contract requirements such as interim completions, staged work, order of work, etc. Periodically as warranted by progress, delays or changes, the Project Engineer should review the schedule for accuracy and progress of work. If it is determined that the current schedule does not provide the required information or is no longer accurate, a Type B supplemental schedule update may be requested from the Contractor. Monthly updates are required when Type C progress schedules are specified, and the cost of the updates is included in the Lump Sum price of the bid item.
The cost of Type B schedule updates is not included in the Lump Sum price of the bid item. When work is added to the project or the work method is changed at the request of the contracting agency, the respective cost to update the Type B progress schedule should be included in the change order. Type B schedule updates driven by the contractor’s actions shall be provided to the contracting agency and are considered incidental to other work. No payment is made for Type A Progress Schedules or Type A schedule updates. Type B and C Progress Schedules are paid as a lump sum. Eighty percent of the lump sum payment is paid upon approval of the initial schedule. The remaining portion is paid when eighty percent of the original work is completed, provided updates have been provided as requested. Weekly look-ahead schedules are considered incidental to other items of work in the contract and therefore are not paid for separately.

When the Contractor has failed to provide a required schedule, the Engineer may:

- Withhold payment for the Type B or Type C schedule if it is not received (but not for other conforming work).
- Withhold all progress payments for failure to comply with the terms of the contract as specified in Section 1-09.9 (this should be a rare event).
- Suspend work and continue to charge each day as workable (this should only be implemented when the Agency is harmed by lack of knowledge of the contractor’s intended approach to the work).

In extreme cases, the Agency may determine that the Contractor is in breach of contract according to Section 1-08.10 (usually accompanied by other serious breaches).

When lacking a progress schedule, the Engineer must base progress on the information available and their best judgment. According to Section 1-08.5, the Contractor may protest working day charges, but must support the protest in sufficient detail to enable the Engineer to ascertain the basis and amount of time disputed. This provides another opportunity for the PE to communicate our need for a progress schedule.

1-2.5A(1) Review and Approval of Progress Schedules

It is the responsibility of the Project Engineer to ensure that the Contractor submits a correct and complete progress schedule in the time specified. Progress schedules must meet the general as well as type specific criteria. Once it is determined that the progress schedule submitted is of the type specified by the contract, the Project Engineer should evaluate the schedule to determine if it meets the requirements of Section 1-08.3 of the Standard Specifications, the Special Provisions and the Contract.

(I) GENERAL REQUIREMENTS

- The progress schedule must include all activities necessary to physically complete the project. By definition, activities consume time and usually consume resources. Activities like concrete curing time and slope staking earthwork may be rolled-up into the overall duration of the activity.

- The progress schedule must show the planned order of work in logical sequence, and in compliance with any requirements of the contract. The reviewer should remember that some work is sequenced by factors inherent in the work, but the Contractor may sequence the work by their preference as long as the project is completed within the authorized time and in conformance to the contract.

- The progress schedule must show durations of work activities in working days. Except for defining nonworking days, the calendar has no relationship to administering contract time. An activity may be stalled by unsuitable weather for days or weeks and remain “on schedule”.

- The progress schedule must show activities in durations that are reasonable for the intended work. Since durations of work are a function of resource allocation, the Project Engineer may be required to estimate production rates using estimating manuals, experience or other resources, or to ask the Contractor to explain their planned resource allocation to support the duration.

- The progress schedule must define activities in sufficient detail that progress of individual activities may be evaluated on a daily basis. The reviewer should keep in mind that the level of detail required in a progress schedule is driven by the amount of precision required to perform and monitor the work. For example a single activity that represents several miles of grading may not provide adequate detail, and may need to be subdivided into smaller activities described by station limits.

- The progress schedule must show the physical completion of all contract work within the authorized contract time.

WSDOT may accept a Progress Schedule indicating and early physical completion date but cannot guarantee that WSDOT’s resources will be available to meet an accelerated schedule.

If the progress schedule does not provide the required information, it should be returned to the Contractor for correction and resubmittal. Because the Standard Specifications do not specify timelines for resubmittal, the Engineer should provide a reasonable amount of time for the Contractor to revise and resubmit the schedule, and advise the Contractor of the expected date of resubmittal.

(II) TYPE A PROGRESS SCHEDULE

Type A Progress Schedules are required for any projects that do not include the bid item for Type B Progress Schedule or Type C Progress Schedule. The Contractor is required to submit five copies of Type A Progress Schedules to the Engineer no later than the first working day of the project. This may be a critical path method (CPM) schedule, a bar chart, or other standard schedule format, such as fenced bar charts, linear schedules, PERT networks and others. These scheduling methods are described in detail in the benchmark document “Construction Planning and Scheduling, Second Edition”, a copy of which has been provided to each Project Office and each Region Construction Office. The Contractor is required to identify the critical path of the project, because a bar chart schedule does not rely on network calculations to determine the critical path.
The Engineer will evaluate this schedule and approve or return it for correction within 15 calendar days of receiving the submittal.

(III) TYPE B PROGRESS SCHEDULE

Type B Progress Schedules are required for all projects containing the bid item for Type B Progress Schedule.

The Contractor is required to submit a preliminary schedule to the Engineer no later than five calendar days after the date the contract is executed. Preliminary schedules must meet all requirements of a Type B Progress Schedule except that they may be limited to activities occurring in the first 60 days of the project.

The Contractor is required to submit five copies of the Type B Progress Schedule to the Engineer no later than 30 calendar days from the date that the contract is executed. This schedule must be a critical path method (CPM) schedule developed by the Precedence Diagramming Method and may employ restraints provided the restraints do not alter the network logic or critical path. As a minimum the Type B Progress Schedule must show:

- The Contract Number and Title
- Construction Start Date
- Critical Path
- Activity Description
- Milestone Description
- Activity Duration
- Predecessor Activities
- Successors Activities
- Early Start and Early Finish for each activity
- Late Start and Late Finish for each activity
- Total Float and Free Float for each activity
- Physical Completion Date
- Data Date

(Many of these terms are defined in “Construction Planning and Scheduling.”)

The reviewer should watch for fixed date constraints that override network logic and force activities to become critical. Specific work windows or “open to traffic” milestones may legitimately influence sequence and duration of related activities. Resource constraints (such as availability of a large crane) may be preferential and may be explained by the Contractor if necessary. Fixed completion milestones for work that is susceptible to unsuitable weather are inappropriate because completion may be extended by the determination of unworkable days.

It is not unusual to see dual critical paths on a CPM schedule, nor is it prohibited. Multiple critical paths are generally very short in duration. Lengthy occurrences of parallel critical activities should be cause for careful scrutiny of activity durations and sequencing.

The Engineer will evaluate this schedule to insure that all required information is included in the schedule, check the network calculations, and approve or return it for correction within 15 calendar days of receiving the submittal.

(IV) TYPE C PROGRESS SCHEDULE

Type C Progress Schedules are required for all projects that include the bid item for Type C Progress Schedule. The Contractor is required five copies of a preliminary Type C Progress Schedule to the Engineer no later than the first working day (as defined in Section 1-08.5 of the Standard Specification). The preliminary schedule must meet all requirements of a Type C Progress Schedule and of Section 1-08.3(1) except that it may be limited to activities occurring within the first 60 working days.

The Contractor is required to submit five printed copies of a Type C Progress Schedule no later than 60 calendar days after the contract is executed. If the Contractor can demonstrate that they are unable to determine resource availability, and that this lack of information prevents them from preparing a reasonable schedule, the Engineer may allow and additional 30 calendar day for schedule submittal.

Each time that a preliminary schedule, Progress Schedule, or Schedule Update is submitted, the Contractor is required to provide the Engineer with an electronic copy of that schedule, on CD-ROM in Primavera Project Planner Enterprise Version, P3e/c or P3 format.

Type C Progress Schedules must contain all of the information required of a Type B schedule, and the following additional information:

- A timed scale logic diagram.
- Activities for traffic detours and closures.
- Milestones for required delivery of State furnished materials (if any).
- Activities for State furnished traffic controller resources (if any).
- Activities for fabrication of materials with longer than 120 calendar days lead time.
- Fixed constraints shall be identified on the activity listing and be supplemented with a written narrative describing why the constraint exists.
- Monthly schedule updates.

If requested by the Engineer, the Contractor shall provide a written narrative describing assumed production rates and planned resource allocation to support activity durations.

(V) WEEKLY LOOK-AHEAD SCHEDULE

Weekly Look-Ahead Schedules are required for all projects. The Contractor is required to submit a Weekly Look-Ahead Schedule, for each week that work is to be performed on the project, showing Contractor and all subcontractor activities for the next two weeks. The Weekly Look-Ahead Schedule must show:

- Description of the work
- Duration of the work.
- Sequence of the work.
- Planned hours of work.

The specification requires that Look-Ahead Schedules show the contractor’s planned hours of work. This information is necessary to evaluate the results of unsuitable weather on the critical path and to assess working days charges correctly.
This schedule is to be submitted by mid-week of the week preceding the scheduled work, or other mutually agreed upon submittal time.

(VI) SCHEDULE UPDATE

Schedule Updates are required for all projects. The Engineer may request schedule updates when any of the following events occur:

- A change that affects the critical path.
- The sequence of work is changed from that in the approved schedule.
- The project is significantly delayed (10 days or 10 percent of the original contract time, whichever is greater).
- An extension of contract time is requested.

It is important to note that schedule updates are only required when they are requested by the Project Engineer, when a contractor submits a request for a time extension, or monthly in the case of a Type C Progress Schedule. The Project Engineer may request an update when any of the triggers occurs, but may choose to forego the update if the impacts to the schedule are readily evident.

The Contractor is required to submit five copies of the Schedule Update for approval within 15 calendar days of a written request, or when an update is required by contract provisions.

In addition to all other requirements, a Schedule Update must show:

- Actual duration and sequence of as-constructed work activities, including changed work.
- Approved time extensions.
- Construction delays or other conditions that affect the progress of work.
- Modifications to sequence or duration of remaining work.
- Physical completion of all remaining work within the remaining time authorized.

It is important to know the difference between an as-planned schedule and an as-constructed schedule. All updates must show the as-constructed sequence and actual durations of all activities prior to the status date.

When the need for a schedule update is triggered by an event that is the contractor’s doing, they are responsible for the cost. When WSDOT causes an event or requests an update for their need, payment will be made as part of an equitable adjustment. When WSDOT is adding work or time by means of a change order, the price of the schedule update can be included as part of the work.

Any unresolved request for time extension must be shown by assuming that no time extension will be granted, and by showing the effects to follow-on activities necessary to physically complete the project within the currently authorized time for completion.
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<th>Const Manual References</th>
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<td>Supplemental Drawings (Shop Plans for Contract or Standard Plan Item)</td>
<td>1-2.4H 1-01.3</td>
<td></td>
<td>6 sets to PE</td>
<td>Project Engineer</td>
<td>Project Engineer</td>
<td>2 sets to Contractor 1 set to Fabrication Inspector</td>
<td></td>
</tr>
<tr>
<td>Calculations for Overload of Structure</td>
<td>None 1-07.7(2) 6-01.6 6-01.9</td>
<td></td>
<td>3 set to PE</td>
<td>Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor PE Stamp required.</td>
<td></td>
</tr>
<tr>
<td>Mfg. Specification for Portable Temporary Traffic Control Signal</td>
<td>None 1-10.3(3)K</td>
<td>6-01.6</td>
<td>3 set to PE</td>
<td>Project Engineer</td>
<td>Project Engineer</td>
<td>2 sets to Contractor</td>
<td></td>
</tr>
<tr>
<td>Prefabricated Vertical Drainage Wick Submittals</td>
<td>None 2-03.3(14)H</td>
<td></td>
<td>3 set to PE</td>
<td>Project Engineer</td>
<td>Project Engineer</td>
<td>2 sets to Contractor</td>
<td></td>
</tr>
<tr>
<td>Calculation for Backfilling Abutment Prior to Superstructure Placement</td>
<td>None 2-03.3(14)I</td>
<td></td>
<td>3 set to PE</td>
<td>Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor</td>
<td></td>
</tr>
<tr>
<td>Blasting Plan</td>
<td>None 2-03.3(2)</td>
<td></td>
<td>3 set to PE</td>
<td>Project Engineer</td>
<td>Project Engineer</td>
<td>2 sets to Contractor</td>
<td></td>
</tr>
<tr>
<td>Excavation Slope Working Drawings and Calculations</td>
<td>None 2-09.3(3)B</td>
<td></td>
<td>3 set to PE</td>
<td>Project Engineer</td>
<td>Project Engineer</td>
<td>2 sets to Contractor</td>
<td></td>
</tr>
<tr>
<td>Cofferdams, Shoring, Cribs, and Trench Boxes</td>
<td>6-1.5 2-09.3(4) 6-01.9 6-02.3(16)</td>
<td></td>
<td>6 sets to Bridge &amp; Structures 2 sets to PE TRENCH BOXES 3 sets to PE</td>
<td>Project Engineer &amp; Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor 1 set to Region Const PE Stamp is Required. 4 additional sets to Bridge if RR is involved (per RR) 6 additional if US Bureau of Reclamation is involved</td>
<td></td>
</tr>
<tr>
<td>Falsework, Forming, and Bracing Plans (including design calculations)</td>
<td>6-1.5 6-02.3(16) 6-02.3(17)F</td>
<td></td>
<td>6 sets to Bridge &amp; Structures 2 sets to PE FOR PREAPPROVAL 1 set Plans &amp; 2 sets design calculations to Bridge &amp; Structures</td>
<td>Project Engineer &amp; Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor 1 set to Region Const PE Stamp is Required. 4 additional sets to Bridge if RR is involved (per RR) 6 additional if US Bureau of Reclamation is involved</td>
<td></td>
</tr>
<tr>
<td>Girder Erection Plans (Including falsework and stress calculations)</td>
<td>None 6-02.3(16) and 6-02.3(25)N 6-03.3(7)A</td>
<td></td>
<td>6 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>Project Engineer &amp; Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor 1 set to Region Const PE Stamp is Required. 4 additional sets to Bridge if RR is involved (per RR)</td>
<td></td>
</tr>
<tr>
<td>Welding Reinforcing Steel</td>
<td>6-2.6D 6-02.3(24)E</td>
<td></td>
<td>5 welding procedures to Bridge &amp; Structures 2 welding procedures to PE</td>
<td>Project Engineer &amp; Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor 2 sets to Fabrication Inspector No mention in spec of Bridge &amp; Structures or number of drawings</td>
<td></td>
</tr>
<tr>
<td>Working Drawing, Shop Plan or Submittal Type</td>
<td>Const Manual References</td>
<td>Standard Spec or Other References</td>
<td>Number of Paper Copies (Contact Bridge &amp; Structures to discuss the option of electronic Submittals)</td>
<td>Reviewer Prior to Approval</td>
<td>Approving Authority</td>
<td>PE Distribution of approved drawings (surplus copies stay @ PE)</td>
<td>Notes</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>------------------------</td>
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<td>-----------------------------------------------</td>
<td>---------------------------</td>
<td>-------------------</td>
<td>------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Shop Detail Plans of Prestressed Concrete Girders, Prestressed Structures, Prestressed &amp; Precast Conc Piles</td>
<td>6-2.7A</td>
<td>6-02.3(25)A None for Piles</td>
<td>5 sets to Bridge &amp; Structures</td>
<td>Project Engineer &amp; Bridge &amp; Structures Engineer</td>
<td>PE approval standard series I girders and concrete piling on standard plans E-4 &amp; E-4a - all other prestressed concrete products and precast piles to Bridge &amp; Structures for approval</td>
<td>1 set to Contractor 2 sets to Fabrication Inspector</td>
<td>6-02.3(16)B is for the formwork plans for preapproval</td>
</tr>
<tr>
<td>Post-Tension Shop Drawings</td>
<td>6-2.8</td>
<td>6-02.3(26)A</td>
<td>7 sets to Bridge &amp; Structures 2 sets to State Bridge Const. Engineer 2 sets to PE</td>
<td>Project Engineer, State Bridge Const. Engineer &amp; Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>1 set to State Const. 2 sets to Contractor 1 set to Region Const.</td>
<td></td>
</tr>
<tr>
<td>Precast Concrete Panels</td>
<td>None</td>
<td>6-02.3(28)A 6-12.3(1)</td>
<td>7 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>Project Engineer &amp; Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>1 set to State Const. Engr. 2 sets to Contractor 1 set to Fabrication Inspector</td>
<td>Additional sets for RR not mentioned in spec.</td>
</tr>
<tr>
<td>Welding Structural Steel (Submitted with Shop Drawings)</td>
<td>6-3.6C</td>
<td>6-03.3(25)</td>
<td>8 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>Project Engineer &amp; Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>1 Set to Region Const. 2 sets to State Materials Lab 2 sets to Contractor</td>
<td>4 additional sets to Bridge if RR is involved. (per RR)</td>
</tr>
<tr>
<td>Shop Plans for Structural Steel for Bridges (Expansion Joints, Metal Bridge Rails, Bridge Drains, etc.)</td>
<td>6-3.1</td>
<td>6-03.3(7) 6-06.3(2) Special Provisions</td>
<td>8 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>Project Engineer &amp; Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>1 set to Region Const. 2 sets to State Mat'l's Lab 2 sets to Contractor</td>
<td>4 additional sets to Bridge if RR is involved. (per RR)</td>
</tr>
<tr>
<td>Treated Timber Structures</td>
<td>6-4.1</td>
<td>6-04.3(3)</td>
<td>6 sets</td>
<td>Project Engineer &amp; Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor 1 set to Fabrication Inspector</td>
<td></td>
</tr>
<tr>
<td>Welding Steel Piling</td>
<td>6-5.6</td>
<td>6-05.3(6) 6-03.3(25)</td>
<td>8 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>Project Engineer &amp; Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor 2 sets to Fabrication Inspector</td>
<td>Weld splices of steel casing for cast-in-place conc. Piles shall be the Contractor's responsibility 4 additional sets to Bridge if RR is involved. (per RR)</td>
</tr>
<tr>
<td>Pile Driving Equipment Adequacy Submittals</td>
<td>6-05.3(9)</td>
<td></td>
<td>3 sets to Geotechnical Engineer 2 sets to State Bridge Const Engineer 2 sets to PE</td>
<td>Geotech. Engr. State Construction Engr. (Bridge)</td>
<td>Geotech. Engr.</td>
<td>2 sets to Contractor</td>
<td></td>
</tr>
</tbody>
</table>

**Shop Plans & Working Drawings (Continued)**

Figure 1-6
<table>
<thead>
<tr>
<th>Working Drawing, Shop Plan or Submittal Type</th>
<th>Const Manual References</th>
<th>Standard Spec or Other References</th>
<th>Number of Paper Copies (Contact Bridge &amp; Structures to discuss the option of electronic Submittals)</th>
<th>Reviewer Prior to Approval</th>
<th>Approving Authority</th>
<th>PE Distribution of approved drawings (surplus copies stay @ PE)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painting – Containment of Abrasive Blasting Plan</td>
<td>None</td>
<td>6-07.3(2)</td>
<td>3 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>PE, Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor</td>
<td></td>
</tr>
<tr>
<td>Modified Concrete Overlays (Mix Design, Equipment Specifications and Procedures)</td>
<td>None</td>
<td>6-09.3(2)</td>
<td>3 sets to State Bridge Const. Engineer 2 sets to PE</td>
<td>PE, State Bridge Const. Engr.</td>
<td>State Bridge Construction Engr.</td>
<td>2 sets to Contractor</td>
<td></td>
</tr>
<tr>
<td>Shaft Installation Plan for Noise Walls, Soldier Pile Walls, and Luminaire Bases</td>
<td>6-2.3E 6-12.3(1) 6-16.3(2)</td>
<td></td>
<td>4 sets to Bridge &amp; Structures 1 set to PE</td>
<td>Bridge &amp; Structures Engineer, &amp; Geotech. Engr.</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 Sets to Contractor</td>
<td></td>
</tr>
<tr>
<td>Structural Earth Wall Submittals</td>
<td>None</td>
<td>6-13.3(2)</td>
<td>3 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>PE, Bridge &amp; Structures Engineer, &amp; Geotech. Engr.</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor</td>
<td></td>
</tr>
<tr>
<td>Geosynthetic Retaining Wall Plans</td>
<td>None</td>
<td>6-14.3(2)</td>
<td>3 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>PE, Bridge &amp; Structures Engineer, &amp; Geotech. Engr.</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor</td>
<td></td>
</tr>
<tr>
<td>Soil Nail Walls</td>
<td>None</td>
<td>6-15.3(3)</td>
<td>3 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>PE, Bridge &amp; Structures Engineer, &amp; Geotech. Engr.</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor</td>
<td>Include State Bridge Const. Engr. if shotcrete facing is permanent (6-18.3(1))</td>
</tr>
<tr>
<td>Soldier Pile Walls</td>
<td>None</td>
<td>6-16.3(2)</td>
<td>3 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>PE, Bridge &amp; Structures Engineer, &amp; Geotech. Engr.</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor</td>
<td></td>
</tr>
<tr>
<td>Permanent Ground Anchor Submittals</td>
<td>None</td>
<td>6-17.3(3)</td>
<td>3 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>PE, Bridge &amp; Structures Engineer, &amp; Geotech. Engr.</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor</td>
<td></td>
</tr>
<tr>
<td>Roadside Plant/Weed &amp; Pest Control Plan</td>
<td>None</td>
<td>8-02.3(2)</td>
<td>4 sets to PE</td>
<td>Project Engineer</td>
<td>Project Engineer</td>
<td>2 sets to Contractor 1 set to Region Const.</td>
<td>Signed by Licensed Chemical Pest Control Consultant</td>
</tr>
<tr>
<td>Shop Plans for Light Standard and Traffic Signal Standards</td>
<td>8-20.2B 8-20.2(1)</td>
<td></td>
<td>6 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>Project Engineer &amp; Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures for light standards and Types II, III, IV, V and SD signal standards. Project Engr for Types PPB, PS, &amp; I signal standards shown on Standard Plan J-7a.</td>
<td>2 sets to Contractor 2 sets to Fabrication Inspector</td>
<td>Shop drawings are required for all signal standards and for those light standards without pre-approved plans. (per Std. Spec)</td>
</tr>
<tr>
<td>Shop Plans for Sign Structures</td>
<td>8-21.3 8-21.3(9)</td>
<td>A refers to Section 6-03.</td>
<td>8 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>Project Engineer &amp; Bridge &amp; Structures Engineer</td>
<td>Project Engineer for Standard Plans G2 through G9a Bridge &amp; Structures for special design sign structures or sign fittings</td>
<td>2 sets to Contractor 2 sets to Fabrication Inspector</td>
<td>4 additional sets to Bridge if RR is involved. (per RR)</td>
</tr>
</tbody>
</table>

**Shop Plans & Working Drawings (Continued)**

*Figure 1-6*
<table>
<thead>
<tr>
<th>Working Drawing, Shop Plan or Submittal Type</th>
<th>Const Manual References</th>
<th>Standard Spec or Other References</th>
<th>Number of Paper Copies (Contact Bridge &amp; Structures to discuss the option of electronic Submittals)</th>
<th>Reviewer Prior to Approval</th>
<th>Approving Authority</th>
<th>PE Distribution of approved drawings (surplus copies stay @ PE)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column Jacket Shop Drawings &amp; Installation Plans</td>
<td>None</td>
<td>See BSP 02300403.GB6 02300404.GB6</td>
<td>8 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>PE, Bridge &amp; Structures Engineer, &amp; Geotech. Engr.</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor</td>
<td>PE Stamp required.</td>
</tr>
<tr>
<td>Form Liners (Various patterns per GSP)</td>
<td>None</td>
<td>See GSP 0231405.GB6</td>
<td>2 sets to Bridge &amp; Structures Architect 2 sets to Project Engineer</td>
<td>PE Bridge &amp; Structures Architect</td>
<td>Bridge &amp; Structures Architect</td>
<td>1 Set to Region Const 2 sets to Contractor</td>
<td>Include 2ft X 2 ft sample with drawing to Bridge &amp; Struct. Architect</td>
</tr>
<tr>
<td>3-Sided Structures</td>
<td>None</td>
<td>See GSP 023281.GR6</td>
<td>8 sets to Bridge &amp; Structures 2 sets to PE 2 sets design calculations to Bridge &amp; Structures</td>
<td>PE, Bridge &amp; Structures Engineer, &amp; Geotech. Engr.</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor</td>
<td>PE Stamp required.</td>
</tr>
<tr>
<td>Project Specific Powder Coating Plan and Materials Submittals</td>
<td>None</td>
<td>See Special Provision</td>
<td>3 Sets to Bridge &amp; Structures, 1 Set to PE</td>
<td>State Materials Engineer, Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 Sets to Contractor</td>
<td></td>
</tr>
<tr>
<td>Bridge Demolition Plans</td>
<td>None</td>
<td>See Special Provisions</td>
<td>6 sets to Bridge 7 Structures 1 set to PE</td>
<td>Project Engineer &amp; Bridge &amp; Structures Engineer</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor 1 set to Region Const</td>
<td>PE Stamp is Required.</td>
</tr>
<tr>
<td>Shaft Installation Plan and Construction Experience for Bridges and Permanent Signing Structures</td>
<td>None</td>
<td>See Special Provisions</td>
<td>3 sets to Bridge &amp; Structures 1 set to PE</td>
<td>PE, Bridge &amp; Structures Engineer, &amp; Geotech. Engr. &amp; State Construction Engr. (Bridge).</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 Sets to Contractor</td>
<td>Construction Manual does not mention approval – only mentions meeting of all parties.</td>
</tr>
<tr>
<td>Precast Vaults</td>
<td>None</td>
<td>See Special Provisions</td>
<td>3 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>PE, Bridge &amp; Structures Engineer, &amp; Geotech. Engr.</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor</td>
<td></td>
</tr>
<tr>
<td>Pipe Jacking Plans</td>
<td>None</td>
<td>See Special Provisions</td>
<td>3 sets to Bridge &amp; Structures 2 sets to PE</td>
<td>PE, Bridge &amp; Structures Engineer, &amp; Geotech. Engr.</td>
<td>Bridge &amp; Structures Engineer</td>
<td>2 sets to Contractor</td>
<td></td>
</tr>
</tbody>
</table>

Shop Plans & Working Drawings (Continued)

Figure 1-6
1-2.5B Working Day Charges

The first working day will be established in accordance with Section 1-08.4 of the Standard Specifications or such other date as prescribed by the contract provisions. Section 1-08.4 indicates that time may start at a time different from that specified if “otherwise approved in writing”. Such other approval is intended only for very unusual circumstances, usually associated with mis-handling of contract documents. It will only be granted in consultation with Headquarters Construction. Time associated with each phase of work established in the contract is to be shown on the Weekly Statement of Working Days. The Project Engineer is to furnish a weekly statement advising the Contractor of the current status of working day charges against the contract. Weekly Statements are generated by the CCIS computer system. This statement is to be issued in accordance with Section 1-08.5 of the Standard Specifications. The purpose of this statement is to advise the Contractor about the Project Engineer’s decision for each passing day. The questions to be answered when determining if a day is chargeable are; is it a nonworking day (holiday or a day the contract does not allow critical work to advance)? was it a chargeable working day (critical work progressed uninhibited)? or was it an unworkable day (critical work delayed by weather or conditions caused by the weather)? in evaluating each day, the Project Engineer should take into consideration the following conditions:

1. The effect of inclement weather on critical activities.
2. The effect of conditions caused by inclement weather on critical activities.
3. Critical work restrictions imposed by the contract or the Project Engineer.

If any of the above conditions prevent work or reduce the Contractor’s efficiency on critical activities on the project, working day charges shall be adjusted accordingly. If the Contractor is able to continue work on critical activities but the efficiency is significantly reduced, a half day may be charged. When determining unworkable days the Project Engineer shall take into consideration the prolonged effects of weather events. If the contractor is required to divert resources from working on critical path activities due to the lasting effects of a weather event the Project Engineer may determine a half day, the whole day or several days as unworkable.

If the contract does not specifically define a working day, a working day will be considered a 24 hour period. The contractor establishes the hours of work in the Weekly-Look Ahead Schedule and the start of the day should be by mutual agreement. The contractor shall be charged for one day during the defined 24 hour period regardless of how many shifts are worked.

Section 1-08.5 grants the Contractor the right to protest working day determinations and working day charges determined by the Engineer. In the event the Contractor submits the required written protest within 10 calendar days following the date of the statement, the Project Engineer will analyze the information provided, and respond to the Contractor by either denying the protest or revising the Weekly Statement of Working Days.

The Project Engineer will complete Weekly Statements of Working Days throughout the course of the project, showing workable, nonworking and unworkable days as they occur. These statements will continue to be completed until the project has reached Substantial Completion and the Working Days assigned to the contract have been exhausted. Following are the three possible scenarios:

- The working days are exhausted prior to reaching Substantial Completion. Weekly Statements of Working Days continue until Substantial Completion.
- The working days are exhausted on the day Substantial Completion is achieved. Weekly Statements of Working Days cease upon Substantial Completion.
- The working days are not exhausted upon reaching Substantial Completion. Weekly Statements of Working Days continue until the working days are exhausted or until physical completion.

Upon Substantial Completion the Project Engineer will ensure that the date is entered into CCIS and is noted in the remaining Weekly Statements of Working Days. After Weekly Statements have stopped, comments concerning weather and other events beyond the Contractor’s control should be entered into the project diary. The effect of these conditions on remaining work and on the scheduled completion should also be noted.

If contract time is expressed in calendar days, then Section 1-08.5 becomes difficult to interpret and the contract special provisions will provide guidance for the charging of contract time.

1-2.5C Suspension of Work

When, in the judgment of the Project Engineer, inclement weather, or conditions caused by inclement weather, make it impracticable to achieve satisfactory results on a critical item of work, an order should be issued to suspend the affected portions of the contract work or the entire project. If at all possible, suspensions for weather should be made with the concurrence of the Contractor. If the Contractor does not agree to a weather suspension, the Project Engineer should consult with the Region Construction Manager before issuing a unilateral suspension.

In addition, subject to the agreement of the Contractor and the approval of the Regional construction manager, delays caused by other conditions beyond the control of the Contractor may also warrant an order to suspend work.

During suspensions of long duration, for example a winter shutdown, the publication of Weekly Statements may be suspended. Notices to suspend or resume work should be written. Forms 421-006 and 421-007 have been developed for this purpose. A letter may accomplish the same purpose. If it is determined that some items of noncritical work on the project could be continued unaffected by weather conditions, then those items may be excluded from the order to suspend work. The prime consideration for unworkable days or suspensions is always the ability to work on critical items.

In the event that a suspension of work for weather or for other reasons beyond the control of the contractor is necessary for an extended period of time, the Project Engineer may recommend that the Contractor be relieved of...
routine maintenance during the period of suspension. Before WSDOT will assume the responsibility for maintenance, the contractor must have taken all necessary actions to control erosion, pollution, and runoff prior to, and during, the shutdown period. The extent of the project area that will be maintained by WSDOT is the subject for a three party negotiation and agreement among the Project Engineer, the Maintenance Superintendent and the Contractor.

The suspensions described above are related to weather or other causes beyond the control of the Contractor. They apply only to critical work items and, therefore, always result in a determination of an unworkable day. If the Engineer and the Contractor agree to stop working on a noncritical item for one of these causes but to continue critical work, then the agreement should be noted in the records and weekly statements should be issued in the normal fashion.

The contract also gives the Engineer the right to suspend work on any part of the project when the Contractor is not complying with the contract’s terms or the orders of the Engineer. This would be a significant action and, except in an emergency situation, should not be undertaken without the full and informed consent of the Region Construction Manager and the State Construction Office. If work is suspended under this contract provision, then weekly statements and the charging of workable days will continue in the normal fashion.

1-2.5D Extension of Time

In general time extensions are appropriate whenever the critical work is delayed due to an action or inaction of the contracting agency, or by a cause that is not the responsibility of the Contractor. Section 1-08.8 of the Standard Specifications includes a list of reasons that entitle the Contractor to a time extension, and a list of reasons for which no time extension will be granted. In all cases, the change or delay must delay critical work or an extension is not appropriate.

The contract requires the Contractor to identify a delay within 10 working days. If a delay is readily identifiable, the Project Engineer should enforce this provision. If the delay is not immediately apparent the time extension discussion should take place as soon as the delay is recognized. Before discussing a potential delay for which adequate notice was not given, the Project Engineer should discuss the situation with the Region Construction Manager to seek guidance. The Contractor should be encouraged to identify delays and bring them to the State’s attention at the earliest opportunity. This allows the contracting agency to mitigate the delay by adding time, modifying the work or recovering the schedule. In the interest of actively managing a delay the project engineer may act unilaterally to address time if the contractor avoids the discussion.

If possible, all time associated with work added by change order should be addressed as part of the change order. If you are unable to come to agreement on the number of working days to add, the Region Construction Manager should be consulted concerning the need to unilaterally add time to the contract. Deferring the discussion of time in a change order to a later date should be a last resort. If the contractor is not granted time for an item, they are required to complete the contract in the number of working days that remain. This may require that the contractor to accelerate their efforts, by adding additional crews, equipment or working longer hours or extra days. If these actions are taken as a result of the contracting agency not granting time extensions when the contractor is entitled to them, the cost for these items would be paid by the contracting agency. If you do choose to defer the time discussion to later, set a time frame during which the decision will be made.

The State has a responsibility to inform the Contractor’s surety whenever increased time is being considered and the current extension, combined with previous extensions, would exceed 20% of the original allotted time in the contract. This information could be represented by the Surety’s signature on the change order that adds time, by a separate letter from the Surety, or by a notice letter direct to the Surety office. Such notice and surety consent is a legal requirement and will help maintain the State’s rights to be protected by the performance bond.

Section 1-08.6 of the Standard Specifications provides under what circumstances the Contractor may be entitled to compensation. Anytime that a project is delayed for any cause, the Project Engineer and the Contractor should consider methods of mitigating the delay damage. A common approach is to pursue schedule recovery by allocating additional resources to the work to get the project back on schedule. When the Project Engineer suspects that the State may be responsible for the delay, then compensation for the mitigation efforts may be proposed.

Any time extension will be documented either in a change order with approval levels defined in Section 1-2.4C of this Manual or in a letter to the Contractor from the State Construction Office.

1-2.5E Substantial Completion

Substantial Completion may be granted when only minor, incidental items of work, replacement of temporary facilities or correction remain in order to physically complete the contract. In determining Substantial Completion, the Project Engineer should consider whether or not:

- The public has full use and benefit of the facility.
- Major safety features are installed and functional, including guardrail, striping, and delineation.
- Illumination, if required, is installed or a temporary system with equal functional capabilities is operating.
- Signals, if required, are installed or a temporary system with equal functional capabilities is operating.
- The need for temporary traffic control on a regular basis has ceased. Only minor traffic restrictions will be needed for the remaining work.
- The traffic is operating in its permanent configuration.

The Project Engineer is responsible for determining the Substantial Completion date. When this has been done, the Contractor will be notified by letter, specifically noting the date on which Substantial Completion was achieved. In order to be in accordance with Section (9-1.5) - Compliance Review for Materials Certification Process, the project engineer will also provide notification of Substantial Completion to the Headquarters Materials Laboratory Documentation Section.
1-2.5F  Date of Physical Completion
The date on which the Project Engineer determines that all physical work has been completed is noted and then established as the date of Physical Completion. The Project Engineer will immediately notify the Contractor by letter of the date determined for Physical Completion. Copies of the letter will be sent to:

- The State Program Management Office.
- The Railroad companies, if applicable.
- The Contract Administration and Payment System (CAPS) Unit of Accountability & Financial Services (AFS).
- The Regional Local Programs Engineer on all city and county projects.
- The State Roadway Data Office, MS 47380.
- Any other distribution that the Region deems appropriate.

Actions the Project Engineer should consider taking once Physical Completion has occurred include:

- Initiate a discussion of contract time.
- Identify any unresolved disputes and initiate discussions.
- Initiate a full review of item quantities, seeking contractor concurrence.
- Initiate a final review of materials documentation.
- On Federal-aid projects, initiate a Stewardship Final Inspection and Acceptance.

1-2.5G  Liquidated Damages
Liquidated Damages must be resolved before the final estimate can be completed and processed. Guidance for assessing Liquidated Damages can be found in Section 1-08 of the Standard Specifications, and in some cases, in the contract provisions.

Any withholding or assessment made against the Contractor’s payments, is to be preceded by a fair notice written communication to the contractor. For those issues that could be remedied with actions taken or initiated by the Contractor, this notice should also include a reasonable period of time that will allow the contractor to take action to mitigate or completely avoid the 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 provisions 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 be assessed the Contractor for overruns in contract time. These assessments are either: (1) the formula calculated liquidated damages, or the liquidated damages prescribed by the contract provisions; or (2) the direct engineering and related costs. All temporary withholding or final assessment of these Liquidated Damages are to be shown as a below the line “Liquidated Damages” deduction on progress estimates and the final estimate.

The State Construction Engineer has not subdelegated to the Region the authority to assess time related 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 Regions, and may be further subdelegated to the Project Engineer. Liquidated Damages should be addressed whenever it is apparent that the number of working days provided in the contract will be used before Substantial Completion. It is emphasized once again that fair notice and communication is necessary as a legal requirement.

In some cases, there are legitimate reasons for time extensions which would preclude withholding liquidated damages on progress estimates. If the Project Engineer is aware of or anticipates a possible time extension that would preclude withholding liquidated damages on progress estimates, the Region and/or the State Construction Office should be consulted for guidance. If the Project Engineer determines that withholding of liquidated damages on progress estimates would not be appropriate, the reasons for not withholding are to be documented by a memorandum to the files. The following describes the procedures for addressing contract time related liquidated damages in the various stages or phases of the project:

- 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 State Construction Office.

- After Substantial Completion Date of the Contract. If substantial completion is granted after the expiration of contract time, the formula for 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 those costs identified as Direct Engineering and related costs that have been incurred by WSDOT. The direct engineering and related costs are defined as field engineering and inspection time charges plus any vehicle, travel pay, per diem, or other charges connected with the delayed contract physical completion. Engineering costs such as computing grades, quantities, etc. which would have been incurred by WSDOT under normal conditions should not be included in the determination of 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.

- Before Physical Completion. If Substantial Completion has not been established, the formula for 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.

Working days added to the contract by time extensions when time has overrun shall only apply to the days on which Liquidated Damages or Direct Engineering have been charged, such as:

- If Substantial Completion has been granted prior to all of the authorized working days being used, then the number of days in the time extension will eliminate an equal number of days on which Direct Engineering charges have accrued.
- If the Substantial completion date is established after all of the authorized working days have been used, then the number of days in the time extension will eliminate an equal number of days on which Liquidated Damages or Direct Engineering charges have accrued.

### 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 or 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 State 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 types of liquidated damages are to be assessed.

### 1-2.5H Completion Date

Immediately after the Physical Completion date has been established, the Project Engineer is to notify the Contractor of all outstanding documents that are required in order to establish a project Completion Date. Once all the obligations of the contract have been performed by the Contractor, the Project Engineer will provide the Contractor written notice of project completion, identifying the Completion Date established for the contract.

In order for the project Completion Date to be established, all the physical work on the project must be completed, and the Contractor must have furnished all documentation required by the contract, contract provisions, and the Standard Specifications. This includes the 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 notice to the Contractor should be prepared and mailed on the same day that is designated as the completion date. A copy of the completion letter must be e-mailed to: caps@wsdot.wa.gov, or faxed to the contract payments section of the WSDOT Accountability and Financial Services Office, (fax number (360)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 required documents, the Project Engineer, the Region and the State Construction Office can work together to move the project towards closure by establishing a unilateral completion date allowing WSDOT Acceptance of 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 outlines prevailing wage responsibilities for the Contractor, subcontractors, lower-tier subcontractors, agents or any other persons performing work under the contract. Additionally, contracts financed in whole or in part with federal funds have the Required Contract Provisions for Federal-aid Construction Contracts (FHWA-1273) included in the contract documents. These provisions identify additional federal wage requirements.

Contracts that are financed by either state or federal funds, or both, will include specific Hourly Minimum Wage Rates and Fringe Benefit schedules from either or both the Washington State Department of Labor and Industries (State L&I) and the United States Department of Labor (USDOL). When both state and federal funds are involved and there is a difference between the two prevailing wage determinations, the Contractor, subcontractors, and lower-tier subcontractors must pay a wage of not less than the higher of the two in order to remain in compliance with both prevailing wage laws. Comparisons that are made between state and federal wage rates must include their corresponding fringe benefits as identified in their respective state or federal wage determinations.

### 1-2.6B Monitoring of State Requirements

The requirements for the Contractor’s compliance with State prevailing wages are noted in Section 1-07.9 of the Standard Specifications. Specific wage rate determinations for State prevailing wages are noted in the contract itself. Though certified payrolls can be requested regardless of the contract’s source of funds, these are a specific requirement for enforcement of federal wage laws only and are not routinely used for monitoring of State prevailing wage issues.

Requirements for State prevailing wages include:

- Section 1-07.9 requires that the Contractor submit a Statement of Intent to Pay Prevailing Wages (SI) prepared on the State L&I form and approved by that agency. Statements are required for the Contractor and for each subcontractor, agent and lower-tier subcontractor. The specification requires that no progress payments be released to the Contractor for work completed by the Contractor, or for portions of work completed by subcontractors, agents or lower-tier subcontractors prior to the Project Engineer’s receipt...
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of the approved statement for the entity performing the work. State L&I will approve the statements and further certify that the documents meet the requirements of State laws.

• After the project has been accepted by WSDOT, the Contractor, all subcontractors, and all lower-tier subcontractors must submit an Affidavit of Wages Paid (AWP) prepared on the State L&I form and approved by that agency. (The form may be submitted earlier by a subcontractor or lower-tier subcontractor should that firm’s work be completed prior to acceptance.) It is the Contractor’s responsibility to obtain and provide all AWP to the Project Engineer for all subcontractor and lower-tier subcontractors performing work on the project. In the event a subcontractor or lower-tier subcontractor cannot or will not provide a completed AWP form, the Contractor should consult or seek guidance from State L&I. Failure to provide all required AWP for all contractors who worked on the project will result in continued withholding of the prime Contractor’s retained percentage.

• A contractor or subcontractor may enter into an agreement with his or her employees to work 10 hours per day without having to pay overtime. This is provided that no employee work more than 4 calendar days a week.

• State L&I has also defined “Contractor” to include some fabricators or manufacturers who produce nonstandard items specifically for use on the public works project. Additionally some companies who may contract with the Contractor, subcontractors, or lower-tier subcontractors for the production and/or delivery of gravel, concrete, asphalt, or similar materials may perform activities that cause employees of these firms to be covered by state prevailing wage laws.

Specific circumstances that may cause employees of these firms to be covered by State prevailing wage laws are described in State L&I publications. These publications are included in the provisions of each contract adjacent to the State Prevailing Wage listings. Where these firms are covered by State prevailing wage laws, an approved Statement of Intent to Pay Prevailing Wages and Affidavit of Wages Paid must be submitted to the Project Engineer on State L&I forms.

The Project Engineer should monitor the Contractor’s efforts in regards to state prevailing wages by:

• Monitoring to ensure an approved Statement of Intent is received prior to releasing any progress payments for work completed by the Contractor, subcontractor or lower-tier subcontractors as well as any fabricators or suppliers of materials whom L&I may also determine as being covered.

• Monitoring to ensure that Affidavits of Wages Paid have been received for the Contractor as well as each subcontractor or lower-tier subcontractor who performed work on the contract. In addition, AWP are also required of each fabricator or supplier who was also covered by state prevailing wages. Ensure that the company name on the Affidavit of Wages Paid matches the company name on the Statement of Intent to Pay Prevailing Wages. If this is not the case, the Affidavit is not acceptable; unless the Contractor or subcontractor can supply a copy of their business license showing both names (i.e. Company Name and Trade Name).

• Monitoring by observing concerns of employees of the Contractor, subcontractors, or lower-tier subcontractors. In particular, the Project Engineer should note any employee complaints regarding specific state prevailing wage violations by the employer.

In the event the Project Engineer identifies or receives a complaint from any employee of the Contractor regarding improper application or nonpayment of state prevailing wages, or improper application of overtime pay, the Project Engineer should immediately notify the Contractor requesting prompt corrective action. All issues of noncompliance involving either the Contractor, subcontractor, and any lower-tier subcontractors are to be addressed through the Prime Contractor for resolution.

Once the Contractor has been informed that an apparent violation of state prevailing wages has occurred, it is expected that a satisfactory correction or explanation will be made within a reasonable period of time. If this does not happen, the Project Engineer should inform the Contractor that the matter may be referred to the Washington State Department of Labor and Industries (L&I) for further action. If the failure to act continues, the Project Engineer should refer the issue to the Region Construction Manager.

Except as noted for missing Statements of Intent, routine monthly progress payments made to the Contractor for work completed should not be deferred for enforcement of state prevailing wage laws. The State Construction Office will refer the matter to State L&I for further investigation that may be appropriate. Should State L&I choose to investigate, L&I will establish the amount of any unpaid wages due employees of the contractor. In order to recover these wages for employees, L&I may choose to file a claim against the Contractor’s retainage held under the contract. State L&I may also choose to recover unpaid wages by requesting that the Prime Contractor withhold funds from monthly progress estimates for work completed by the Contractor.


In addition to the requirements of Section 1-07.9 of the Standard Specifications, all contracts financed with Federal-aid funds include the Required Contract Provisions for Federal-aid Construction Contracts (FHWA-1273). These provisions identify federal wage requirements. The federal prevailing wage requirements included in these provisions are also commonly referred to as Davis Bacon and Related Acts (DBRA). It is the responsibility of the Project Engineer to both monitor and enforce these provisions to the degree necessary to ensure full compliance. In order to comply with these requirements, the Contractor must:

• Submit weekly certified payrolls to the Project Engineer for themselves, each subcontractor, and each agent or lower-tier subcontractor. These consist of copies of weekly payrolls along with a signed Statement of Compliance.

• Post wage rate posters.
• Post the wage determinations of the United States Secretary of Labor. These determinations consist of the listing of Federal Wages that are included in the provisions of each contract.

• Allow interviews of employees during working hours by authorized representatives of WSDOT, the Federal Highway Administration, and the U.S. Department of Labor.

The prime Contractor is ultimately responsible for all subcontractor, agent, or lower-tier subcontractor compliance with the requirements for federal prevailing wages.

1-2.6C(1) Federal Prevailing Wage Rates

The Contractor must post the federal wage determination, consisting of the wage listing included in the contract provisions, in a prominent place where it can easily be seen by workers. Standard posters (forms FHWA 1495 and FHWA 1495A) are also to be posted and are available to the Region from the Support Services Supervisor, FHWA, Olympia, Washington. Form FHWA 1495A is printed in Spanish and is to be posted when the project is in an area where there is a possibility that some workers may speak only Spanish.

1-2.6C(2) Certified Payroll Inspection

The “Contract Provisions for Federal-Aid Construction Contracts” (FHWA-1273) require the Contractor, subcontractors, agents or lower-tier subcontractors to submit certified payrolls. These are to be checked by the Project Engineer to ensure the required information has been included and is correct. The Project Engineer should accomplish this by making a complete check of the first payroll submitted on the project by the Contractor, each subcontractor, and each lower-tier subcontractor. Once satisfied that these first payrolls are correctly prepared, subsequent payrolls for that project may be accepted by a random spot checking of approximately 10 percent of the payrolls submitted. If errors are found during any spot-checking of the payrolls, a more complete or thorough check should occur until the Project Engineer has determined that the errors detected have been corrected and monitoring should occur until the Project Engineer has determined that the errors detected have been corrected and monitoring should occur until the Project Engineer has determined that the errors detected have been corrected and monitoring should occur until the Project Engineer has determined that the errors detected have been corrected and monitoring should occur until the Project Engineer has determined that the errors detected have been corrected and monitoring should occur until the Project Engineer has determined that the errors detected have been corrected and monitoring should occur until the Project Engineer has determined that the errors detected have been corrected and monitoring should occur until the Project Engineer has determined that the errors detected have been corrected 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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.

Payroll deductions must conform to the “Anti-Kickback” Act noted in the Required Contract Provisions for Federal-aid Construction Contracts (FHWA-1273). If payroll deductions are questionable, contact the State Construction Office for assistance.

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 Required Contract Provisions for Federal-aid Construction Contracts (FHWA-1273) provides a method for resolving this.

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).

The Contractor, subcontractor, or lower-tier subcontractor, in accordance with the requirements of DBRA, must certify all payrolls. This certification contains four elements:

• That the payroll copy furnished is a true copy;
• That the payroll is correct and complete;
• 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
• That the appropriate fringe benefits due each employee have been paid in full.

Subcontractors and lower-tier subcontractors are required to submit payrolls through the Prime Contractor to the Project Engineer. Any payrolls which do not comply fully with the requirements outlined above must be corrected by a supplemental payroll.

1-2.6C(3) Employee Interviews

The Project Engineer must conduct periodic employee interviews. The purpose of these spot interviews is to establish, with reasonable certainty, that the provisions for federal prevailing minimum wages are being complied with and that there is no misclassification of workers or disproportionate employment of laborers, helpers, or apprentices. The occupation description must be shown on the form used for the employee interview noted under current duties. The occupation description is noted in the wage listing included in the contract provisions.

Some employees may refuse to reveal their rate of pay. This 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.

The Contract Provisions for Federal-Aid Construction Contracts (FHWA-1273) require the Contractor to use word descriptions for the labor classifications that are included in the contract provisions identifying federal wage rates, and are to be used on all payrolls. Section 1-07.9 of the Standard Specifications permits the Contractor to use an alternative method to identify or correlate the labor descriptions used in order that they may be compared to the contract provisions.

The Project Engineer must conduct periodic employee interviews. The purpose of these spot interviews is to establish, with reasonable certainty, that the provisions for federal prevailing minimum wages are being complied with and that there is no misclassification of workers or disproportionate employment of laborers, helpers, or apprentices. The occupation description must be shown on the form used for the employee interview noted under current duties. The occupation description is noted in the wage listing included in the contract provisions.

Some employees may refuse to reveal their rate of pay. This 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.
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 by the Project Engineer must be conducted. The investigation may be as simple as a follow up interview with the employee or a more in depth investigation may result in a requirement for a supplemental payroll. 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 is to 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 sampling has been made for all classes of workers employed on the contract. A minimum sampling should include employees of the Contractor and all major (30 percent or more of the contract dollars) subcontractors. The interviews should be made with such frequency as may be necessary to ensure compliance.

Any complaints regarding violations of minimum wage rate regulations that are referred to the Project Engineer by employees of the Contractor, subcontractor, or lower-tier subcontractors should be treated as confidential, and should be promptly investigated by the Project Engineer. If there are questions regarding complaints and the application or interpretation of the federal prevailing wage provisions, the Project Engineer should consider referring the issue to the Region Construction Manager or contacting the State Construction Office for further assistance.

1-2.6C(4) Complaints

Any complaints regarding violations of minimum wage rate regulations that are referred to the Project Engineer by employees of the Contractor, subcontractor, or lower-tier subcontractors should be treated as confidential, and should be promptly investigated by the Project Engineer. If there are questions regarding complaints and the application or interpretation of the federal prevailing wage provisions, the Project Engineer should consider referring the issue to the Region Construction Manager or contacting the State Construction Office for further assistance.

1-2.6C(5) Federal Prevailing Wage Violations

In the event the Project Engineer identifies or receives a complaint from any employee of the Contractor regarding improper application or nonpayment of federal prevailing wages, improper application of overtime pay, or any other requirement noted in the Required Contract Provisions for Federal-aid Construction Contracts (FHWA-1273), the Project Engineer should immediately notify the Contractor requesting prompt corrective action. All issues of noncompliance involving either the Contractor, subcontractor, and any lower-tier subcontractors are to be addressed through the prime contractor for resolution.

If the Project Engineer determines the Contractor is in violation of the provision noted in the FHWA 1273 or Section 1-07.9 of the Standard Specifications, the Contractor should be immediately informed and requested to make the necessary corrective actions. Once the Contractor has been informed that an apparent violation has occurred, it is expected that a satisfactory correction or explanation will be made within a reasonable period of time. If this does not happen, the Project Engineer should withhold an appropriate portion of payment (see 1-3.1B(9)). If the failure to act continues, the Project Engineer should refer the issue to the Region Construction Manager.

1-2.6C(6) Department of Labor Investigation

The U.S. Department of Labor may investigate compliance with the DBRA and the Contract Work Hours and Safety Standard Act (CWHSSA) when conducting any investigations relative to compliance with the Fair Labor Standards Act or any other acts under its enforcement authority. Investigative action taken by the U.S. Department of Labor with respect to DBRA and CWHSSA do not, in any way, change the degree of authority or responsibility of WSDOT for enforcement of these Acts. Any actions taken by the U.S. Department of Labor 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 to ensure compliance.

1-2.6C(7) 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. This notice points out the consequences of any impropriety on the part of any contractor or WSDOT employee working on the project.

1-2.6C(8) Request For Authorization of Additional Classification and Rate

The U.S. Department of Labor (DOL) issues wage determinations under the Davis-Bacon Act (DBA) using available statistical data on prevailing wages and benefits paid in a specific locality. On occasion, the data does not contain sufficient information to issue rates for a particular classification of worker needed in the performance of the contract. Because of this, DBA provisions contain a conformance procedure for the purpose of establishing an enforceable wage and benefit rate for the missing classification (reference Standard Specification 1-07.9(1) and FHWA 1273).

Contractors are responsible for determining the appropriate staffing necessary to perform the contract work. Contractors are also responsible for complying with the minimum wage and benefits requirements for each classification performing work on the contract. If a classification considered necessary by the contractor for performance of the work is not listed on the applicable wage determination, the contractor must initiate a request for approval of an additional classification along with the proposed wage and benefit rates for that classification.

The Contractor initiates the request by preparing form SF1444, Request for Authorization of Additional Classification and Rate, at the time of employment of the unlisted classification. (Reference FAR 22.406-3 and 52.222-6(b), and Title 29 CFR Part 5, Section 5.5(a)). The Contractor completes blocks 2 through 15 on the form. Standard Form 1444 is readily available via the internet and is accessible at www.dol.gov/library.htm, under the heading “Conformance”.

1-2.6C(6) Department of Labor Investigation

The U.S. Department of Labor may investigate compliance with the DBRA and the Contract Work Hours and Safety Standard Act (CWHSSA) when conducting any investigations relative to compliance with the Fair Labor Standards Act or any other acts under its enforcement authority. Investigative action taken by the U.S. Department of Labor with respect to DBRA and CWHSSA do not, in any way, change the degree of authority or responsibility of WSDOT for enforcement of these Acts. Any actions taken by the U.S. Department of Labor 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 to ensure compliance.

1-2.6C(7) 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. This notice points out the consequences of any impropriety on the part of any contractor or WSDOT employee working on the project.

1-2.6C(8) Request For Authorization of Additional Classification and Rate

The U.S. Department of Labor (DOL) issues wage determinations under the Davis-Bacon Act (DBA) using available statistical data on prevailing wages and benefits paid in a specific locality. On occasion, the data does not contain sufficient information to issue rates for a particular classification of worker needed in the performance of the contract. Because of this, DBA provisions contain a conformance procedure for the purpose of establishing an enforceable wage and benefit rate for the missing classification (reference Standard Specification 1-07.9(1) and FHWA 1273).

Contractors are responsible for determining the appropriate staffing necessary to perform the contract work. Contractors are also responsible for complying with the minimum wage and benefits requirements for each classification performing work on the contract. If a classification considered necessary by the contractor for performance of the work is not listed on the applicable wage determination, the contractor must initiate a request for approval of an additional classification along with the proposed wage and benefit rates for that classification.

The Contractor initiates the request by preparing form SF1444, Request for Authorization of Additional Classification and Rate, at the time of employment of the unlisted classification. (Reference FAR 22.406-3 and 52.222-6(b), and Title 29 CFR Part 5, Section 5.5(a)). The Contractor completes blocks 2 through 15 on the form. Standard Form 1444 is readily available via the internet and is accessible at www.dol.gov/library.htm, under the heading “Conformance”.
The Contractor submits the request to the Contracting Officer (HQ Construction) via the Project Engineer’s office. The Contracting Officer reviews the request for completeness and signs the form designating the contracting agency’s concurrence or disagreement with the Contractor’s proposal. If the Contracting Officer indicates disagreement with the Contractor’s proposal, a statement must be attached supporting a recommendation for different rates. The Contracting Officer then submits the proposal with all attachments to DOL for approval. The Contractor is obligated to pay the proposed wage and benefit rates pending a response from DOL.

1-2.7 EEO, D/M/WBE and Training

1-2.7A Overview

Differences between State and Federal laws require a variety of guiding requirements. As a result individual contracts may have different guiding requirements depending on what laws were in place at the time the contract was executed and how the project is funded. The special provisions, Standard Specifications, and amendments determine the specific requirements for each project. The Construction Manual is one of many resources available for general information on the obligations and policy of WSDOT with regard to external civil rights. Other resources include:

1. Office of Equal Opportunity (OEO): OEO monitors, maintains, and updates WSDOT Equal Employment Opportunity (EEO) policies and commitments to FHWA. As part of that effort they maintain the following documents which are available through the OEO homepage:
   • Equal Employment Opportunity Compliance Program (EEO and on the Job Training)
   • Disadvantaged Business Enterprise Participation Plan (contract goals, if included in a project, will be mandatory)
   • Title VI Plan (nondiscrimination)
2. Standard Specifications, as follows, apply to all projects:
   • 1-07.11 Requirements for Nondiscrimination
   • 1-08.1 Subcontract Completion and Return of Retainage Withheld
3. General Special Provisions as may be included in the contract include:
   • Minority and Women’s Business Enterprise (MWBE) Participation (included in projects financed with only State funds)
   • Requirement for Affirmative Action to Ensure Equal Employment Opportunity (included in projects with FHWA participation)
   • Disadvantaged Business Enterprise Participation (included in projects with FHWA participation)
   • Special Training Provisions (included in projects with FHWA participation and only if the contract is selected for training)
   • Indian Preference and Tribal Ordinances (TEROs) (only if the project includes work on the reservation and only if the ordinances exist)

While some requirements and provisions apply to all projects, others apply to projects with State funds only and others yet apply to projects that are partially or fully financed with Federal funding.

1-2.7B EEO (Federally Funded Projects)

WSDOT has committed to FHWA to perform comprehensive construction compliance reviews to ensure that the requirements of Section 1-07.11 have been adhered to. This review is performed by the WSDOT Office of Equal Opportunity (OEO) on a selected number of FHWA funded projects and may take place at any point during the life of the project or after the project has been completed. A Contractor that is found in violation of the contractually required affirmative action good faith efforts will be invited to a compliance conference to develop a corrective action plan. Failure to accept and comply with a corrective action plan may result in sanctions. The records that have been maintained at the Contractor’s office will be utilized for these reviews. The FHWA also retains the authority to review the Contractor’s records for EEO compliance. These reviews do not normally involve the project office other than notification of their occurrence and the resulting findings.

Contract compliance reviews include an on-site review, and interviews of contractor employees, while the contractor is actively engaged in performing work associated with the contract. If interviews cannot be conducted during the site review, such interviews may be conducted off-site, at another location, or at a later time. The WSDOT Office of Equal Opportunity (OEO) may also interview WSDOT personnel associated with the project. FHWA has established narrow time frames during the execution of the project that maximize the potential for obtaining the information required for an on-site review. OEO will contact the Region EEO Officer or project staff to facilitate the timing of the review. Federal regulations for projects having federal-aid dollars as part of their funding source require the full cooperation of any contractor who performs work on the project.

1-2.7B(1) Prompt Return of Retainage to All Subcontractors

As a condition of receiving Federal funding, WSDOT is required to ensure prompt payment to all subcontractors on all contracts regardless of funding. State Statutes (Revised Code of Washington, RCW) pertaining to prompt pay require that the contracting agency make prompt payment to the prime contractor and that the prime contractor, in turn, pass these payments on to subcontractors in a timely manner. Return of the subcontractor’s retainage held by the prime contractor is required by the Standard Specifications. This is a race neutral effort intended to support all small businesses in their efforts to participate in WSDOT contracts.

Therefore, in accordance with the contract provisions, the prime contractor is required to release any and all retainage to the subcontractor within a designated time period after subcontract completion. The Project Engineer has no role in this process other than to respond to allegations of non-compliance with this contract requirement as with any other. We need to keep in mind that our contract is with the prime contractor, and we are not a party to the prime contractor’s subcontract documents. We should avoid becoming involved in a prime’s relationship with their subcontractors.
In the prime contractor’s effort to determine completion of subcontract work, as required by the contract provisions, the Project Engineer may be asked to determine completion of a portion of the work. While we need to work with the Contractor to comply with the requirements of the specification, we should also take specific care to not issue partial punch lists or to place ourselves in a position of “accepting” portions of the work. In some cases we may provide the Contractor relief under certain conditions as described in Section 1-07.13 of the Standard Specifications, “Contractor’s Responsibility for the Work.”

1-2.7C EEO (State Funded Projects)

The Contractor is required to comply with the EEO requirements detailed in the Standard Specifications Section 1-07.11, Requirements for Nondiscrimination. In general, these requirements include having an EEO Officer, developing, maintaining, making known, and utilizing an EEO program. The Project Engineer should be alert for and respond to any indications or accusations of discrimination. If the Project Engineer, or any other WSDOT personnel, becomes aware of any indications or accusations of discrimination, they should immediately notify the Region EEO Officer, who will in turn immediately notify WSDOT OEO. WSDOT OEO will handle any investigation that is warranted. The Office of Equal Opportunity and your regional OEO staff are available for guidance and assistance in these types of situations.

1-2.7D EEO (Federally Assisted Projects)

The requirements for EEO and nondiscrimination for federally assisted contracts are similar to those required for State funded projects. However, additional monitoring, reporting, and authority are mandated by Federal laws as noted in the Federal contract requirements known as the “FHWA 1273.” The “FHWA 1273” is included in every Federally assisted contract. These requirements are reiterated in the Standard Specifications Section 1-07.11, Requirements for Nondiscrimination.

Reporting

- Federal-Aid Highway Construction Contractors Annual EEO Report, Form FHWA - 1391 — This form is required for all Federally assisted projects provided the prime contract is equal to or greater than $10,000 and for every associated subcontract equal to or greater than $10,000. Each contract requires separate reports be filed for the prime contractor and each subcontractor (subject to the above noted criteria.) These forms are to be submitted to the Project Engineer, and are due by August 25th each year in which work was performed in the month of July.

The payroll period to be reflected in the report is the last payroll period in July in which work was performed. A contractor who works on more than one Federally assisted contract in July is required to file a separate report for each of those contracts. For multi year projects, a report is required to be submitted each year work was performed during the month of July through the duration of the contract. A responsible official of the company must sign the completed report. Upon receipt, the Project Engineer will forward the annual report to the Region’s EEO Officer by September 5th. The Region EEO staff at the direction of the OEO will compile and report the information noted on the forms. The figures reported must reflect the number of employees, not hours, in each category, with subtotals broken out for women and minorities and grand totals for the category. Tables A through E reflect both apprentices and on the job trainees that were also utilized within each trade. The form must also include the corresponding subtotals in each category, A through E, broken out by both women and ethnicity.

- Summary of Employment Data Report, Form FHWA - 1392 — As a part of the WSDOT OEO Equal Employment Opportunity Contractor Compliance Program, WSDOT is required to submit a summary of employment data to FHWA for each Federal fiscal year. This Summary of Employment Data Report, FHWA-1392, is prepared from forms FHWA-1391 (project specific annual reports) that have been submitted to the Region by the Project Engineer’s offices. This summary is prepared by the Region EEO lead or other Region designee for each Federally assisted project. This report also includes Local Agency projects administered through the Region’s Highways and Local Programs offices. The completed FHWA-1392 summary reports, including all forms FHWA-1391, are then submitted by the Region EEO lead to the WSDOT Office of Equal Opportunity by September 15th each year.

- Monthly Employment Utilization Reports, WSDOT Form - 820-010 — This form, or approved substitute, is required for all federally assisted projects if the prime contract is equal to or greater than $10,000 and for every associated subcontract equal to or greater than $10,000. This report includes the total work hours for each employee classification as well as the total number of employees, broken out by ethnicity, in each trade, for each WSDOT project. Instructions for completing the form can be found on the back of the form itself. These monthly reports are to be maintained by the Contractor in the respective prime or subcontractor’s records for a period of three years from acceptance of the contract, and available to WSDOT and/or Federal reviewers upon request.

The information required by WSDOT Form 820-010 may be accepted in an alternate format provided that format contains all of the data required by and is completed in accordance with the instructions for WSDOT Form 820-010. The Region EEO staff should be consulted regarding the acceptability of any alternate format proposed by the Contractor.

Records Retention and Reviews

The Contractor is required to maintain all project records, including the aforementioned EEO records, for three years following completion of the contract.
1-2.7E  Minority and Women Owned Business Enterprise (MBE, WBE)

MBE, WBE is the designation for holding State certification as a minority or women owned business enterprise. The State Office of Minority and Women’s Owned Business Enterprises (OMWBE) certifies businesses as either a minority owned business (MBE), a women owned business (WBE), or a combination of both (M/WBE). On projects funded in whole or in part with State funds, the contract provisions will include a MBE, WBE special provision. This provision may specify voluntary goals for the Contractor’s utilization of M/WBE. The provision also includes suggested methods for encouraging M/WBE participation. As noted, these requirements are indeed voluntary and there are neither preferences for accomplishment nor sanctions for noncompliance.

MBE/WBE Reporting

- Annual Report of Amounts Paid MBE/WBE Participants (Form 421-023). In accordance with Section 1-08.1 of the Standard Specifications, an Annual Report of Amounts Paid MBE/WBE Participants (Form 421-023) is required from the prime contractor for all projects funded entirely by State funds. When a project contains Federal assistance, the Federal quarterly reporting requirements for DBE utilization override the States requirements, eliminating the need for the State’s annual report of amounts paid.

The Annual Report of Amounts Paid MBE/WBE Participants reflects the State fiscal year, July 1 through June 30, and is to be submitted to the Contracting Agency by the 20th of July each year and/or upon physical completion of the contract. The dollar amounts shown in the report are those amounts paid to the MBE/WBE firms during the reporting period. The final report is to show only the dollar amounts paid since July 1st through the Physical Completion date. The Region is responsible for entering this data into CCIS. The Region Documentation/Equal Employment Opportunity (EEO) Officer needs to verify the information has been entered and validate the information. The completed form is maintained as a part of the project records and becomes a part of the temporary final records upon completion.

1-2.7F  Disadvantaged Business Enterprise (DBE)

DBE is the designation for holding Federal certification as a Disadvantaged Business Enterprise. On Federally funded projects there will normally be a DBE requirement of some sort specified by the contract special provisions. This special provision will be one of two types:

1-2.7F(1)  GSP Includes No Goal

When No Goal is specified, the contractor is encouraged to take actions that promote DBE participation. The goal is intended to draw the attention of bidders to the opportunity to subcontract with DBE’s. However, these requirements are indeed voluntary and there are neither preferences for accomplishment nor sanctions for noncompliance. They do contribute to the overall goal established by the Department. It is therefore important that the Department capture the work that is being performed. This can be done through “Quarterly Report of Amounts Credited as DBE Participation.”

1-2.7F(2)  GSP Includes Condition of Award (COA) Goal

When a Condition of Award Goal (COA) is specified, the Contractor is required to employ DBE participation to at least the extent identified in the contract special provisions. This is a condition of awarding the contract to the Contractor and a project can not be considered successful unless the Contractor meets the COA DBE participation goal, or the Contractor demonstrates that a good faith effort was made to deliver on the Condition of Award. These specifications are placed in contracts as a condition of continued Federal Funding for the Department.

- As a Condition of Award, the Contractor must commit to, and follow through on, subcontracting at least the work and the amount identified by the COA to certified DBE firms or make a good faith effort to do so.
- Measurement of attainment is not simply the payments made to the DBE. Attainment is measured in accordance with the provisions of the “DBE Participation” section of the contract special provisions.
- Changes to the amounts specified for COA must be made in accordance with the procedures outlined in this section.

1-2.7F(3)  Additional Execution Documents

Successful bidders will be required to provide a “Bidders List” to the Department. This list is to include the names and addresses of every firm that submitted a bid or quotation to the Prime, whether or not that bid was used as part of the overall proposal. The Contractor is directed to send this list directly to the WSDOT Office of Equal Opportunity in Olympia and normally the Project Engineer will have no involvement.

1-2.7F(4)  DBE Reporting

The contract special provisions require the Contractor to submit to the Project Engineer a “Quarterly Report of Amounts Credited as DBE Participation” for each quarter and upon completion of the project. Again, the measurement is not simply the payments made to the DBEs, rather it is in accordance with the “DBE Participation” section of the contract special provisions. This report should contain all DBEs utilized on the contract not just the COA DBEs. The information is used to track the Departments attainment of our overall goal and it is important to insure that they are received and processed in a timely manner. The Region Documentation/EEO Officers shall track and verify that the affidavits are being received and entered for all applicable contracts. The Region Documentation/EEO Officers shall also compare the affidavits with the Condition of Award requirements.
1-2.7F(5) On Site Reviews

On-site reviews shall be conducted on all Federal-aid contracts where there is DBE participation (with or without Condition of Award (COA) goals). On-site reviews shall be conducted at periodic intervals – when the DBE begins work, during the peak period of the DBE’s work, and any time there is a change in the nature or methods of the DBE’s work. An on-site review must also be conducted when there is a change in the DBE performing the work (substitution of a DBE firm). An on-site review is a “snapshot in time” and should record personal observations, documentation reviews and personnel interviews, as applicable. A copy of the completed on-site review (WSDOT Form 272-051 EF) should be forwarded to WSDOT’s Office of Equal Opportunity (OEO).

One of the requirements of the overall DBE Program is that all DBE firms working on Federal-aid project are in control of their specific items of work and are performing a “Commercially Useful Function” (CUF), as described by the specification. An on-site review may lead to a more in-depth CUF review, conducted by the OEO. These in-depth CUF reviews may be a result of concerns identified during the initial on-site review, or the OEO may select DBE firms on a periodic basis for a more in-depth review. The OEO uses these in-depth reviews to stay abreast of the DBE firm’s capabilities. The OEO will contact the Project Office directly to schedule these reviews. The fact that the OEO is going to conduct a review shall be kept in confidence in order to ensure that the review truly reflects a sampling of the typical work of the DBE firm. The CUF review will include observations of the work, as well as interviews with key staff of all parties on the contract, in addition to the DBE firm.

On those projects containing a COA goal, the COA letter requires that the identified DBE firms perform specific items of work for the estimated dollar amounts included in the proposal. The COA letter also identifies whether the DBE firm will be performing as a “subcontractor”, “manufacturer”, or “regular dealer (supplier)”. Any issues regarding DBE compliance should be brought to the attention of the OEO and the State Construction Office.

In order for WSDOT to take credit for DBE participation (as reflected by the quarterly reports), WSDOT must ensure that all DBE firms perform a “Commercially Useful Function”. Determination of whether or not a firm is performing a “Commercially Useful Function” requires on-site monitoring. The Project Office plays a key role in this monitoring by acting as the Departments “eyes and ears” in the field.

1-2.7F(6) Changes to the Condition of Award (COA)

The Contractor is required to utilize the COA subcontractors, manufacturers, etc., to perform the work as listed in the COA letter. Substitution of another DBE is allowed if:

- A COA DBE firm becomes decertified, or
- The Contractor proposes a change to the contract, that is subsequently approved by WSDOT which reduces DBE COA participation, or
- The prime contractor provides documentation that a DBE firm is unwilling or unable to perform the work.

Exceptions to the substitution requirement may be allowed under any of the following circumstances:

- WSDOT deletes the COA firm’s intended work.
- The COA work accomplished under runs the original planned quantity.
- The Contractor can show substantial financial loss if a substitution is required.
- The work has progressed to the point where no other work remains to be subcontracted.
- The DBE subcontractor has taken the positive step of graduating from the DBE program.

The State Construction Office must approve any substitution with concurrence from the Office of Equal Opportunity.

1-2.7F(7) Substitution

Substitutions must meet the following requirements:

- The new firm must do an equal dollar value of work on the contract.
- The change order does not increase the dollar amount of the original goal.

1-2.7F(8) Condition of Award (COA) Change Orders

Changes to the contract COA amounts must be made through a change order executed by the Headquarters Construction Office. Approval is granted after consultation with the Office of Equal Opportunity. This approval shall be obtained and documented prior to the changed work, and any related work, being performed. The amounts shown in the COA change order should be limited to the credit necessary to accomplish the original contract goal amount. The request for approval and the change order as well as the change order package needs to contain the following information:

- An explanation of why the change is necessary.
- Identification of both the deleted work and the added work.
- Revised subtotals for all COA DBE firms. The change order only needs to address each affected DBE firm, not all COA DBE firms.
- Revised total attainment for DBE participation.
- Documentation of a good faith effort to substitute should go in the change order file, (if required, see 1-2.7F(6)).

1-2.7F(9) Consulting with the Office of Equal Opportunity

The Department’s DBE program is managed by the External Civil Rights Branch of the Office of Equal Opportunity (OEO) at Headquarters. The Project Engineer must communicate extensively and continuously with that office about any aspect of the DBE activities on the project. Any questions received from the Contractor or subcontractor about DBE provisions or enforcement should be answered only with full knowledge of the opinions and directions of the OEO. The OEO phone number at Headquarters is 360-705-7085.
The Office of Equal Opportunity is also required to approve DBE firms that are manufacturers and regular dealers (suppliers).

The State Construction Office must execute any change orders that revise the COA commitment. When preparing the change order in CCIS pending CO’s menu use option 3, “Condition of Award Items.” Include the first three items listed above in the change order document. When submitting the change order to the Contractor for signature, the Project Engineer should also send copies to the affected DBE firms and should advise the Contractor that this has been done.

1-2.7G On-the-Job Training (OJT)

1-2.7G(1) On-the-Job Training Special Provisions — General

The requirements for training are made a part of the contract by the special provision, Special Training Provisions. The amount of training is set by the WSDOT Office of Equal Opportunity based on the opportunities presented by the work and the needs in the geographical area involved. The requirements for trainee, training plan approval, and trainee payment are all specified in the contract special provisions.

1-2.7G(2) OJT Required Reports

The contract provisions allow the Contractor to accomplish training as part of their work activities, or through the activities of their subcontractors or lower-tier subcontractors. However the prime contractor is designated as being solely responsible for the completion of the training requirements as they are outlined in the contract provisions.

- Form DOT 272-049 Training Program — A training program is to be completed by the Contractor. The program must be submitted to the Engineer for approval prior to commencing contract work. The Project Engineer’s office may approve Office of Apprenticeship, Training, Employer and Labor Services (OATELS) or Washington the State Apprentice and Training Council (WSATC) programs provided they meet the requirements specified in the contract provisions. The Region will review any non-OATELS/WSATC training plans submitted under section III of the form for compliance. If the plan appears to be in compliance, the Region will sign it, check “Approval Recommended”, and submit it to the WSDOT Office of Equal Opportunity (OEO) for concurrence. If concurrence is granted, OEO will note this on the plan and will submit the plan to FHWA for approval.

- Form 272-050 Apprentice/Trainee Approval Request — Approval of an individual trainee cannot be authorized until an approved Training Program is filed with the Region. This form is to be submitted by the Contractor for each trainee to be trained on the project. When an OATELS/WSATC apprentice/trainee is first enrolled, a copy of the apprentice/trainee’s certificate showing apprenticeship/training registration must accompany the Trainee Approval Request. Trainees are approved by the Project Engineer’s office based on the criteria in the special provisions. If the contractor submits a request for approval of trainee who is neither female, nor a minority, the region must obtain concurrence from the WSDOT Region EEO Officer or the WSDOT Office of Equal Opportunity prior to approval of the requested trainee.

- Form 226-012 EF Trainee Interview Questionnaire — One trainee interview is to be conducted for each craft designated on an approved training program for contracts which have 600 or more training hours or on projects otherwise designated by the Region EEO. The Region EEO shall designate additional contracts on which trainee interviews are to be completed in conjunction with those that meet the criteria above to ensure that trainee interviews are conducted on at least one fourth of all the contracts that have training hours established for any given construction season. The intent of these training interviews is to document that the trainees are working and receiving proper training consistent with their approved programs. DOT form 226-012EF should be used to document these spot checks.

1-2.7G(3) Payment for “Training”

At progress estimate cutoff time, the Contractor shall submit a certified invoice requesting payment for training. The invoice must provide the following information for each trainee:

- The related weekly payroll number
- Name of trainee
- Total hours trained under the program
- Previously paid hours under the contract
- Hours due for current estimate
- Dollar amount due for current updated estimate

Retroactive payment may be allowed provided:

- The Training Program is approved
- There are no outstanding issues or circumstances that would have prevented approval of the apprentice/trainee

Increases in training hours are allowable and may be approved on a case by case basis by the Project Engineer in consultation with the Regional EEO Officer.
1-2.7H Apprentice Participation

1-2.7H(1) Apprentice Participation Special Provision – General

The requirements for apprentice utilization are made a part of the contract by the special provision “Apprentice Utilization”. The use of this provision, and the percentage of required apprentice participation, will be determined by meeting the date and dollar thresholds as follows:

- 10% On contracts advertised on or after July 1, 2007 but before July 1, 2008 and estimated to cost five million dollars or greater.
- 12% On contracts advertised on or after July 1, 2008 but before July 1, 2009 and estimated to cost three million dollars or greater.
- 15% On contracts advertised on or after July 1, 2009 and estimated to cost two million dollars or greater.

Only apprentices enrolled in and apprenticeship program approved by the Washington State Apprenticeship Council may be counted toward attainment of the apprentice utilization requirement. The Contractor may attain the apprentice utilization goal as part of their work activities, or through the work activities of subcontractors or lower-tier subcontractors. Attainment of the requirement will be calculated by comparing the total labor hours worked by all the enrolled apprentices performing work for the Contractor and any subcontractors, in all trades, with the total labor hours performed on the project, in all trades.

It is important to note that the Apprentice Utilization Requirement is a separate program from the Federal Training requirements included in all contracts which contain federal monies. The two programs are not mutually exclusive. The intent of the federal program is to increase the availability of women and minorities within the construction trades; whereas the Apprentice Utilization Requirement (state program) is promoting the use of apprentices in general. The state program will generally be much larger than the federal training program. Federal training goals are set on approximately 25% of all federally funded contracts and the state program will be required on all contracts estimated to cost two million dollars or greater. The state program will ultimately require that 15% of all labor hours on a project be performed by enrolled apprentices; this could range from 700 to 10,000 hours. Training hours on federal contracts range as high as 3,000 hours for a similar sized contract.

1-2.7H(2) Apprentice Utilization Plan

The Contractor is required to submit an apprentice utilization plan, on WSDOT Form No. 422-115 EF, to the Project Engineer within 30 days of execution of the contract. This plan is not submitted for approval; but to inform the Project Office as to how the Contractor will attain the utilization goal. The intent of the plan is to provide the Project Engineer with enough information to track the Contractor’s progress in the utilization requirements. If the plan does not indicate that the Contractor will attain the goal, a revised plan should be requested and/or the Contractor should be notified that “Good Faith” documentation will be required, as specified.

1-2.7H(3) Reporting

For each contract with an apprentice utilization requirement, the Contractor is required to submit a monthly Statement of Apprentice/Journey Participation (WSDOT Form No. 422-110 EF) to the Project Office. This report shall be a consolidated report, and include data from the Contractor’s work activities, as well as from the work activities of all subcontractors. This report will include the total hours and number of apprentices and journeymen working on the contract during the reporting period. The report will list the apprentices by name, registration number, and craft or trade; as well as the name of the Contractor or subcontractor for whom the apprentice is working. The reporting period starts on the first day of the month and runs through the last day of the month, and will be reported on the last working day of the following month. The Project Office should use this report and the apprentice utilization plan to measure the Contractor’s progress toward attainment of the utilization goal. If apprentices are not being reported on the project when the plan shows that they should be working, the Project Office should contact the Contractor and request a revised plan. The Project Office should forward copies of all apprentice utilization plans to the Headquarters Construction Office, and the Region. The original apprentice utilization plan should be kept in the project file. A copy of all reports, and any “Good Faith” documentation submitted, should also be submitted to the Headquarters Construction Office, and the Region.

1-2.7H(4) “Good Faith” Procedures

“Good Faith” is the action taken by the Contractor to meet the Apprentice Utilization requirement. Documentation of the Contractor’s “Good Faith” efforts is only required if the Contractor fails to attain the goal. “Good Faith” documentation may arrive with the monthly report or at the completion of the contract. The need to provide “Good Faith” documentation should be stressed if it is determined that the monthly reports show a level of attainment that significantly differs from that in the Apprentice Utilization Plan. If this should occur, the Project Office should request a revised Apprentice Utilization Plan and/or “Good Faith” documentation from the Contractor. “Good Faith” documentation is basically written correspondence form approved program sponsors indicating that apprentices are not available to the Contractor. All apprentice programs must be approved by the Washington State Apprenticeship Council. A listing of approved programs can be found at the Department of Labor and Industries web page.

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 professional judgment must be exercised by the Project Engineer in order to avoid exceeding the authority as delegated and to avoid decisions or actions that may be
contrary to WSDOT policy. Should there be any doubts as to
the limits of authority, the Project Engineer should consult
the Regional Construction Manager.

Standard Specifications Section 1-07.16(1) Private/Public
Property restricts the contractor from using Contracting
Agency owned or controlled property other than property
directly affected by the contract work without the approval of
the Engineer. The Engineer has the authority to allow the use
of Contracting Agency owned or controlled property within
the project limits and any other property specifically listed
for use in the contract. The use of any other Contracting
Agency owned or controlled property would require a lease
agreement as detailed in Chapter 11 of the WSDOT Right of

In many 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. Because of this, it is important that the
Project Engineer make no instructions, verbally or by
written memoranda, that are outside the scope of the plans,
specifications, contract provisions, or the authority delegated
by the Engineer.

In advance of or during the course of the project, in the
interest of economy and efficiency, noncritical items of work
may be identified for which the Project Engineer may choose
to modify the normal inspection or testing procedures. In
taking these actions, the Project Engineer is acting under
the professional responsibility inherent in all actions as a
representative of the Department and a Licensed Professional
Engineer. Full accountability of such incidents is expected.
The scope of such actions should not exceed $10,000 for a
single bid item, nor exceed $25,000 for an entire project.

The nature of the work to be accepted in this manner will
generally be limited to minor and isolated items. Acceptance
would typically involve dimensional conformance to
the plans and a visual determination that the materials
are suitable, however, the Project Engineer may require
some testing or other means to support a decision. 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. Typically, changes in
acceptance procedures will only be made to work outside
of vertical lines through the horizontal limits of the traveled
way. Consideration should be given to the consequences
of subsequent failure, ease of replacement, whether or not
there is a high variability in the quality of similar work, or
any other pertinent facts. Actions taken in accepting such
materials should be identified in the project records with
acknowledgment by signature of the Project Engineer.

Materials accepted in accordance with this guidance should
be identified in the Project Engineer’s preparation of the
Certification of Materials under Chapter 9-1.5 of this manual.

The use of this process is not intended to retroactively justify
deficiencies discovered after the completion of work.

1-2.8B Contractor’s Equipment, Personnel,
and Operations

The Contractor is required to furnish adequate equipment for
the intended use. The Contractor’s equipment must also be
maintained in good working condition. Prior to the start of
work, the Project Engineer should ensure, by inspection, that
the Contractor’s plant, equipment, and tools comply with the
specifications.

Whenever the specifications contain specific equipment
requirements, the Project Engineer should verify that the
equipment provided meets these specifications. This should
be documented in project records such as the Inspector’s
Daily Report. The Contractor is required to furnish, upon
request, any manuals, data, or specialized tools necessary to
check the equipment.

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.

The Contractor’s supervisory personnel must be experienced,
and able to properly execute the work at hand. If, in the
Project Engineer’s opinion, the Contractor’s supervisory
personnel are not fully competent, the Project Engineer
should immediately notify the Regional Construction
Manager of the facts in the matter, seeking assistance
and advice.

It is expected that, consistent with WSDOT’s policies and
delegated authority, the Project Engineer will assist the
Contractor in every way possible to accomplish the work
under the contract. However, the Project Engineer must
not undertake, in any way, to direct the method or manner
of performing the work. Contrary to popular legend, this
statement is true of force account work as well. Should
the Contractor select a method of operation that results in
substandard quality of work, non-specification 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
or make changes in order to comply with the contract
requirements. Where cooperation cannot be achieved, the
Project Engineer should notify the Regional Construction
Manager of the facts in the matter, seeking assistance
and advice.

1-2.8C Defective or Unauthorized Materials
or Work

Contract Final Acceptance for all work completed on a
project is made solely by the Secretary of Transportation
acting through the State Construction Engineer. However,
the Engineer relies heavily on the actions and professional
opinions of others, involved throughout the course of work,
in determining acceptability. Because of this, it is expected
that the Project Engineer, working with the assistance of
the Regional Construction Manager, as well as making full
use of the many resources available at both the Regional
level and Headquarters, particularly the office of the State
Construction Engineer, will ensure that sufficient inspection
is conducted in order to determine that the work performed
or the materials utilized to construct the project comply
with the requirements included in the contract plans and specifications. When inspections or tests are performed that indicate substandard work or materials, the Project Engineer should immediately notify the Contractor, rejecting the unsatisfactory work or material. When a review of the Contractor’s work or materials used indicate questionable acceptability with regard to the specifications, the Contractor should be notified as quickly as possible so that changes in materials or work methods can be made in order to avoid materials or work being rejected.

1-2.8C(1) Defective Materials
The contract plans and specifications for construction of a project require that specific materials and/or work practices be utilized in completing the work. The Project Engineer may reject any materials not conforming to the requirements of the specifications. The rejected materials, whether in place or not, are to be immediately removed from the site of the work unless the following guidelines for acceptance of non-specification materials are followed:

Material Not in Place
1. Nonconforming materials that are within the defined tolerance limits noted in Chapter 9-5.6 of this manual may be accepted for use on the project in accordance with the guidance in Chapter 9-5.4.
2. There may be situations where WSDOT determines the use of nonconforming materials is acceptable. This requires prior approval of the State Construction Engineer and a change order modifying the project specifications.

Material in Place
1. Price adjustments have been developed and are referenced in the contract for acceptance of certain materials whose properties cannot be determined until they are in place. Items this policy applies to include: concrete compressive strength, Portland cement concrete pavement thickness, hot mix asphalt mixture and density, and pavement smoothness.
2. Material incorporated into the work that is subsequently found to be in nonconformance with the specifications and for which price adjustments for acceptance are not included in the contract, must be reviewed to determine acceptability. The determination of acceptability should be made only when, in the Project Engineer’s judgment, there is a possible service or benefit to be obtained from its use. If it is determined that no benefit or service is obtained from the material’s use, the Project Engineer may direct that the material be immediately removed and replaced at no cost to WSDOT.

The Project Engineer may consult the State Construction Office, State Materials Laboratory, the State Bridge and Structures Office, or other design organizations for assistance in determining the usefulness of the nonconforming material. If consulted, these offices will offer technical advice to the extent that information is available. It is not intended to enter into extensive research to assess material which could be removed and replaced under the contract terms.

If the material is acceptable for continued use, a determination shall by made by the Project Engineer of the possible reduced service life caused by the material substitution and the resulting credit assessed by change order. This determination of acceptability and the resulting credit must meet with the Region Construction Manager’s approval for execution of the change order. In addition, prior review and approval must be obtained from the State Construction Engineer with a recommendation from the State Materials Engineer for the intended application of the material. With this determination for acceptance of non-specification material, discussions should be initiated with the Contractor and a change order completed.

If it is determined that the specification violation will not compromise the performance of the material and the nature of the violation is considered to be more of a technical infraction of the specification, the material may be accepted with a change order, possibly including a price reduction. If there is sufficient data and if the nature of the material makes analysis feasible, a pay factor may be determined using QC/QA methods similar to those described in the Standard Specifications, Section 1-06.2(2). If QC/QA can not be applied, the Project Engineer may determine an adjustment subjectively, using whatever information is available. This assessment or price adjustment is typically based on the unit bid price and may vary from no price adjustment up to the total contract unit bid price for the item involved. If it is determined that the violation is serious enough that the material can not be accepted for use on the project, the Project Engineer may direct its complete removal and replacement at no cost to WSDOT.

All change orders for acceptance of nonconforming materials are Contractor proposed and WSDOT is under no obligation to accept or approve any of them.

1-2.8C(2) Defective or Unauthorized Work
The following types of activities will be considered unauthorized work and will be completed solely at the risk and expense of the Contractor:
- Work performed contrary to, or regardless of, the instructions of the Project Engineer.
- Work and materials that do not conform to the contract requirements.
- Work done beyond the lines and grades set by the plans or the Engineer.
- Any deviation made from the plans and specifications without written authority of the Project Engineer.

Until all issues of material acceptance and conformity to the contract plans and specifications can be resolved, unauthorized work will not be measured and paid for by WSDOT. The Project Engineer may direct that all unauthorized or defective work be immediately remedied, removed, replaced, or disposed of. In correcting unauthorized or defective work, the Contractor will be responsible to bear all costs in order to comply with the Engineer’s order.

For additional guidance, 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 should immediately notify the Regional Construction Manager of the facts in the matter, seeking assistance and advice.

1-2.8C(3) Material Acceptance by Manufacturer’s Certificate

All material is to be accepted for use on the project based on satisfactory test results that demonstrate compliance with the contract plans and specifications. All work demonstrating compliance is to be completed prior to the material’s incorporation into the work. In many cases, this testing has already been completed in advance by the manufacturer. A Manufacturer’s Certificate of Compliance is a means to utilize this work in lieu of job testing performed prior to each use of the product. While this provides for a timely use of the material upon arrival to the job site without having delay in waiting for the return of test results, it creates potential difficulties in obtaining and assessing the adequacy of a certificate.

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 these certificates. Since a certificate is a substitute for prior testing, it is intended that all certificates be furnished to the Project Engineer prior to use or installation of the material.

However, there are some circumstances where the Contractor may request, in writing, the Project Engineer’s approval to install materials prior to receipt and submittal of the required certificate. The Project Engineer’s approval of this request must be conditioned upon withholding payment for the entire item of work until an acceptable Manufacturer’s Certificate of Compliance is received. Examples of materials that shall not be approved by the Project Engineer for installation prior to the Contractor’s submittal of an acceptable certificate are: materials encased in concrete (i.e., rebar, bridge drains, etc.); materials under succeeding items where the later work cannot be reasonably removed (i.e., culvert under a ramp to be opened to traffic); etc. The Project Engineer’s approval or denial shall be in writing to the Contractor, stating the circumstances that determined the decision. If the requirements of this provision are followed, including the written request by the Contractor and the written approval by the Project Engineer, then the remedy for failure to provide the certificate is the withholding of 100% of the cost of the material and the cost of the work associated with the installation of the material.

At the conclusion of the contract, there may still be some items that are lacking the required certificates. These items must be assessed as to their usefulness for the installation, prior to payment of the Final Estimate and subsequent Materials Certification of the contract. The review of these items may include:

- Comparison with the suitability of other shipments to the project or other current projects.
- If possible, sampling and testing of the items involved or residual material from the particular lot or shipment.
- Independent inspection on site of the completed installation.

If it is determined that the uncertified material is not usable or is inappropriate for the completed work that incorporates the material, the Contractor should be directed to immediately remove the material, replacing it with other certified materials. If the material is found to be usable and is not detrimental to the installation it was incorporated into, it may be left in place but, if the provisions of Section 1-06.3 were followed, with a reduction to no pay. The reduction in pay will be the entire cost of the work (i.e., unit contract price, portion of lump sum, etc.) rather than only the material cost. The Contractor should continue to have the option of removing and replacing the uncertified material in order to regain contract payment for the installation. If the provisions of Section 1-06.3 were not followed, then there can be no withholding beyond the value of the missing work itself (the preparation and submittal of the Certificate.)

1-2.8D Contractor Submittals

Missing submittals is a principal source of delays in closing out the project and processing the final estimate. As the project proceeds toward completion, the Project Engineer and the Contractor should attempt to obtain all submittals as the need arises. These might include such things as materials certificates, certified payrolls, extension of time requests, or any other item or document that might delay processing the final estimate. Attention is needed to assure the receipt of these items from subcontractors as they complete their work.

1-2.8E Guarantees/Warranties

As specified in Section 1-05.10 and 1-06.5 of the Standard Specifications, the Contractor shall provide to the Project Engineer all guarantees, warranties, or manuals furnished as a customary trade practice, for material or equipment incorporated into the project. The Project Engineer should transmit the originals of any such guarantees / warranties or manuals to the organization that will be maintaining the items covered by the guarantee/warranty or manuals. The Project office should maintain a copy of the guarantee/warranty, and a letter of transmittal for manuals, with the materials documentation file for the project.

1-2.8F Contractor’s Performance Reports

The procedures for completing and submitting the Prime Contractor’s Performance Report are included with the report, Form 421-010, and the Prime Contractor’s Performance Report Manual, M 41-40. The requirement for this report and other direction can also be found in WAC 468-16-150 and WAC 468-16-160.

Should the Contractor’s typical performance on a contract become below standard, the Project Engineer should immediately notify the Regional Construction Manager of the facts in the matter, seeking assistance and advice.
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 must 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. This is then used to pay the Contractor for actual work performed during each designated pay period or for materials on hand. The automated system that completes this task is called the Contract Administration and Payment System (CAPS). CAPS utilizes an electronic tie between each project office’s computer system and the mainframe computer. This system provides access to a large volume of corporate data and facilitates the maintenance of this data by different groups in different locations. Some of these different activities include:

- **Contract Initiation** — A Headquarters 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.
- **Project Ledger** — An updating process by the Project Office which keeps track of work performed on the contract as it is completed.
- **Estimate Payments** — A Project Office action whereby progress estimates and Regional final estimates are processed directly from the Project Office. The Headquarters Final Estimate process activates the Region Final when all the required paperwork is in place. Supplemental final estimates are processed by Headquarters only. Complete instructions for use of the CAPS computer system are included in the manual titled Contract Administration and Payment System (M 13-01).

1-3.1B Progress Estimates
Progress estimates are normally processed on the 5th of the month for odd numbered contracts and on the 20th of the month for even numbered contracts. Where the Project Engineer deems it appropriate, estimates may also be run on other dates.

Estimates may also be run on other dates if the progress estimate or parts of the progress estimate were 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.

Within the CAPS system, the basis for making any estimate payment is 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 CAPS system gathers all the ledger entries that are identified as eligible for payment, prints them on the report summarized by item, and shows the total amount completed to date for that item but not yet paid for by progress estimate. 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 corrections are made, the Ledger Pre-Estimate Report must be run again in order to get the corrections into the report and made available for payment by progress estimate. Once the Ledger Pre-Estimate Report is correct, an actual estimate can be paid. The report containing the Project Engineer’s signature should be retained in the project files.

The estimate process is then accomplished with a few keystrokes in option 2, estimate payments, in the CAPS main menu. At this point, the CAPS system 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 CAPS system 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 should be accomplished by memorandum from the Region to the State Accounting Services 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 Lump Sum Items
The Contractor is required to submit a detailed Lump Sum price breakdown for those items specified as Lump Sum for which there is no specified payment described in the payment clause of the applicable specification. Estimate payments for items specified as Lump Sum will be a percentage of the price in the Proposal, based on the Project Engineer’s determination of the amount of work performed. Consideration will be given to, but payment will not be
based solely on, the Contractor’s Lump Sum breakdown. The Project Engineer should verify that the price breakdown is based upon a reasonable proportioning of the work, and detailed enough to allow a determination of the work performed on a monthly basis.

Payment of the first 80 percent of the Lump Sum price for Type B Progress Schedules will be made on the next progress estimate following the submittal and approval of the Type B Progress Schedule. The payment will be increased to 100 percent of the Lump Sum price when the Contractor has attained 80 percent of the Original Contract Award amount, as shown on the CAPS Pre-Estimate Report (inclusive of payments made for Material on Hand).

On WSDOT contracts for which payment is made through CAPS (Contract Administration and Payment System), payment for mobilization is calculated and paid automatically by the system. On contracts that do not use CAPS, the Project Office must calculate, and make payment for, the Contract item “Mobilization”. Payment will be made in accordance with Standard Specification 1-09.7 - Mobilization. Based on the lump sum Contract price for “Mobilization”, partial payment will be made as follows:

1. When 5-percent of the original Contract amount has been earned from other Contract items, excluding any amounts paid for materials on hand, the Contractor is also entitled to a partial payment of the bid item “Mobilization”. This payment, which is in addition to payment for contract work performed, will be calculated as 50-percent of the amount bid for “Mobilization” or 5-percent of the original Contract amount, whichever is the least.

2. When 10-percent of the original Contract amount has been earned from other Contract items, excluding any amounts paid for materials on hand, the Contractor will be paid 100-percent of the amount bid for “Mobilization” or 10-percent of the original Contract amount, whichever is the least. This payment is in addition to payment for contract work performed.

3. When the Substantial Completion date has been established for the project, payment of any remaining portion of the lump sum item “Mobilization” will be made.

### 1-3.1B(2) Payment for Material on Hand

Payment for material on hand (MOH) may be considered for materials intended to be incorporated into the permanent work. The requirements for payment of MOH are noted in Section 1-09.8 of the Standard Specifications. Payments for MOH are made under the 900 series of item numbers as ledger entries and need to be backed out as items are utilized such that 900 series entries are zeroed at close out of the contract. Therefore logically payment for MOH shall not exceed the value of the corresponding bid item. It is the responsibility of the project engineer to devise procedures that assure this is done correctly.

Payments may be made provided the contractor submits documentation verifying the amounts requested, the materials meet the requirements of the contract and the materials are delivered to a specified storage site or stored at the suppliers/fabricators as approved by the project engineer. Materials shall be segregated, identified and reserved for use on a specific contract or project. Payments commensurate with the percentage of completion may be paid for partially fabricated items.

All materials paid for as MOH must be readily available for inspection by the owner. Steel materials must be available for inspection but this availability need not be immediate. Reasonable notice should be given to allow the contractor to locate and make the material available for inspection. The project engineer may accept a higher level of risk that steel material may not be reserved for our use. The contractor’s obligation to perform the work and the surety’s guarantee of this obligation serve to offset the risk that reserved materials are diverted to other projects.

When materials paid for as MOH are stored in areas outside the general area the region shall make arrangements for inspection as deemed necessary prior to making payment. The region may utilize other regions or the State Materials Laboratory in doing so.

When contracts are estimated to cost more than $2 million and require more than 120 working days to complete, a General Special Provision (GSP) will be included in the contract provisions, requiring documentation from the contractor as the basis for MOH payments and deductions. When this GSP is included in the contract provisions, 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 will submit a document and the necessary backup to the Project Engineer that clearly states:
  - The dollar amount previously paid for MOH,
  - The dollar amount of the previously paid MOH incorporated into the various work items during the month, and
  - The dollar amount that should continue to be retained in MOH items.

If work is performed on the items and the contractor does not submit a document, all previous associated MOH payments may be deducted on the next progress estimate.

### 1-3.1B(3) 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. The Project Engineer may require the Contractor to furnish a breakdown of the costs to substantiate falsework costs. For any given payment request, the Contractor may be required to furnish invoices for materials used and substantiation for equipment and labor costs.

### 1-3.1B(4) Payment for Shoring or Extra Excavation

When Shoring or Extra Excavation Class A is included as a bid item, payment must 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(5) Payment for Asphalt, Steel, and Fuel Cost Adjustment

Some projects may include the specifications for Asphalt Cost Adjustment, Steel Cost Adjustment, or Fuel Cost Adjustment (one or more) as a General Special Provision. Not all projects will contain these provisions, since their use depends on the type of work, the duration of the contract, and Region preference. For those contracts containing one or more of the cost adjustment bid items, an adjustment (payment or credit) will be calculated monthly for qualifying changes in the index price of the commodity. No adjustment (payment or credit) shall be made if the ‘Current Reference Cost’ is within the percentage of the ‘Base Cost’ specified in the contract, and only those items that are included in the provision are eligible for adjustment. Worksheets are available, in the “Shared Documents” folder of the “HQ Construction” Sharepoint site (http://sharepoint/HQConstruct/default.aspx), to assist the Project office in computing these price adjustments.

It is important to understand that the adjustments provided by these provisions are not a guarantee of full compensation for changes in the contractors cost, and that they are intended only to absorb some of the risk of severe cost escalation during contract performance. Because of this, the method of computing the adjustment has been simplified to eliminate tedious considerations that would otherwise be required to provide precise reimbursement of actual costs.

Payment for “Asphalt Cost Price Adjustment” and “Fuel Cost Adjustment” is based on quantities of the eligible materials incorporated during the period covered, as demonstrated by pay notes for those items. Payment for “Steel Cost Adjustment” is based on the quantity of eligible steel items incorporated or paid as Materials on Hand for the period covered. The Contractor is required to provide documentation of the quantities and the date shipped from the producing mill to the manufacturer. If the Contractor fails to provide the required documentation, any adjustment credit will be unilaterally computed by the Project Office using a shipment date determined by the Engineer. If the Contractor wishes to protest this adjustment, it must be done in accordance with Section 1-04.5 of the Standard Specification.

The provisions for these items are prescriptive, and should result in the correct adjustment if they are followed to the letter. Regardless of whether the estimate cutoff is the 5th of the month or the 20th of the month, any adjustment will apply the most current reference cost to the entire current quantity of each eligible item paid (or deferred) in the current estimate. When a portion of the payment for an eligible item is deferred, a similar portion of the price adjustment for that item should be deferred.

The provisions for these cost adjustments are silent in regard to changed work because there are other contract clauses that address how the Department will pay for changed work. Should changes occur in bid items that are eligible for adjustment, equitable adjustments should adhere to the guidance provided in Chapter 1-2.4C of this Manual. Under no circumstances should eligible items that were not included in the specifications at the time of bid be added by change order after award and execution of the contract. Likewise, these provisions should not be added by change order. FHWA will not participate in the cost of retroactive price adjustments.

### 1-3.1B(6) 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 materials meet 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 excess aggregate for either maintenance or future construction contracts, the material may be purchased into the appropriate inventory account. The Project Engineer should contact Region Maintenance and Accounting for guidance. If aggregates are to be disposed of as surplus, the Project Engineer should contact the State Administrative Services Office, Purchasing and Inventory Section, for additional assistance.

### 1-3.1B(7) Liquidated Damages

Liquidated Damages and Direct Engineering, or other related charges, are to be addressed as described in the contract specifications, Section 1-08.9 of the Standard Specifications, and Chapter 1-2.5G of this manual. Direct Engineering charges are a form of Liquidated Damages and must be listed on the monthly progress estimates on the line for Liquidated Damages. Traffic related damages as described in Chapter 1-2.5G(2) of this manual are to be listed under Miscellaneous Deductions. The Project Engineer must evaluate potential Liquidated Damages that have accrued as a result of the expiration of contract time before the damages are withheld from moneys due the Contractor. The work and circumstances that have occurred over the course of the project should be reviewed to determine if there is potential entitlement for granting additional contract time. Liquidated Damages that have accrued should be adjusted for this evaluation. Liquidated Damages deemed chargeable should then be withheld from moneys due the Contractor each monthly progress estimate as Liquidated Damages accrue. While the Project Engineer takes the action to withhold damages as the work progresses, only the State Construction Office may actually assess those damages.

### 1-3.1B(8) 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:
• 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.

• 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.

• 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.

• Other work by WSDOT forces or WSDOT materials when the Contractor cannot or will not repair damages that are the responsibility of the Contractor under the contract.

• Liquidated damages not associated with contract time, i.e., ramp closures, lane closures (see Chapter 1-2.5G).

• As provided for in the specifications, specific costs or credits owed WSDOT for unsuccessful contractor challenged samples and testing.

The authority to withhold and assess routine “Below the Line Miscellaneous Deduction” on progress and final estimates has been delegated to the Regional Construction Manager, and may be further subdelegated to the Project Engineer. The Project Engineer must give written documentation to the Contractor describing the deduction and provide sufficient notice of the impending assessment.

Credit items which are specifically provided for by the Standard Specifications or contract provisions, such as non-specification density, non-specification materials, etc. may be taken through the contract items established for those purposes. A change order is required for credit items which are not specifically provided for by the contract provisions.

Occasionally a Contractor will send a check directly to a Project Office for payment of money due WSDOT. (The Project Office should not request payment.) Whenever a Project Office or WSDOT employee receives a check or cash directly from a Contractor, it is very important that the guidance found in the Accounting Manual (M 13-82), Chapter 2-1, Control of Cash Receipts, be followed.

1-3.1B(10) Payment for Third Party Damages

Section 1-2.4I of this manual details when WSDOT assumes responsibility and pays for third party damages. The Risk Management Manual, M 72 01, provides detailed guidance on procedures, including lines of communication. Payment should be made under the item “Reimbursement for Third Party Damages”. This item is only intended to be used for costs that are the responsibility of the contracting agency. 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 an incident occurs. On some items such as “Repair Impact Attenuator” there has been a conscious decision by the contracting agency during design to assume a risk which is otherwise the contractor’s. It would not be appropriate to assume this risk for other items of work by adding a similar pay item through a change order.

The next step is for the Project Engineer to determine if an incident warrants an attempt to recover costs based on cost effectiveness. If so, a memo is necessary to provide notice and information to the risk management office. Basically, they need the information necessary to investigate the incident, find the responsible party, determine the amount of the damages and obtain reimbursement for the State. The risk management office needs the following information:

• Contract Number, Project Description
• Names of Witnesses
• Documentation Related to the Damage
  • Change Order Number
  • Field Notes
  • Police Reports
  • Work Order Coding
• Summary of Repair Costs

1-3.1B(11) Withholding of Payments

Withholding payments for work the Contractor has performed and completed in accordance with the contract should not be done casually. There must be clear contract language supporting the action. The authority to withhold progress payments is subdelegated to the Regions. Further delegation to the Project Engineers is at the discretion of each Region.

There are very few occasions when it would be appropriate to withhold the total amount of a payment for completed work. If a minor amount of cleanup remains, if a portion of the associated paperwork has not been submitted, or if minor corrective measures are needed, then the correct action is to pay for the work and defer an amount commensurate with the needed remaining effort.

The concept of “allowing the Contractor to proceed at his own risk” and then withholding payment is not often supported by the contract. There is a contractual obligation to finish the work correctly, there would certainly be a “moral obligation” on the part of the Contractor to live up to the bargain, but there is no contract language that allows such an action. Specific exceptions to this rule are listed below.
Once a decision to withhold any part of the monthly payment has been reached, then it is imperative that the Contractor receive fair notice of this action. The method of this notice can be negotiated with the Contractor and could be a listing at the time of estimate cutoff, a copy of the pre-estimate report or other mechanism. Once notice has been provided, then it is also necessary to allow a reasonable time for corrections to be made.

**No Payment for the Work**

*Standard Specification 1-06.3.* “Manufacturer’s Certificate of Compliance” is unique in that this is a situation, specified as part of the contract, where the contractor may request permission to assume the risk for no certificate and end up never being paid for the related work.

**Progress Payment Deferral**

In the following situations, the contract specifies that the contracting agency has the authority to defer the entire progress payment:

- The contracting agency may not make any payments for work performed by a Prime/Subcontractor until the contractor performing the work has submitted a Statement of Intent to Pay Prevailing Wages approved by Labor and Industries (RCW 39.12.040)
- Failure to submit the “required reports” by their due dates (Standard Specification 1-07.11(10)B)

**Wage Administration in General**

The administration of wages and payment for the work are separate issues. Holding a force account payment for certified payrolls is not appropriate. Withholding payments on the contract is suggested as a method to achieve compliance under the *Standard Specifications* pertaining to wages (1-07.9(1)). This remedy should not be used without approval of the Headquarters Construction Office. Routine enforcement of wage requirements should be done on their own merits utilizing the sanctions specified as follows:

**State Wage Administration**

Labor and Industries is the enforcement agency for state prevailing wage administration. The State (WSDOT) is protected under the contract from wage claims by reserving 5 percent of the moneys earned as retained percentage. This 5 percent is made available for unpaid or underpaid wages liens among other claims. Contract payments should not be deferred due to a contractor’s failure to pay the State minimum prevailing wage.

**Federal Wage Administration**

FHWA 1273 specifies that the State Highway Administration (SHA) is in the enforcement role for federal prevailing wage administration. Under Section IV “Payment of Predetermined Minimum Wage” subsection 6., “Withholding,” the State Highway Administration (contracting agency) is authorized to withhold an amount deemed necessary to make up any shortfalls in meeting Davis Bacon prevailing wage requirements. It goes on to authorize the deferral of all payments, under certain conditions, until such violations have ceased. This is only for federal wage requirements and the amount “deemed necessary” must be based on the amount of the underpayment.

**Application of the Standard Specifications**

Under 1-05.1 Authority of the Engineer reads in part as follows: “If the Contractor fails to respond promptly to the requirements of the contract or orders from the Engineer: ….”

2. The Contracting Agency will not be obligated to pay the Contractor, and ……….”

Under Section 1-09.9 Payments reads in part as follows: “Failure to perform any of the obligations under the contract by the Contractor may be decreed by the Contracting Agency to be adequate reason for withholding any payments until compliance is achieved”.

Sounds good and we can do so, but withholding of payments owed the contractor must not be done on an arbitrary basis. Other than the previously noted exceptions, money is normally withheld because work/work methods are not in accordance with contract specifications. Also, the amount withheld must have a logical basis. We cannot penalize the contractor by withholding more than the out of compliance work is worth.

Withholding payments should not be used routinely as a tool for forcing compliance on general contract administration requirements. The State is protected against nonperformance by requiring a performance bond. In the event that lack of contract compliance puts the State at substantial risk monetarily or safety wise, it may be appropriate to inform the contractor of the compliance problem and suspend work under *Standard Specification 1-05.1 “Authority of the Engineer”* until corrections are made.

When withholding money, remember that delaying the contractor’s cash flow may damage the contractor’s ability to perform work. Before doing so, the State should be able to demonstrate:

- specifically what was not in accordance with the contract and where the requirement is specified in the documents
- that the amount withheld is commensurate with the amount of the unauthorized, uncompleted or defective work
- that the contractor was notified in a timely manner (within 8 days per prompt pay laws) and given a chance to make corrections
- that the State has worked with the contractor to mitigate corrections to non-specification work in order to minimize the cost

The State is required to pay the contractor in a prompt manner within 30 days after receipt of the work or after recognition of entitlement to additional compensation. The Project Engineer must keep an eye on the calendar when scheduling monthly estimate payments.

Regions are not authorized to withhold amounts that are greater than the estimated cost of the missing or incorrect portion of the work. Any such excess withholding must be approved by the Headquarters Construction Office.
1-3.1C Final Estimates — Regions

The final estimate for a project is processed in the same manner as a routine monthly progress estimate. The Work Done to Date entry on a final estimate is the physical completion date. When the Region final estimate is completed and is run in CAPS at the Region, it will not generate a warrant for the Contractor. Instead, the Region final estimate will produce several reports: a final Comparison of Quantities; the Contract Estimate Payment Advice; the Contract Estimate Payment Total; and the Sales Tax Summary.

These reports should be carefully checked to verify the accuracy of items, quantities posted, and the costs that have accumulated through various progress estimates during the life of the contract. Where necessary, corrections can be made to the ledger and the Region final estimate rerun as many times as it takes to make it correct before proceeding with the final estimate process.

If the final estimate shows an overpayment has been made to the Contractor, the estimate should still be processed in the same manner as a normal final estimate. If this occurs, the Contract Estimate Payment Totals report will show a minus amount due the Contractor. When the State Accounting Services Office receives the accepted final estimate package, that office will request any reimbursement due from the Contractor. The Project Engineer should not request reimbursement from the Contractor.

Once the Project Engineer has validated the final estimate amounts, a copy of the Comparison of Quantities Report, the Contract Estimate Payment Advice Report, and the Contract Estimate Payment Totals Report should be forwarded to the Contractor along with the Final Contract Voucher Certification. The Project Engineer might remind the Contractor that the person signing the Final Contract Voucher Certification must be authorized to do so. Authorized signatures are submitted by the contractor at the beginning of each contract.

Once the project has been physically completed, the final estimate package described above should be submitted to the Contractor for signature as soon as is reasonably possible. The final estimate package and request for the Contractor’s signature should be transmitted to the Contractor formally. The effort to prepare the final estimate package will vary in nature and magnitude, depending on the project. In some cases, this work will conflict with field work on other projects. It is expected that final estimate preparation will be scheduled and accomplished as soon as possible, but not later than six months after physical completion.

Once the signatures and all necessary documents have been obtained, the final estimate package should be assembled by the Region and submitted to the State Construction Office. If any needed recommendations for assessment of liquidated damages associated with contract time have not already been submitted, this submittal should include them. The State Construction Office must resolve all issues of liquidated damages before the final estimate can be accepted and submitted to the State Accounting Services Office.

1-3.1D Final Estimates — Headquarters

The final estimate package submitted to the State Construction Office consists of the following:

- Project Status Report — the Project Status Report should address contract time and recommendations for liquidated damages related to contract time, amount of railroad flagging used if any, Miscellaneous Deductions identified, etc. In addition, the report should indicate whether or not all Affidavits of Wages Paid have been received for the Contractor, and all subcontractors, agents or lower-tier subcontractors.
- Final Contract Voucher Certification — Form 134-146, original only.
- If an assessment of liquidated damages has been made previously, include a copy of the letter from the State Construction Engineer to the Contractor assessing these.
- If an assessment of miscellaneous damages or liquidated damages resulting from causes other than time, include copies of letters from the Region to the Contractor for assessment of these.
- Contract Estimate Payment Totals — RAKC300F-EA.

The final estimate package is reviewed by the State Construction Office and submitted to the State Construction Engineer for acceptance of the contract. The date on which the State Construction Engineer signs the Final Contract Voucher Certification becomes the final acceptance date for the contract itself. The final estimate package is then submitted to the State Accounting Services Office.

1-3.1D(1) Final Estimate Claim Reservations

Should the Contractor indicate a claim reservation on the Final Contract Voucher Certification, it must be accompanied by all of the requirements of Section 1-09.11(2) of the Standard Specifications (provided these have not been met in a previous claim submittal). The Project Engineer must assure that the requirements have been met prior to submitting the final estimate package to the State Construction Office. If the claim package is incomplete, return the voucher to the Contractor with notice of the missing parts.

1-3.1D(2) Unilateral Acceptance of Final Estimates

The Project Engineer cannot establish a completion date for the contract if the Contractor is unwilling or unable to submit one or more of the required documents noted in Section 1-08.5 of Standard Specifications. However, the Region can request that the State Construction Engineer accept the contract by signing the Final Contract Voucher Certification (FCVC) in spite of the missing documents.

If the Contractor has not signed the FCVC, the Region can request that the State Construction Engineer accept the contract without the Contractor’s signature. The Region is responsible for notifying the Contractor before such a request is made. The State Construction Office will generate the certified letter notice mentioned in the Standard Specifications, Section 1-09.9. The date of the State Construction Engineer’s signature of the FCVC becomes both the acceptance date and the completion date of the contract, both established unilaterally.
1-3.1E Supplemental Final Estimates

A Supplemental Final Estimate is a payment adjustment made to a contract after the Final Estimate has been processed and the project has been accepted by the State Construction Engineer. A Supplemental Final Estimate may be necessary to correct an inadvertent under payment or where a claim settlement may require additional payment be made to the Contractor. In order to complete a Supplemental Final Estimate, the Project Engineer should complete and assemble the following items, routing them through the Region to the State Construction Office for review and further processing:

1. Complete any corrections or additional postings necessary in CAPS, including any postings to change order items added to CAPS for the settlement of a claim. (Please note, where additional CAPS postings are necessary after the Physical Completion date has been established, the “Work Done To” date in CAPS must be entered as the Physical Completion date or prior.)

2. Complete a Pre-Estimate report including the Project Engineer’s recommendation for payment.

3. Assemble the backup information supporting the necessity and substantiating the cost of the changes to be made.

4. Complete a supplemental Final Contract Voucher Certification (WSDOT Form 134-146 EF) reflecting the changes made and showing the new total “Final Amount”.

After review, the Pre-Estimate report will be signed by the State Construction Engineer authorizing payment to proceed. While postings and corrections to CAPS may continue, once the Completion date has been established for a contract, CAPS will no longer allow the Project Engineer or the Region to process further payments to the Contractor. As a result, payment of the Supplemental Final Estimate will need to be completed for the Project Engineer by the WSDOT HQ Accountability and Financial Services Office.

If this process requires a more timely response, the above documentation may be scanned and e-mailed to the State Construction Office and CAPS; and the contract payments section can be requested to print out the pre-estimate report to be taken to the State Construction Engineer for signature prior to processing the supplemental final estimate. Once the supplemental payment is completed, the signed and executed Pre-Estimate report will be returned to the Project Engineer where it can be maintained as part of the project payment files and made a part of the Region Temporary Final Records.

While a new Final Contract Voucher Certification is completed as a part of the Supplemental Final Estimate, the Acceptance date will remain the same as established by the State Construction Engineer’s signature on the original Final Contract Voucher Certification.

The above process may not be used when there has been an inadvertent over payment to the Contractor, the Final Estimate has been processed, and the project has been accepted by the State Construction Engineer. In this case, the Project Engineer must work with the Region, the contract payments section of the WSDOT Accountability and Financial Services Office, and the State Construction Office to make the correction. All dates in the system will be deleted, the correction made, and the Final Estimate process will begin again with the Region Final Estimate (see Chapter 1-3.1C of this manual).

1-3.1F Retained Percentage

Retained percentage withholding is based upon RCW 60.28, which provides that:

- A sum not to exceed 5 percent of the money earned by the Contractor on estimates be retained by the Contracting Agency.
- The Contractor may submit a bond for all or any portion of the amount of funds retained by WSDOT.

When a contract is awarded, the State Accounting Services Office or the Region Plans Office sends a package of contract documents to the Contractor.

This package of contract documents also includes the necessary instructions for the Contractor to make application for a bond to replace all or any portion of the retainage. The bond form will be processed by the State Accounting Services Office without involvement from Project Engineer’s Office.

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 must forward this request by transmittal letter to the State Accounting Services 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.

- For projects that include landscaping, the Contractor may request that, 30 days after physical completion of all contract work other than landscaping work, WSDOT release and pay in full the amount of funds retained during the life of the contract for all work except landscaping.

In order to initiate this release of funds, Form 421-009 should be completed by the Contractor and submitted to the Project Engineer. In signing the request, the Project Engineer will confirm that all work, except landscaping work, is in fact physically completed. For any landscaping work that may have been completed, the Project Engineer will designate the amount of landscaping moneys, if any, that have been earned to date by the contractor. In the space designated for remarks the Project Engineer will identify the landscaping or plant establishment work that remains to be completed and its approximate value. Except for landscaping work, the Project Engineer will determine if all Statements of Intent and Affidavit of Wages Paid have been received for the work that has been physically completed. WSDOT will continue to withhold a 5 percent retainage of any moneys earned for landscaping work that may have been completed to date and will
1-3.2 Final Records for Projects Constructed by Contract

The Project Engineer is responsible for preparing all necessary records in order 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 Claims By the Contractor

1-3.3A(1) Disagreement, Dispute, Protest

During the course of a contract, differences of opinion may arise over decisions and planning interpretations that benefit one party at the expense of the other. It is the policy of WSDOT to pursue resolution of these differences at the earliest possible time and to fully recognize all of the contractual rights of the Contractor during the resolution process.

Disagreements, disputes, and protests are the responsibility of the Project Engineer until a formal claim is filed in accordance with Section 1-09.11(2). Contact the Headquarters Construction Office for concurrence before taking any issue to a Disputes Review Board. The Project Engineer may employ a variety of techniques and procedures to pursue resolution of these issues. With the high potential for cost impact, it is strongly recommended that all disagreements be identified and tracked.

When a protest occurs during a contract, the Contractor shall pursue resolution through the Project Engineer as outlined in Section 1-04.5 of the Standard Specifications. The Specification contains specific requirements which, if not followed, may result in a waiver of the Contractor’s claim. The Project Engineer should monitor whether the Contractor is meeting these requirements. If all of the requirements have been met, the Project Engineer shall evaluate the merits of the protest and take whatever appropriate action is needed to resolve the issue. If it appears that the Contractor has failed to meet any of the requirements set forth in 1-04.5, the Project Engineer should advise the State Construction Office and request guidance. Pending such guidance, the Project Engineer may continue to discuss the protest with the Contractor with the qualification that no final evaluation of the protest will be made until permission is received from the State Construction Office.

1-3.3A(2) Claims

If the Contractor has pursued and exhausted all the means provided in Section 1-04.5 to resolve a dispute, the Contractor may file a formal claim. A formal claim, filed in accordance with Section 1-09.11(2), is a much more structured device and demands a high level of conformance with the contract requirements. The objective is to utilize the rights that WSDOT has under the contract to identify the issues, obtain a sufficient level of information from the Contractor and limit the discussion to a defined subject matter. To accomplish this, and to maintain the Department’s rights in a situation that may lead to court action and expensive lawsuits, the Project Engineer must insist on rigid conformance with the requirements of the provision. In fact, the first evaluation must not be of the claim’s merit, but rather of the claim’s structure and content. If the package fails the specification requirements in any way, it should be returned to the Contractor immediately with a written explanation. Conversely, if the package meets the contract requirements, then the Project Engineer must comply with the demands for WSDOT actions that are included in the same specification.

The existence of a formal claim does not diminish the responsibility of the Project Engineer to pursue resolution. The only difference is that Headquarters final approval of a proposed settlement is required. The change order settling a formal claim must include waiver language similar to the following:

“

The Contractor, (company name), by the signing of this change order agrees and certifies that:

Upon payment of this change order in the amount of $__________, any and all claims set forth in the letter(s) to the Department of Transportation, dated ____________ and signed by ____________ of (company name) in the approximate amount of $__________, have been satisfied in full and the State of Washington is released and discharged from any such claims or extra compensation”.

If the settlement is intended to close out all dispute discussions for the contract, use language similar to:

“

The Contractor, (company name), by the signing of this change order agrees and certifies that:

Upon payment of this change order in the amount of $__________, 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(s) to the Department of Transportation, dated ____________ and signed by ____________ of (company name) in the approximate amount of $__________, have been satisfied in full and the State of Washington is released and discharged from any such claims or extra compensation”.

"
1-3.3A(3) Legal Filing

Once the Contractor has submitted a formal claim in acceptable form and the State has either denied the claim or failed to respond in the time allowed, the Contractor is free to seek judicial action by filing a lawsuit or, in some cases, demanding binding arbitration. Note that the Contractor must fully comply with the provisions of Section 1-09.11 before it can seek judicial relief. Once any legal action has been started, the Project Engineer may only continue with settlement efforts if the Attorney General’s office has given specific permission to do so. Such permission may be sought through the State Construction Office. Settlements of claims which have resulted in a judicial filing need review and approval by the Attorney General’s office and different waiver language similar to the following:

“The Contractor, (company name), by the signing of this change order agrees and certifies that:

Upon payment of this change order in the amount of $__________, 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 complaint filed under Thurston County Cause No. ____________ (Contractor’s name) vs. State of Washington), have been satisfied in full and the State of Washington is released and discharged from any such claims or extra compensation in any manner arising out of Contract No. ____________.”

1-3.3A(4) Final Contract Voucher Certification

In some cases, of course, the Contractor will not have been so cooperative as to participate in resolution efforts. After a protest has been disallowed, there may have been no formal claim filed and the Project Engineer really doesn’t know if there is a continuing problem. The way to resolve this after the project is physically complete is to assemble the final estimate and send it to the Contractor with a Final Contract Voucher Certification (FCVC). The FCVC is the Contractor’s last chance to formally file a claim. If there is no exception above the Contractor’s signature on the FCVC, there is no claim. The contract will be over as soon as the State Construction Engineer accepts it. If the Contractor does not return the FCVC in a reasonable time, WSDOT may unilaterally set the completion date and process the final estimate without the Contractor’s signature. Proposals to unilaterally accept a contract should be discussed with Region managers before any action is initiated.

1-3.3B Claims Against the Contractor — Damage

The Department has a claims office, now known as the Washington State Department of Transportation Risk Management Office (RMO). All receptionist job descriptions, all Region operations manuals, and all telephone training is set up to refer citizens with damage claims related to construction to the RMO and to provide the toll free number (1-800-737-0615). The RMO will react to the call, issuing claims forms, contacting the contractor, and following up on the actions taken.

The Project Engineer’s role is to appropriately advise the RMO, if needed. There may be confusion about which contract is involved. Field office knowledge about the incident and the surrounding circumstances may be solicited. The contractor’s insurance and the insurance provided by the contractor for the State may be involved and information about the policy will, most likely, be requested.

If, in spite of the Department process, the claimant contacts the field office directly, the Project Engineer should refer the claimant to the State Risk Management Office (1-800-737-0615).

1-3.3C Claims Against the Contractor — Money

Claims received by the Region 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 and be referred to the State Accounting Services Office for obtaining the necessary lien forms.

1-3.3D Claims 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 their conduct and prescribes the manner in which the action must be taken. Whenever this occurs, the state will furnish the legal defense and pay any judgments if the act which caused the alleged damage was within the scope of the person’s duties, was in good faith, and without negligence.

1-3.4 Stewardship

Webster defines “steward” as “one who acts as a supervisor or administrator, of finances and property, for another or others.” the designated steward of all federal highway funds is the United States Department of Transportation, acting through the Federal Highway Administration. In Washington State, FHWA is represented by its Washington Division. Washington Division has delegated a portion of its stewardship responsibility (and the corresponding authority) to the Washington State Department of Transportation through the Federal-Aid Highway Program Stewardship and Oversight Agreement, signed on February 19, 2008.

This section describes further agreement between FHWA and WSDOT concerning the details of the part of the stewardship agreement that applies to construction (Section V c. Construction and Contract Administration and VII Appendix B Construction Monitoring Plan). The subject matter of this sub-agreement is monitoring of construction performed on behalf of WSDOT by independent contractors.

Scope of Construction Monitoring Plan

This plan deals specifically with federally-financed construction performed under contracts with WSDOT and administered through the WSDOT State Construction Office. It is not intended to be all-encompassing. WSDOT Ferries Division contracts for construction of vessels and facilities are not included. Contracts for work through local agencies are not included. Federally-financed utility agreements
are not included. Emergency Relief work performed by contractors and administered by WSDOT Maintenance is not included.

**Project Responsibility**

FHWA, Washington Division, has delegated to WSDOT (and through the WSDOT delegation of authority to the State Construction Office) stewardship responsibility and authority for all federally-funded construction except new construction and re-construction on the Interstate system and certain specially-selected areas of high interest. The special selections are made by FHWA and include significant demonstration projects, special funding agreements and projects of very high national interest. Projects with full FHWA oversight are listed on the State Construction Office web site at: http://www.wsdot.wa.gov/biz/construction/Stewardship/Stewardship.xls.

The Construction Office has further delegated the stewardship reporting responsibility for projects with a contract value less than $6.0 Million to the various WSDOT Regions. The delegation of stewardship authority from Headquarters to the Regions is through the Construction Manual.

FHWA has also delegated to WSDOT the authority to accept projects on the Interstate system that are not new construction or re-construction. This authority has been further sub-delegated to the Regions for projects with a contract value less than $6.0 Million.

**FHWA Review/Approval Actions & Related Processes**

With the pre-approval of specifications and processes and the extensive delegation of stewardship authority, there are relatively few approval actions needed from FHWA during actual construction.

For new construction and re-construction on the Interstate system, FHWA has retained the oversight role of interim, or project, inspections, final inspections and acceptance, and the approval of certain high-value change orders.

The following processes will apply:

For project inspections, the WSDOT Project Engineer and the FHWA Area Engineer shall agree on the timing of such inspections. Typically, project inspections will take place quarterly, however, the Area Engineer may select other frequencies. The Project Engineer will advise the Area Engineer when agreed milestones or completion stages have been accomplished and the Area Engineer will schedule the review and prepare the report. (A similar process will be followed between the Project Engineer and the Headquarters Construction representative for delegated projects when the delegation has been retained at Headquarters. Regions will develop processes for those jobs delegated to them.)

For final inspections and acceptance, the review will be conducted in two parts. The first part will be a field review of the work and will be conducted at about the time of physical completion, when the contractor is still available to make corrections or changes identified during the review. The second part of the process will be the final acceptance review. This will be conducted after WSDOT has accepted the contract and has assembled all cost and materials documents. The second part of the review (acceptance) may be conducted with an exchange of documents and without a physical visit to the site. The Project Engineer will notify the Area Engineer when these times have arrived and the Area Engineer will schedule the reviews and will prepare one final report summarizing both reviews. (A similar process will be followed between the Project Engineer and the Headquarters Construction representative for delegated projects when the delegation has been retained at Headquarters. Regions will develop processes for those jobs delegated to them.)

Change orders on FHWA stewardship projects (for which FHWA has not delegated stewardship responsibility to WSDOT) may be approved by WSDOT unless they alter the termini, character or scope of work on the contract they have a net value of more than $200,000, or they change contract time by more than 30 days. Note: Changes that adjust quantities without changing the work may be approved by WSDOT regardless of value. FHWA approval will normally be a written formal response, but may be verbal if the public interest is served by the more timely action. In all cases, the FHWA approval of a change order shall be obtained through the State Construction Office.

The FHWA Area Engineer may also choose to accompany the WSDOT reviewer during the review of any federal-aid project. Such participation will be random and will be initiated by the Area Engineer. This participation by the FHWA will not change any delegation of oversight responsibility or authority in any way. When the Area Engineer has participated in a review, a copy of the summary report will be provided directly to the Area Engineer.

**Stewardship Summary Reports**

It is important to note the difference between a steward and a stewardship reviewer/reporter. Stewardship on WSDOT federal-aid projects is provided by a wide cross-section of employees who make stewardship decisions according to the requirements of the Construction Manual and their own delegated responsibilities and authorities. From the field inspector who observes contract work and prepares pay instructions, to the Project Engineer who reviews and approves a monthly progress payment, to the Region Construction Manager who executes a change order, to the State Construction Engineer who negotiates and approves a claim settlement, all are acting as stewards in their own job descriptions and assignments.

The stewardship reviewer/reporter, on the other hand, is acting as an overseer, observing and collecting information about all of the stewardship activities, evaluating that information, making recommendations concerning the qualification of the covered work for federal funding and preparing reports to summarize the activities. Reviewers may be FHWA Area Engineers, State Construction Engineers, Region Managers or subordinate Region specialists in documentation or contract administration. For the reports that it prepares, WSDOT may assign any person of the classification of Transportation Engineer 3 or above to this duty. The only restrictions are that the reviewer must not have been involved in the project-level administration and the report must be signed by someone with supervisory authority over the Project Engineer or management responsibility over the contract itself.
• Types of Reports
Interim Reports (also known as Project Reports) are intermediate summaries of stewardship activities on an uncompleted project. These will be performed on multi-season jobs at least annually. Interim reports may be submitted at a greater frequency or for a special purpose at any time, at the discretion of the stewardship reviewer. Interim reports may be submitted on single-season projects for special purposes, again at the discretion of the reviewer.

Abbreviated Final Inspection/Acceptance Reports are single page closeout reports for projects between $1.00 and $500,000 that summarizes the project in more of a checklist format with opportunity for comments. It will still be necessary for the Stewardship reviewer to evaluate the project documentation and procedures, but the reporting will not be to the same level of detail as a Final Inspection and Acceptance of Federal Aid Project for a project over $500,001. Final Inspection/Acceptance Reports are single close-out reports that summarize the results of reviews conducted in two parts at the completion of all projects. The first part is a review of the field work conducted at a time when the contractor is still available to perform additional work or corrective work. The second part is after acceptance, when the final cost figures are known and the materials certification is available. For FHWA-retained projects, the final inspection and acceptance will be conducted by the FHWA Area Engineer. For delegated projects with a greater value than $6.0 Million, the final inspection and acceptance will be conducted by a representative of the State Construction Office. For projects further delegated to a Region, the final inspection and acceptance will be conducted by a Region representative. The final acceptance portion of the final review may be done without a site visit, working from documents and computer data only.

• Timing of Reports
At least once per year, Headquarters Construction will publish a list of all projects that have been started and not closed out for federal funding. The list will be divided to show the responsibility of stewardship reporting for each project. In the past a Final Inspection and Acceptance of federal-aid project report was required for each project financed in part or in whole with federal dollars. In an effort to expedite contract closure and move unused obligated funds back into the various highway programs sooner, stewardship reporting will take the following course:

  • For projects with values between $1 and $500,000: 25% of the projects will be selected from each project office from each Region and an abbreviated Final Inspection and Acceptance of Federal-Aid Project will be required.  
  • For projects with values between $500,001 and $6,000,000: 50% of the projects will be selected from each project office from each Region and a Final Inspection and Acceptance for Federal-Aid Project (WSDOT Form No. 421-101 EF) will be required.  
  • For projects with values greater than $6,000,000: 50% of the projects will require a Final Inspection and Acceptance of Federal-Aid Project form. Interim reports will be performed at times that are appropriate for the nature and progress of the work and the seasonality of the project. These times will be determined through the judgment of the reviewer. The objective for all reviewers will be to prepare and submit interim reports within 30 calendar days after the field review.

For Abbreviated Final Inspection/Acceptance Reports, final inspection will be conducted around the time of physical completion, while the contractor is still mobilized and able to perform corrective or added tasks. Final acceptance review of the project will be conducted after the State Construction Engineer’s final acceptance of the contract itself and after receipt of the Region’s Materials Certification. The objective for all reviewers will be to prepare and submit the Abbreviated Inspection/Acceptance Report within 30 calendar days after project final acceptance. Final inspections for projects over $500,001 will be conducted around the time of physical completion, while the contractor is still mobilized and able to perform corrective or added tasks. The Project Engineer is in the best position to identify this time and shall advise the reviewer that a final inspection is needed. Final acceptance reviews will be conducted after the State Construction Engineer’s final acceptance of the contract itself and after receipt of the Region’s Materials Certification. The objective for all reviewers will be to prepare and submit the final inspection/acceptance report within 60 calendar days after project final acceptance.

Copies of reports prepared by FHWA will be sent to the State Construction Office. Copies of reports prepared by any WSDOT reviewer will be collected by the State Construction Office and forwarded to FHWA.

• Content of Reports:
Stewardship reports provide a high-level overview for those who may not know the project intimately, but may need to be aware of the more significant details of the contract. Communicating those details in a concise and comprehensive manner is a critical aspect of the report. Any individual reading the report should be able to have a reasonable idea of how the project proceeded.

In addition to providing an objective view of the project, a stewardship report should clearly identify what is unique to that project and what circumstances made it unique. Most of our projects are routine and the stewardship reports will reflect that. However, when a project has conditions that are out of the ordinary, the stewardship report should explain what occurred on the project to make those conditions significant.

The ability to write a practical report in a clear and concise manner is a mark of a good engineer.

Job Description: A description of the major elements of the work. Include a narrative about the job. Include the contractor’s name, the award date and the amount of the bid.
Time and Damages: On an interim report, discuss the present status of time and its relationship to the completion status. If behind, describe what is being done to catch up. Describe any suspensions or time extensions. On a final report, discuss the final time result. If overrun, discuss liquidated damages. Subjectively, comment on the amount of time set up. If working days are extended by 10% of the original contract amount, describe the cause(s) that warranted the increase.

Change Orders: Confirm that each change was approved according to the checklist before the work started. Evaluate the preparation of the change order and the justification. For all changes, include a statement of federal participation eligibility. Include more detailed discussions of major or significant changes (e.g. Scope Change, Claim Settlements, Significant Actions, and Changes over $100,000).

Cost: List the final payment, the original amount, the net effect of change orders and the mathematical calculation of net overruns/underruns. Obtain and include a general explanation of the overs and unders.

Materials: On an interim report, review a process in progress by checking for submittals and approvals of RAMs, any drawing or catalog submittals, the testing method and frequency, adjustments to the ROM, observe field tests and include a summary report. Comment on the overall status of materials testing, documentation and adequacy. On a final report, review the Region Materials Certification, comment on any missing items and mention the resolution of the certification for participation purposes. If material deficiencies warrant withholding of Federal participation, define the deficiencies and the amount of Federal participation being withheld. Refer to the following section, “Quality Improvement and Accountability,” in the Stewardship and Oversight Agreement, for a discussion on selection of processes for review.

Disputes, Claims: On an interim report, note any claims or major disputes presently underway. Note how previous issues have been resolved. On a final report, note any exceptions to the final voucher certification and describe the issue.

Traffic Control: Comment on the adequacy of the traffic control plans. Discuss the project’s use of flagging, devices, pilot cars, etc. and any unusual events during the project.

Training: On an interim report, determine that a plan has been submitted and approved. Also, note the comparison between accomplished training and the completion status. Report any efforts to recover if behind. On the final report, list the amount of training originally included, any changes made to this requirement and the total amount of training accomplished.

Subcontracting: Discuss the level and nature of subcontracted work. Note any DBE requirements and any change orders modifying these requirements by deleting, adding or substituting DBE commitments. Make reference to any Condition of Award requirements. Assure that mandatory DBE contracting did happen and that the DBEs performed a commercially useful function (review the On-Site reports). Review on-site reports for any DBE firm utilized, whether or not its utilization was mandatory.

Other: Talk to the Project Engineer. Look for special notes. If there was an experimental specification or process, discuss it. If there was an unusual event or happenstance, discuss that. Describe the overall impression of the contractual relationship. Describe any evidence of successful collaboration between the parties. Include any other information of interest.

Note: As a significant part of any review, the reviewer must visit the jobsite and confirm that a project of approximately the nature and magnitude of that shown on the plans actually does exist. This is true for all stewardship reporting.

Communication

Much of the day-to-day communication between WSDOT and FHWA is informal in nature. Verbal discussions, telephone consultations and e-mail notices (including digital photos when needed for clarity) are used extensively. Except where formal written notices are specifically required, staff from both agencies will attempt to utilize the simplest form of communication that accomplishes the needed communication in the least time. All reports and correspondence related to a project shall bear both the WSDOT contract number and the FHWA project number as identifiers.

1-4 Utility and Railroad Relocation

1-4.1 Work Performed Under Utility Agreements

Utility agreement work associated with a contract exists in two categories. The first is work done for a utility by WSDOT that is included in the contract and performed by the WSDOT contractor. The second is work done, either by the utility or the utility’s contractor, that is associated with and done near the WSDOT project.

If the utility work is included in the contract, the plans will show the work and will include pay items exactly as if the work was part of the transportation improvement. The responsibility of the Project Engineer is to treat this work the same way that “normal” work is handled. There will be a necessity for communication with the utility itself, inviting comments and joint reviews and inspection of the work. In many cases, the utility will provide materials or equipment to be incorporated into the work. The utility will also provide certification that provided material meets the requirements of the contract. If problems arise and changes are considered, there are additional paperwork demands. The Project Engineer should consult with the Utility and the Region Utility Engineer.
1-5 Surveying

1-5.1 Site Surveying

1-5.1A 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.

1-5.1B 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 monuments and for recording surveys as a public record. 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, for all monuments that are set or reset, a record of the monument be filed on a Monumentation Map with the County Engineer in the county in which the corner exists and the original sent to the State Right of Way Plans Branch. Headquarters will forward a copy to DNR for their records.

1-5.1C Alignment Monumentation

During construction, alignment monumentation may be altered to fit field conditions. Such changes may include:

- 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.

- 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.

- 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.

If the work is associated with the project, or if unrelated work is being done nearby, and the railroad or its contractor is performing the work, the Project Engineer should treat the neighboring work in the same manner that adjacent WSDOT work would be treated. (See Standard Specifications, Section 1-05.14 and Section 1-2.2H of this manual.)

1-4.2 Work Performed Under Railroad Agreements

Railroad work associated with a contract exists in three categories. The first is work done for a railroad by WSDOT that is included in the contract and performed by the WSDOT contractor. The second is work done, either by the railroad or the railroad’s contractor, that is associated with and done near the WSDOT project. The third category is railroad protective services. Protective services, such as flagging, are typically provided by the railroad.

If the railroad work is included in the contract, the plans will show the work and will include pay items exactly as if the work was part of the transportation improvement. The responsibility of the Project Engineer is to treat this work the same way that “normal” work is handled. There will be a necessity for communication with the railroad itself, inviting comments and joint reviews and inspection of the work. In many cases, the railroad will provide materials or equipment to be incorporated into the work. The railroad will also provide certification that provided material meets the requirements of the contract. If problems arise and changes are considered, there are additional paperwork demands. The Project Engineer should consult with the Railroad Company and the Region Utility Engineer.

If the work is associated with the project, or if unrelated work is being done nearby, and the railroad or its contractor is performing the work, the Project Engineer should treat the neighboring work in the same manner that adjacent WSDOT work would be treated. (See Standard Specifications, Section 1-05.14 and Section 1-2.2H of this manual.)

Protective services may be called for when the Contractor is performing work on railroad facilities (first category above) or when the Contractor’s work is conflicting or adjacent to a railroad facility that is not being changed. Typically, the railroad will determine the need for service, provide the protective services, and send the bill to WSDOT. There may be an agreement in place, or the railroad’s actions may be unilateral. On all projects including railroad flagging, the Project Engineer will notify the Railroad Company when all work involving the railroad is physically complete.

The addition or revision of agreements with the railroad can be lengthy processes. The Project Engineer should stay alert for possible changes and the need for revisions to the agreement. When these arise, the Railroad Company and the Region Utility Engineer should be contacted early and often.
1-5.2 Construction Surveying

1-5.2A Surveying Provided by the State

Unless the contract states otherwise, the Project Engineer is responsible for providing all surveying needed to locate and define the contract work. The staking done in construction surveying must assure that the work will conform to the plans and must also conform to the Contractor’s approach to the work. There are numerous survey techniques that will accomplish these objectives. Prior to each phase of the work, the Project Engineer must reach agreement with the Contractor concerning the method, location, and timing of construction staking. Once this agreement is reached, it must be shared with all WSDOT, Contractor, and subcontractor personnel who place or use construction stakes.

1-5.2B Contractor Surveying

If the contract requires the Contractor to provide some or all of the construction surveying, the Project Engineer is required to provide only the primary control points staked, marked, and verified in the field and the coordinate information for the main alignment points in the plans. The plan alignment and the field control points must be referenced to the same grid coordinate system.

The provisions for contractor surveying are intended to provide the stakes needed to inspect the work, as well as the primary function of locating and defining the work. If the survey stakes required by the contract do not provide the reference data needed for inspection, then the Project Engineer will have to provide additional survey work that is needed. As an alternative, a change could be negotiated with the Contractor to perform the added work.

The Contractor’s survey work is a contract item, just like all other contract items. It must be inspected for adequacy and conformance with the contract. Once it is performed and inspected, it must be paid for.

The wise Project Engineer will inspect the survey efforts and check as much of the contractor’s work as is practical. Any errors should be brought to the Contractor’s attention for corrective action. The inclusion of contractor surveying in a project transfers the risk of survey errors to the Contractor. If the contract requires the Contractor to provide some or all of the surveying for the main alignment points, then the Project Engineer must assure that the survey work of the Contracting Agency does not relieve the Contractor of the risk.

1-5.2C Grade Control

1-5.2C(1) 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 0.05 foot below subgrade elevation and be accurate to + or – 0.01 foot. The finished subgrade surface shall not deviate from the plan subgrade elevation by more than +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 effort and care on the part of the Contractor. Conformance to grade shall be checked by rod and level, straight-edging, or other appropriate engineering method as selected by the Engineer.

1-5.2C(2) Surfacing Tolerance

Red and Yellow tops for surfacing materials shall be set accurate to + or -0.01 foot. The finish of the compacted 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 – 0.05 foot; top course for bituminous surface treatment, + or – 0.03 foot; top course for asphalt concrete, + or – 0.02 foot; surface treated base course, + or – 0.03 foot; treated base under Portland cement concrete pavement, + 0.00 to – 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 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.

In the event that additional blue tops are not set for setting grade of 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.

1-6 Inspection of Course Thicknesses

Tabulated below are the permissible deviations in measured thickness for specified depths of surfacing and paving. While these are the maximum deviations that can be allowed, the Project Engineer may impose tighter requirements for conforming to the plan dimensions where there is a reason to do so.

<table>
<thead>
<tr>
<th>Material</th>
<th>Specified Depth</th>
<th>Max. Allowable Deviation at Any One Point</th>
<th>Average Depth Deviation for Entire Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated Surfacing and ATB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.00 – 0.25’</td>
<td>-0.05’</td>
<td>-0.025’</td>
<td></td>
</tr>
<tr>
<td>0.26 – 0.50’</td>
<td>-0.06’</td>
<td>-0.03’</td>
<td></td>
</tr>
<tr>
<td>0.51 – 0.75’</td>
<td>-0.07’</td>
<td>-0.035’</td>
<td></td>
</tr>
<tr>
<td>0.76 – 1.0’</td>
<td>-0.08’</td>
<td>-0.04’</td>
<td></td>
</tr>
<tr>
<td>Over 1.0’</td>
<td>-8%</td>
<td>-4%</td>
<td></td>
</tr>
<tr>
<td>Hot Mix Asphalt (HMA)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(single-lift)</td>
<td>0.08 – 0.15’</td>
<td>-0.045’</td>
<td>-0.015’</td>
</tr>
<tr>
<td>(multi-lift)</td>
<td>0.00 – 0.25’</td>
<td>-0.03’</td>
<td>-0.01’</td>
</tr>
<tr>
<td>0.26 – 0.50’</td>
<td>-0.045’</td>
<td>-0.015’</td>
<td></td>
</tr>
<tr>
<td>0.51 – 0.75’</td>
<td>-0.06’</td>
<td>-0.02’</td>
<td></td>
</tr>
<tr>
<td>Over 0.75’</td>
<td>-0.075’</td>
<td>-0.025’</td>
<td></td>
</tr>
</tbody>
</table>

For HMA overlays with a specified depth of less than 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.
# Chapter 4  Bases

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</table>
Chapter 4  Bases

4-1  Gravel Base

4-1.1  General Instructions
Gravel Base is typically used in the construction of the roadway section and provides support for the pavement. A minimum stabilometer “R” value of 72 is required so that the gravel base will be strong and resist displacement. WSDOT Test Method T 611, as performed by the State Materials Laboratory, shall be used to determine the “R” value of the material. For the pavement to provide a long life, it is important the gravel base be placed uniformly and compacted properly.

4-1.2  Substitution of Gravel Borrow for Gravel Base
When gravel base is specified in the contract, the Contractor may request, in writing, that gravel borrow be used in lieu of gravel base. When gravel borrow is substituted for gravel base, the gravel borrow shall have a minimum stabilometer value of 67, as determined by WSDOT Test Method T 611, in addition to the requirements of Section 9-03.14(1) of the Standard Specifications. The top 0.10 foot (30 millimeters) of gravel borrow shall be replaced with 0.10 foot (30 millimeters) of crushed surfacing top course (CSTC). Testing and sampling frequencies will be as required for the material actually placed. The CSTC and gravel borrow used in lieu of the gravel base is measured and paid for as gravel base and not as CSTC or gravel borrow. The inspector should note on the item quantity ticket that the CSTC or gravel borrow is being used in lieu of gravel base. The as-built plans will identify sections where gravel borrow and CSTC were substituted for gravel base.

4-2  Ballast and Crushed Surfacing

4-2.1  General Instructions
Ballast and crushed surfacing is used in the construction of the roadway section and provides support for the pavement. Ballast may be naturally occurring or manufactured, crushed surfacing is a manufactured material. Careful inspection during the manufacturing process is required to verify that the material meets the contract specifications. This is important so the material will have the properties needed to provide support to the pavement and drain water from beneath it. For the pavement to provide a long life, it is important that ballast or crushed surfacing be placed uniformly to the line, grade, and cross section specified in the plans and compacted properly.

4-2.1B  Staking
See Chapter 1-5 Surveying of this manual for listed tolerance and the Highway Surveying Manual for additional instruction concerning staking.

4-2.2  Loading, Hauling and Spreading
Subgrade for ballast or crushed surfacing is prepared in accordance with the appropriate specifications. Any soft or spongy areas shall be removed or stabilized before the ballast or surfacing material is placed over it.

The Standard Specifications require the material to be mixed by the Central Plant Mix Method, the Road Mix Method, or a combination of the two methods. On some projects, the Central Plant Mix Method is the required method. Ballast and crushed surfacing materials shall be hauled and placed on the roadway with the equipment and in accordance with the Standard Specification.

It is imperative that the Inspector watch for segregation of materials during all stages of manufacture, hauling, and placement. The design of the roadway section is based on all materials meeting all requirements of the specifications, including gradation requirements. If crushed surfacing materials are deposited on the roadway in a segregated condition, the only corrective measure available is processing of the material on the roadway, using motor graders 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.

Various types of equipment have been developed in order to facilitate placing the required amount of material with a minimum of segregation to the correct cross-section. When the material is mixed with water in a central plant before placing on the roadway 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. Some equipment operates from grade control wires to ensure the material is placed at the proper elevation and transverse slope. If this type of operation is proposed to be used by the Contractor, the Inspector should become familiar with the operation and intricacies of the equipment.
Before each course of surfacing is placed, the Inspector should verify that the underlying course is uniformly graded and compacted properly. The Inspector should also see that each course is finished to a true, smooth profile with no humps or hollows. A good way to locate irregularities in the roadway profile or crown is by careful visual inspection. Viewing the grade from a prone position or using stringlines between hubs may be helpful. In this way, additional material can be spot-placed to eliminate low and irregular areas, and the material graded and compacted to a true, smooth surface.

It is important the Contractor place the courses of surfacing material in such a manner as to minimize any deleterious effect on the quality of the material already placed. One of the best ways to minimize damage to the previously placed materials is to reduce the amount of hauling equipment traveling over each course. The placement of the surfacing should begin at the extreme end of the haul and proceed toward the point of loading. In this way, the least amount of hauling over completed courses will be required.

### 4-2.3 Compaction

Prior to placing any surfacing material, the Project Engineer submits 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 compaction control test. For each surfacing material, the Project Engineer will receive a Maximum Density Curve worksheet from either the Regional Materials Laboratory or State Materials Laboratory. This worksheet shows the standard density for all gradations of the tested material as related to the percent passing the U.S. No. 4 (4.75 mm) sieve.

Each layer of surfacing material placed, including gravel base, is to be compacted with approved compaction equipment and checked for compliance with density specifications before the next layer of material is placed. When individual layers are placed to a depth of less than 1 inch (25 millimeters), testing of two layers at one time is permissible. Field in-place density tests are performed in accordance with the test procedures and testing frequencies outlined in Chapter 9 of this manual. A minimum of 95 percent of the standard density as determined by the compaction control test for granular materials is typically required before the next layer of material is placed.

During processing and compaction, the moisture content of the material should be maintained at the optimum water content. The optimum water content is determined by the State Materials Laboratory and is listed on the Maximum Density Curve worksheet. Frequent light applications of water rather than periodic heavy applications are preferable as light applications tend to avoid saturation of the surfacing material below the surface. Some projects, typically ones with a large quantity of crushed surfacing, will require the water be added to the surfacing by the central mix plant method. With this method, the amount of water added can be closely controlled and mixed thoroughly with the aggregate. This will result in a material that is uniform both in gradation and water content which will be easier to compact.

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 cutting of the surfacing by the trimming machine is controlled by wire lines setup along each side of the roadway. It is therefore important that frequent checks of the wire be made both at the initial setup of the wire and during the trimming operation. This is necessary to verify that the wire has not been disturbed and that the grade will be trimmed correctly.

The Project Engineer should 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. After completion of the trimming and compaction of the surfacing the finished grade should be checked. 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 or very hard. On some projects subsequent operations such as concrete paving will also require wire lines and the contractor will typically use the same wire for both operations. The wires for these cases will need to be set far enough out to allow for the operation of the paving equipment. An alternative to requiring trimming machines for some projects is to use motor graders with automatic controls.

### 4-2.4 Maintenance of Surfacing

Upon completion of the surfacing courses, the Contractor is 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 shutdown for the winter.
4-2.5 Keystone

Keystone may be used as needed to provide a tight surface for ballast, gravel base, crushed surfacing base course, or any other surfacing. If the Contractor’s operation are such that a considerable amount of coarse rock accumulates on the surface of the completed course that will not compact tightly, keystone may 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 crushed surfacing top course. If the contract does not include the item crushed surfacing top course, approval for adding the item to the contract is required before it may be used. Keystone placed for the convenience of the contractor is paid for at the lower unit contract price for either the base material being keyed or the crushed surfacing top course.

The specifications require that when keystone is necessary that 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. In areas where the pavement is subject to freeze thaw conditions, the use of crushed surfacing top course may not be appropriate if the crushed surfacing top course is frost susceptible. The Regional Materials Engineer should be contacted prior to using crushed surfacing top course in freeze thaw locations.

4-2.6 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 properly prepared and meets density specifications before allowing the next course to be placed.
3. When applying water to a surfacing course, see that it is distributed evenly over the entire course. Avoid overwatering which may cause soft spots in subgrade.
4. Make frequent checks of yield to see that the 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 the profile are removed.
6. See that surfacing is maintained properly. Should irregularities develop in any surfacing the contractor shall repair the defects prior to placement of the next course.
7. Make depth checks to ensure conformance with the roadway section.
8. Make daily moisture checks on material paid for by the ton (tonne) when excess moisture is present.

4-2.7 Measurement of Quantities

The Standard Specifications require that surfacing materials be weighed and paid for by the ton (tonne) or measured by the cubic yard (cubic meter) in the hauling vehicle at the point of receiving the material.

For surfacing materials paid for by the ton (tonne), 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:

\[ D = 100 + \frac{M - A}{T} \]

where

- \( T \) = total daily tonnage (mass) over the scales
- \( M \) = percent of moisture
- \( A \) = allowable moisture

4-2.7A Measurement by the Ton (Tonne)

Refer to Chapter 10-2.2 for instructions for measuring materials by the ton (tonne).

The following is a list of the scaleman’s duties:

1. Keep the Scaleman’s Daily Report 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.

4-2.7B Measurement by the Cubic Yard (Cubic Meter)

Refer to Chapter 10-2.3A of this manual for instructions for measuring materials by volume, truck measure.
4-3  Asphalt Treated Base 4-3.1
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, construction of ATB to seal the subgrade from 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 with ATB as soon as 10,000 square yards (square meters) of subgrade has been completed on any roadway which is to receive ATB. 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 construct 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.
Lifting loops shall be removed to ½ inch (15 millimeters) 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 4000P (28P) 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 5-foot (1.5-meter) 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 5 feet (1.5 meters) 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 10 feet (3 meters) of concrete. In all cases, the concrete shall be vibrated to a point at least 5 feet (1.5 meters) 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 shall 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 State 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 formula 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 pile elevations in the plans and compare them to the foundation report recommendations. Any discrepancies should be reported to the State Construction Office.

The minimum tip elevations are a design parameter that may come from the geotechnical design or the structural design. A pile tip elevation that is less than minimum cannot be accepted in the field, it must be reviewed by the State Bridge and Structures Office, the State Bridge Construction Office, and the State Geotechnical Engineer. If, during the initial pile driving operations, minimum tip is not being achieved, no additional piling should be driven until concurrence is obtained to change the minimum tip elevation, or the contractor will have to change his method of installation so that the minimum tip elevation can be achieved.

Where the specified minimum tip elevations cannot be reached the State 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 6 inches (150 millimeters) or more from the plan shall be reported to the State Construction Office before accepting the pile. The tolerance for all types of battered piles is ½ inch in 12 inches (20 millimeters in 1 meter). Any deviation exceeding this tolerance shall be reported to the State Construction Office for evaluation.

Pile driving leads shall be fixed at the top and bottom as discussed in Section 6-05.3(9)C of the Standard Specifications, to ensure that the piling can be accurately driven both as to position and batter.
The type and size of hammers to be used to drive piling are specified in Section 6-05.3(9)B 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. A useful formula to determine the drop of a single acting diesel hammer determined from measuring the blows per minute is:

\[
\text{Stroke Formula (ft. of drop) = } 4.01 \left(\frac{60}{\text{BPM}}\right)^2 - 0.3
\]

\[
\text{Stroke Formula (meter of drop) = } (4.01 \left(\frac{60}{\text{BPM}}\right)^2 - 0.3) \times 0.3048
\]

Where BPM is the blows per minute of the hammer.

This drop can then be used in the bearing equation shown in Section 6-05.3(12) of the Standard Specifications to determine the bearing of the piling.

This formula calculates the drop from the rate of blows per minute that the hammer is hitting at and makes it no longer necessary to watch the top of the hammer and estimate the distance that hammer is coming out of the casing. Since the rate the hammer runs at is dependent on the drop of the hammer, and this hammer drop is accelerated at a constant by gravity, the distance the ram travels can be determined from the formula.

The Standard Specifications, Section 6-05.3(9)B, and Special Provisions, govern the hammer size by specifying the minimum ram weight (mass) 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 weight (mass) 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 State Construction Office should be consulted for any other hammer submittals or insufficient performance in the field.

Drop hammers, which are rarely used, must be weighed in accordance with Section 6-05.3(9)B of the Standard Specifications, 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 State 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 foot (300 millimeters) 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.
Chapter 8

8-0 Introduction

Although many items of construction in this chapter are specialized, procedures for sampling materials, documenting construction, and requiring that work be done in accordance with the specifications is not different from other types of highway construction work.

Federal, state and local water quality regulations prohibit sediment and other pollutants associated with construction activity from impacting air and water quality. All projects must comply with these laws and the required permits. WSDOT creates Temporary Erosion and Sediment Control (TESC) plans to prevent erosion and any damage to the site, adjacent properties, and the environment. Section 8-01 of the Standard Specifications covers the requirements for controlling erosion and water pollution on projects. Applicable provisions are included in the contract and must be enforced by construction staff to ensure effective erosion prevention and water quality protection.

The National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit is one of the most common permits on WSDOT projects. It requires erosion prevention when vegetation is removed, when soil is disturbed, or when water flow has the potential to cause erosion. In addition to the required TESC planning, the NPDES permit requires site inspections, water quality monitoring (both turbidity and pH), and record keeping.

It is important to partner with environmental agencies during construction. Early, open communication sets up a good working relationship that may prove invaluable later on if problems occur. Permit requirements normally require notification to environmental agencies prior to conducting construction activities. On some projects it may be advisable to invite representatives from regulatory agencies to part on if problems occur. Permit requirements normally require notification to environmental agencies prior to conducting construction activities. On some projects it may be advisable to invite representatives from regulatory agencies to part of the preconstruction meeting when environmental issues are discussed.

When working around sensitive areas, applicable permits are typically attached to the contract as appendices. These permits must be carefully reviewed to ensure that, among other things, the Temporary Erosion and Sediment Control (TESC) plan meets permit requirements. It is important to remember these permits are sometimes obtained after the main design work was done. If the original TESC plan does not meet permit requirements, the plan must be modified with the assistance of the Region Environmental Office.

8-1 Erosion Control

8-1.1 TESC Planning and Implementation

A TESC plan consists of a narrative document and plan sheets. The narrative document includes an analysis of erosion risk and a list of Standard Specifications, General Special Provisions (GSPs), and special provisions used to mitigate the risk. The plan sheets show the locations of BMPs and other features such as topography and location of sensitive areas for multiple project stages. Chapter 6 of the Highway Runoff Manual M31-16 provides guidance on creating thorough TESC plans. Appendix 6A describes all erosion control best management practices (BMPs). Contact Region Environmental or the Statewide Erosion Control Coordinator for more information.

WSDOT develops the TESC plan and tries to account for all inherent risks on each site and plan to minimize these risks through the use of design, procedural, and physical BMPs. The effectiveness of TESC plans will vary based on how well designers assessed risks and selected contractually enforceable tools for addressing those risks. Unpredictable elements such as the weather also impact effectiveness of the TESC plan. Although we try, it is truly impossible to account for all risks associated with a project before construction begins.

When constructing the project, there may be times when it is necessary to exceed the maximum acreage exposure limits allowed by Standard Specification 8-01.3(1). If the Engineer grants the Contractor’s request to exceed these limits, the Contractor must provide to the Engineer a revised plan, commensurate with the scope and risk of the variance proposed, stating what measures will be used to protect the project from erosion damage, how water quality and sensitive areas will be protected, and include the schedule of methods employed to regain adherence to 8-01.3(1). The Construction Stormwater General Permit (NPDES) prohibits the Engineer from increasing the time periods required in 8-01.3(1) for covering erodible soil that is not being worked.

The Contractor can either adopt WSDOT’s TESC plan or provide suggested revisions. These suggestions may lead to additional costs, but if they properly identify the risks that we missed or suggest more practical solutions, those ideas should be adopted. However, some suggestions weaken plans and put WSDOT at greater risk of problems. Such proposals should be rejected. Encourage the contractor to help develop solutions that are compatible with their construction activities. Getting everyone involved early in the process will help you come up with effective solutions that can be agreed upon by everyone.

It is important to clearly understand the TESC plans prior to construction. The actual site conditions may not match those described in the original plan due to development in the area, changed construction dates, and inaccuracies in the original plan. Newly paved areas or housing developments located up gradient from the project site may increase surface water flows to the site. An accurate evaluation of current site conditions is essential for preventing erosion.
When conducting an initial evaluation, the inspector should walk through the site with the TESC plan in hand. If available, the designer should go along on the walk through. It is important to verify the current site conditions and determine whether any plan changes are necessary. Mark any needed changes on the plan sheets so that necessary changes can later be shown to the contractor.

Some of the most important factors leading to erosion control problems include: onsite runon, groundwater, unstable slopes, poor soils, and exposing too much soil during the wet season. Therefore, the responsiveness of construction staff to changing conditions is the most important determining factor in whether or not the plan is effective.

Knowledge of soil types in the project area is quite important. If erodible soils are present, special consideration must be given to reducing erosion when these materials are encountered in cuts or used in embankment construction on the project. If problems are encountered during construction, contact Region Environmental staff or Geotechnical staff for assistance.

Frequently, infiltration can be used when other BMPs fail to make site runoff meet water quality requirements and to reduce stormwater volumes. Infiltration should be considered whenever conditions allow. On sites with highly permeable soils and large undisturbed areas, infiltration should be used as one of the main storm water management BMPs. When no runoff leaves the site the possibility of water quality exceedence is eliminated and smaller volumes of stormwater reduce the overall potential for erosion.

As a project progresses, new risks emerge and must be addressed in order for the TESC plan to remain effective. Prevention is better, cheaper, and easier than repair or mitigation after a plan fails. Many problems can be prevented in the initial stages of construction if the Contractor protects the roadway as work progresses. In the long run, poor construction practices can cost the contractor additional money to correct the damage.

By maintaining an effective TESC plan, WSDOT will save money, time, and prevent environmental problems. Should an environmental non-compliance event occur, i.e. an action not in compliance with environmental standards, permits, or laws during construction refer to Section 1-2.2K(1) for the appropriate notification and corrective action procedures.

Upon project completion and final stabilization, most temporary BMPs are removed and removal is paid for using the force account item when it is included in the contract. It is the responsibility of the inspector to ensure that the contractor removes temporary BMPs in such a way that we do not impact water quality or increase the potential for erosion. Some temporary BMPs, such as inlet protection, must be removed or they may cause problems in the function of the facility. Others, such as wattles or compost socks, may be allowed to remain until they biodegrade if they are serving a useful purpose and do not pose an impediment to safety or function. However, some BMPs such as silt fence may need to remain in place and be removed after the need for them has passed, even if the duration extends beyond contract completion. Inspectors must determine when the site is adequately stabilized and the temporary BMPs can be removed. The Project engineer may need to coordinate with State Maintenance forces to arrange for silt fence or other BMP removal occurring after the contract is completed.

8-1.2 TESC Inspections

The contractor must identify their certified Erosion and Sediment Control (ESC) Lead for the project and include the ESC Lead on the Emergency Contact List. The ESC Lead must have, for the life of the contract, a current Certificate of Training in Construction Erosion and Sediment Control from a course approved by the Washington State Department of Ecology. Information on approved training can be obtained at: http://www.ecy.wa.gov/programs/wq/stormwater/cesel.htm.

The Contractor’s ESC lead is obligated to perform erosion control inspections using a standard WSDOT form. Standard Specification 8-01.3(1)B provides additional guidance on site inspections including the standard form number. Inspections completed using the form meet NPDES Construction Stormwater General Permit requirements. WSDOT staff should verify the Contractor is inspecting the site, maintaining records, and showing plan revisions. WSDOT must keep a copy of all inspection reports on-site in a Site Log Book in order to be in compliance with the NPDES requirements.

If WSDOT can identify potential erosion areas early, we can prevent problems such as stop work orders and fines from Ecology, construction delays, and unfavorable publicity. Site inspections allow us to verify that the Contractor is implementing the plan and that it is working effectively. You should walk through the site with the TESC plan in hand to evaluate whether BMPs were installed as specified on the plan drawings. You may need to assist the Contractor with identifying appropriate locations to ensure the site is always prepared for a storm. Inspections must also be made during storm events to evaluate how well BMPs are performing.

The effectiveness of BMPs must be evaluated in the field. If installed BMPs are ineffective, replacement BMPs must be selected and installed. If the quality of installation or lack of maintenance is responsible for a failure, the contractor should repair the BMPs at no cost to WSDOT. If the failure is a result of faulty BMP selection, we must identify a new BMP. Any changes to BMPs in the field must be recorded or drawn onto the TESC plan sheets and documented on the site inspection form. For recommended erosion prevention practices see Chapter 6 of the Highway Runoff Manual M31-16. For site-specific recommendations, contact Region Environmental or Environmental Services Erosion Control Coordinator.

Everyone on the construction site should know what to do when an environmental agency representative visits the site. The Contractor’s ESC Lead is trained to direct the agency representative to the project engineer or the inspector delegated in charge of erosion issues. All Contractors working on the site must know who is in charge of erosion control for WSDOT. Contractors should be directed
All drawings shall be clearly marked (“Approved as Noted”, “Returned for Correction”, or “Approved”) 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 generally to conform with existing national electrical codes. There are instances when the Department permits methods of construction that are considered equivalent to state and national codes.

 Generally, local inspection authorities do not inspect highway work that is within the state highway right of way. From time to time, however, the Department of Labor and Industries 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. The Department does have authority to permit alternate methods when equivalent objectives can be met if the work is within the State right of way. Should any question arise over a conflict between our plans and their opinions, the matter should be referred to the State 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.

Sufficient cover must be provided to protect the conduit from damage as provided in Section 8-20.3(5) of the Standard Specifications.

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.

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. Junction boxes and conduit should be placed away from areas that water is funneled to prevent it from entering into the conduits. For example, the bottom of ditches, sag vertical curves should be avoided or other low spots where water is likely to collect.

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. If there is any doubt concerning the adequacy of a connector, the advice of the Regional Electrical Inspector 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 8-20.3(8) and 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 signal standards, rope or fabric 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 Department personnel meet the contractor at the delivery storage site. 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 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.

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. The checklist (Figure 8-1) is provided to assist the Project Engineer in identifying the specific tasks that must be completed prior to signal turn-on. This checklist is a guide, and line items may be added or deleted as necessary to fit each specific signal installation.
This checklist highlights the critical items of work that are to be complete before the signal system can be placed into operation.

*The Project Engineer has the authority to reschedule the test date or signal turn-on at their discretion.

### SIGNING:
1. Advance warning “Signal Ahead/W3-3” signs (permanent)
2. “New Signal” or “Signal Revision” signs (temporary)
3. “Left Turn Must Yield on Green Ball” sign
4. Lane control signs
5. Street name signs

### STRIPING (Installed or scheduled):
6. Stop Bar(s)
7. Crosswalk stripes
8. Channelization
9. Channelization aligns with signal heads

### SIGNAL DISPLAY SYSTEM:
10. All vehicle displays are connected and tested
11. All pedestrian displays are connected and tested
12. Restrictive left turn display is over left turn lane
13. Combination of restrictive/permissive left turn display is over the gore stripe.
14. Optically programmed displays are properly programmed for the intended movement.
15. Vertical clearances are met.

### SIGNAL DETECTION SYSTEM:
16. All vehicle detection (temporary and permanent) is tested.
17. If staging is required, all side street stop bar detection is tested as a minimum for semi-actuated operation.
18. All pedestrian detection (push buttons) are tested.
19. All emergency vehicle preemption detection are tested.
20. Railroad preemption is tested.

### SIGNAL CONTROL SYSTEM:
21. Controller is tested and available
22. Cabinet is installed, wired and ready for controller hookup.
23. Interconnect is tested.
24. Permanent power source is supplied to the system.

### CONTRACTOR CONTACT RESPONSIBILITIES:
25. Controller manufacturer representative (not required if state supplied controller)
26. Uniformed Police/State Patrol for Traffic Control

### ELECTRICAL INSPECTOR CONTACT RESPONSIBILITIES (Five (5) days prior to proposed* signal test date):
27. Signal Maintenance
28. Signal Operations

### PROJECT ENGINEER CONTACT RESPONSIBILITIES (Five (5) days prior to proposed* signal test date):
29. Local Agencies (City, County, State Patrol, Fire District, etc.)

### COMMENTS:
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 insure that readings of the megohmmeter taken on every electrical circuit are furnished to the Regional Electrical Inspector. 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 may 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
Installation of 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 equipment, 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 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 may be moved up to 500 feet (150 meters) in either direction if severe ground or slope conditions are encountered. If the sign must be moved more than 300 feet (150 meters), 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 State Bridge and Structures Office, Bridge Preservation Office. The Project Engineer shall request a sign structure identification plate for installation on the sign support by the Contractor. Installation instructions will be provided by the State Bridge Preservation Office.

Anytime an existing bridge mounted sign bracket, cantilever sign structure, or sign bridge structure is removed from service, the Contractor shall remove the identification plate and give it to the Project Engineer. The Project Engineer will return the identification plate to the State Bridge Preservation Office so the sign structure can be removed from the inventory.

### 8-21.3 Approval of Materials

All materials for installation on permanent signing projects should be selected off the Qualified Products List (QPL) or listed on the Request for Approval of Materials (RAM). Materials listed on RAM not listed on the QPL shall be submitted to the State 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-9b. The Project Engineer approves plans in conformance with the standard plans. Any request to deviate from standard plans should be reviewed by the State Bridge and Structures Office.

The six sets of shop drawings of special design sign structures and/or special sign fittings shall be submitted to the State Bridge and Structures office, which will coordinate approval with the State Materials Laboratory. After approval, the State Bridge and Structures office will retain one set and forward two sets to the State Materials Engineer and send three sets to the Project Engineer. One of the State Materials Engineer’s sets will be forwarded to the Fabrication Inspector. The Project Engineer will send two sets to the Contractor, who will forward one set to the Fabricator.

If a structural review is not required by the State Bridge and Structures office, the Project Engineer shall mark all changes in red on all six copies and distribute per the Shop Plans and Working Drawings Table in Chapter 1-2.4H of this manual.

All drawings shall be clearly marked (“Approved as Noted”, “Returned for Correction”, or “Approved”) before returned to the Contractor, whether reviewed and checked by the Project Engineer or the State Bridge and Structures Office.

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 State Materials Laboratory.

### 8-21.4 Inspection

A “fabrication approval” decal dated and signed by the Sign Fabrication 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.

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 Base Connections

It is important to ensure the proper torque is applied to bolts connecting the bases when installing Standard Plan G-8 and G-8a Sign Structures. Procedures for assembling and inspecting high strength bolts are covered in Chapter 6-3.6B of this manual. All base 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.
# Chapter 9  Materials

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Chapter 9  Materials

9-1  General

9-1.1  Introduction
The quality of material used on the project will be evaluated and accepted in various ways, whether by testing of samples, visual inspection, or certification of compliance. This chapter details the manner in which these materials can be accepted.

9-1.2  Requirements
Requirements for materials are described in Section 1-06 and Division 9 of the Standard Specifications for Road, Bridge and Municipal Construction (M 41-10). Tolerance limits and a procedure for acceptance of certain materials are given in Chapters 9-5.4 and 9-5.6. For inspection of course thickness, the maximum deviations for measured thickness of surfacing and paving see Chapter 1-6 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, independent assurance, and verification samples for each type of material for which there is a separate bid item. Verification samples shall be referenced to the corresponding Manufacturer’s Certificate of Compliance.

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 material sampled may require further treatment before it will meet the specification requirements. Preliminary samples are a basis for approving which aggregate site or brand of material will be considered for use. Deliveries cannot be accepted on the basis of preliminary samples unless the samples represent an identified lot of materials.

Unless specified for a particular purpose, preliminary sampling and testing of materials from a potential source are not mandatory functions. It is to be performed when requested by the Project Engineer, Region Materials Engineer or the State Materials Laboratory on the Request for Approval of Material (DOT Form 350-071).

For aggregate sources that have been identified as having variable quality, contact the Regional Materials Engineer prior to use. It has been demonstrated that some of these sources can provide quality material through diligent production and stockpile management. The Regional Materials Engineer may approve these aggregate sources by the stockpile(s) or on a project-by-project basis. To determine aggregate approval status, consult the ‘Aggregate Source Approval Report’ generated from the ASA database prior to use.

In order to insure consistency in sampling of aggregate sources for preliminary testing, the sampling must be witnessed or taken by a designated representative of the Regional Materials Engineer.

Before sampling, check to see if the source that is proposed is currently approved for the intended use. If current preliminary test reports are available and confirm that the material meets the contract requirements, additional tests may not be needed. If in doubt, contact the State Materials Laboratory for assistance.

9-1.3B  Acceptance Samples and Tests
Acceptance samples and tests are defined as those samples tested for determining the quality, acceptability, and workmanship of the materials prior to incorporating the materials into the project. The results of these tests are used to determine conformance to the contract documents. The minimum frequency for sampling and testing of acceptance samples is detailed in Chapter 9-5.7 of this manual.

9-1.3C  Vacant

9-1.3D  Verification Samples and Tests
Verification samples and tests are used for making checks on the reliability of a manufacturers test results when acceptance of the material is based upon a Manufacturer’s Certificate of Compliance.

9-1.4  Form Letters
A number of form letters have been prepared as an aid to the Project Engineer in transmitting information to the laboratory. In order to minimize delays to completion of material testing, transmittal letters should include all the information that is pertinent to the sample in question. In order to assist the laboratory, copies of the transmittal letters should be retained in the Project Engineers Office. The following is a list of the forms that may be used for transmittal of samples and/or information to the materials laboratory:

350-009 EF  Concrete Test Cylinder Transmittal
350-016  Asphalt Sample Label
350-026 EF  Preliminary Sample Transmittal
350-040 EF  Concrete Mix Design
350-041 EF  Request for Reference HMA Mix Design
350-042 EF  HMA Mix Design Submittal
350-056 EF  Sample Transmittal
350-067 EF  Thickness Measurement and Core Transmittal
350-071 EF  Request for Approval of Material
350-073 EF  Hot Mix Asphalt Test Section Report
350-074 EF  Field Density Test
350-074A EF  Field Dry Density Test
350-092 EF  Hot Mix Asphalt Compaction Report
350-114 EF  Summary Report of Acceptance Sampling and Testing
350-115 EF  Contract Materials Checklist
351-015 EF  Daily Compaction Test Report
410-025 EF  Project Engineer Transmittal
9-1.5 Project Material Certification

The Project Engineer is responsible for obtaining all required materials documentation or otherwise ensuring that all required materials testing is completed, all with satisfactory results, prior to the materials being incorporated into the project. The Project Engineer is also responsible for maintaining a successful accounting for the materials incorporated into the project in order to support the Region’s Certification of Materials. Management and accounting for materials used in the construction of a project are to be administered in the same manner regardless of its funding source; Federal, State, or a combination of both.

The Region is responsible for periodic reviews of each project’s materials documentation at the Project Engineer’s office. Upon completion of the project the Region will prepare a Region Materials Certification letter listing all variances that were identified and their resolution. On projects that involve Federal participation where material deficiencies are documented, these deficiencies must be resolved with the State Construction Office through the Region before the Region Certification of Materials can be completed. On projects that involve State Funds only, documented deficiencies must be resolved with the Region prior to the Region Certification of Materials. The Regional Administrator or their designee is responsible for signing and distributing the certification letter.

The State Materials Laboratory will also perform compliance reviews on a sampling of completed projects statewide where the materials have been certified.

Definitions

Certification: A Region Materials Certification based on a documented evaluation of the project’s materials inspection, sampling, testing, and other materials acceptance activities for their conformance to the contract documents, Standard Specifications and this manual. The certification reflects the project’s conformance with the Record of Materials as adjusted by the Project Engineer for:

1. Actual project quantities utilized,
2. Acceptance practices as provided for in this manual, including Chapters 1-2.8 and 9-5.2, and Non-critical items,
3. Adjusted sampling/testing frequencies as provided for in Chapter 9-5.2, and
4. Work added by Change Order.

Variance: An identified difference between the materials acceptance requirements noted in this manual, the contract documents, the Standard Specifications, and a review of the completed projects Record of Materials. All variances must be noted. Such notations will need to include the basis by which the material was accepted and how the requirements for that material were met. Any variance between the recognized acceptance requirements and the Project Engineer’s use of the material must be resolved with either the Region, State Construction Office, and/or State Materials Laboratory, as appropriate.

Project Material Certification Process

Environmental and Engineering Programs Division (EEPD)

1. State Materials Laboratory (Documentation Section)
   a. Prepare the initial Record of Material for all major items of materials listed in the contract.
   b. Provide technical support, certification guidelines, format, and suggested documents. See Figure 9-1 for Project Materials Checklist (DOT Form 350-115, latest version). See Figure 9-2 for examples of the Region Materials Certification letter and its distribution.
   c. Conduct Compliance Reviews on a sampling of completed projects statewide where the Region has certified the materials.

2. The State Construction Office
   a. Receives variances for federal aid projects identified during the Region’s materials certification review.
   b. Coordinates FHWA and Region to determine funding eligibility for variances.
   c. Prepares response to Region identifying degree of participation (Letter of Resolution).

3. Accounting Office
   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 Project Materials Certification, the Letter of Resolution and assure 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.

Region

1. Project Engineer
   a. Sets up and maintains a materials documentation system.
   b. Maintains and monitors a current Record of Material ensuring materials certification throughout the course of the project.
   c. Identify, document, and justify all materials variances including determination and acceptance of noncritical items in accordance with Chapter 1-2.8 of this manual. Justification may be any of the following:
      1. Follow requirements of Section 1-2.8C(3) if the deficiency is a lack of manufacturer’s certification.
      2. Satisfy the deficiency through additional testing or documentation.
      3. Demonstration that the existing documentation is adequate (for example, 19 out of 20 test were taken).
# Contract Materials Checklist

<table>
<thead>
<tr>
<th>Contract Number</th>
<th>Sign Route</th>
<th>Federal Aid Number(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Title</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No*</th>
<th>N/A</th>
<th>Item No(s).</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. All materials/products used in the construction of this project, including items added by Change Order, have been approved &amp; are listed on the Record of Materials.</td>
<td></td>
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<td>**</td>
</tr>
<tr>
<td>2. The actual materials/products used along with the actual basis for acceptance of those materials and products has been documented.</td>
<td></td>
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<td>**</td>
</tr>
<tr>
<td>3. All uses of proprietary items, including those listed in the Special Provisions and/or contractor provided QPL items, are documented.</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4. When required, change of material/product letters and a revised RAM were initiated by the contractor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. A Change Order has been completed for all materials accepted and incorporated into the project, but which failed to meet the required specifications when tested.</td>
<td></td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>6. An appropriate credit has been received for all non-specification materials used.</td>
<td></td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>7. Modifications to testing/inspection procedures, including CM 1-2.8A, have been explained and documented by the Project Engineer prior to construction of the item.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>8. Acceptance based on Sampling and Testing for Small Quantities has been documented. CM Chapter 9-5.2C.</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>9. Where Manufacturers Certifications were not provided prior to material or product installation, the Project Engineer has provided specific prior approval for the work to continue in accordance with 1-06.3 of the Standard Specifications.</td>
<td></td>
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<tr>
<td>10. All required acceptance actions and documentation were completed and satisfactory test results demonstrated before payment was made on each item.</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>11. Acceptance sampling &amp; testing frequencies for each item accepted is adequate for the total quantities of those items incorporated into the project.</td>
<td></td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>12. All Acceptance Sampling and Testing completed by the Project Engineer utilized Qualified Testers and Certified Testing Equipment in accordance with the Qualified Tester program.</td>
<td></td>
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</tr>
<tr>
<td>13. All fabrication inspected items have been accepted in accordance with CM 9-1.5D</td>
<td></td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>14. The contractor has submitted all required Manufacturer Certifications and Mill Certifications, the Certifications represent the specification requirements noted in the contract, and quantities represented by the certifications match or exceed the final quantities used.</td>
<td></td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>15. All required catalog cuts have been approved and are on file.</td>
<td></td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>16. All required Certificates of Materials Origin have been received and are on file. (Fed Aid projects only)</td>
<td></td>
<td></td>
<td></td>
<td>**</td>
</tr>
</tbody>
</table>

* Checklist items marked "No" constitute a Materials Certification deficiency. Each "No" requires the contract item number for the affected item to be shown along with an attachment to the Materials Checklist detailing the circumstances of use, the method used for acceptance of the material, the Project Engineer's evaluation of the material, suitability for its application, and determination as to whether or not it may have met the specification in spite of the materials documentation oversight. If the project is Federally funded, the Project Engineer should also include a recommendation for Federal participation in light of the use of undocumented materials.

** These specific materials deficiencies on Federal Aid projects must be resolved through State Construction Office and may result in the loss of Federal participation.

---

Project Engineer

Date

Region Construction Engineer/Operations Engineer/Area Engineering Manager

Date

DOT Form 350-115 EF Revised 3/2002

Figure 9-1
Date:

Linea Laird, P.E.
State Construction Engineer
P.O. Box 47354
Olympia, WA 98504-7354
MS: 47354

Cont. No.: SR-
F.A. No:
Section:

Completion Date:

Dear Linea:

This is to certify that:

The results of acceptance sampling and testing completed for the project referenced above, confirm that the materials incorporated into the project were found to have met the requirements as outlined in the contract plans, provisions, and Standard Specifications.

There were no exceptions

OR:

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.

Exceptions to the plan and specifications are explained on the attached sheet(s).

Very truly yours,

Regional Administrator or designee

XX:xx
Attachment

cc: FHWA, 40943 (F.A. Projects Only)
State Materials Engineer, 47365
Regional Oper./Const. Engineer
Project Engineer

Figure 9-2
Chapter 9  Materials

4. Demonstration that the cost of obtaining the missing documentation will not be justified by the benefits received.

d. Identify and document the determination and acceptance of all non-critical items in accordance with Section 1.2-8A of this Manual.

e. Prepares the Region Materials Certification package, which includes the Region Materials Certification letter, identified variances, Letters of Resolution for all identified variances on federal aid projects and resolution actions taken. This package also includes a completed Contract Materials Checklist (DOT Form 350-115). The certification package is submitted to the Region Construction Manager for review. The certification letter is to be addressed to the State Construction Engineer.

2. Regional Operations/Construction Office
   a. The Region shall review projects according to Chapter 10-5 of this manual for documentation requirements including materials.
   
   b. Resolve materials variances identified by the Project Engineer and the Region's review of materials documentation at the Region level for State funds only projects. Resolve materials variances on Federal aid projects through contact with the State Construction Office.
   
   c. Review certification package for completeness.
   
   d. Submit certification letter to Regional Administrator for signature.
   
   e. Distribute signed Region Materials Certification letter. The original is submitted to the State Construction Engineer, with copies sent to FHWA (for F.A. Projects) and the State Materials Engineer. A copy of the Letter of Resolution shall be attached if there are any variances.

3. Regional Administrator, or designee
   a. Signs the certification letter.

4. State Construction Administration and Support Accounting Office
   a. Completes the necessary paperwork.

Compliance Review for Materials Certification Process

Compliance reviews will be performed by the State Materials Laboratory to document how well project records conform to materials certification standards.

The compliance review will normally be conducted at the Project Engineer Office unless arrangements are made for it to be conducted elsewhere.

The goal is to perform a compliance review on at least one project per Project Engineer Office every two years. Compliance reviews may be conducted more frequently as appropriate. Projects will be selected with consideration given to project size and complexity.

Reviews may be performed either prior to or after receipt of the Region Certification of Materials letter. If the review is performed prior to receipt of the Region Certification letter, the review will occur after Substantial Completion. Compliance reviews are performed in order to assist the Project Engineer Office in verifying that all required materials documentation and testing has been completed in accordance with established requirements and standards.

If the review is to be performed at the receipt of the Region Materials Certification Letter, the State Materials Laboratory will notify the Region within 60 days of intent to perform a compliance review on that project. Compliance reviews performed prior to receipt of the Region Materials Certification Letter will occur at any time after Substantial Completion.

The goal is to perform a compliance review on at least one project per project office every two years. Compliance reviews may be conducted more frequently as appropriate. Projects will be selected with consideration given to project size and complexity.

The records maintained and developed by the Project Engineer for approval, acceptance and, field verification of the materials placed and paid for on the contract and the identification of variances will be reviewed.

Upon completion of the review, the findings will be discussed with the Project Engineer and/or their representative. A draft report of the findings will be prepared and sent to the Project Engineer after the review. The Project Engineer Office will be given time to rectify any possible deficiencies before the final report is written. A copy of the final report will be sent to the Regional Documentation Engineer, Construction Manager, State Construction Office, and the FHWA Division Office.

In addition to addressing material documentation deficiencies, the Project Engineer/Construction Manager will correct any such discrepancy in the Project Engineer Office material documentation process noted during the Compliance review.

The following items of documentation must be made available for the review:

1. Record of Materials, as revised and amended by the Project Engineer Office (ref. 9-1.5A)

2. Approval Documents:
   a. Request for Approval of Material (ref. 9-1.5B)
   b. Qualified Products List pages (ref. 9-1.5B)

3. Acceptance Documents:
   a. Test Results
      1. Acceptance Test Reports
      2. Assurance Test Reports (where applicable)
      3. Independent Assurance Test Reports (where applicable)
      4. Verification Test Reports (Cement and Liquid Asphalt)
b. Manufacturer’s Certificate of Compliance (ref. 9-1.5E)
   1. Concrete Pipe Acceptance Report (ref. 9-1.5F)
   2. Lumber Grading Certificate
   3. Certification of Cement Shipment
   4. Notice of Asphalt Shipment or Certified Bill of Lading
   5. Any other certificates required by the contract documents

c. WSDOT Fabrications Inspected Items (ref. 9-1.5D)

d. Catalog Cuts (ref. 9-1.5H)

e. Proprietary or Agency Supplied Items (ref. 9-1.5B)

f. Visual Inspection Items (ref. 9-1.5C)

g. Small Quantity Acceptance Documentation

h. Reduced Frequency Testing Documentation

4. Field Verification Documentation (ref. 9-1.5C)
   a. Inspectors Daily Reports
   b. Field Acceptance Reports
   c. Field Note Records (individual materials information initialed and dated by the inspector in the field)

5. Inspectors Daily Reports

6. Field Note Records

7. Comparison/Summary of Quantities

8. List of Change Orders

9. Project Engineer Office Signature/Initial List

9-1.5A Record of Materials (ROM)

A Record of Materials (ROM) listing of all major construction items is provided by the State Materials Laboratory for each project. For these major construction items, the ROM identifies the kinds and quantities for all materials deemed to require quality control testing. It further identifies the minimum number of acceptance and verification samples that would be required for acceptance of those materials. The minimum number of acceptance tests is based on the planned quantities for the project and should be adjusted for the actual quantities used. Also listed are those materials requiring other actions, such as fabrication inspection, Manufacturer’s Certificate of Compliance, shop drawings, or catalog cuts.

The acceptance action and/or numbers of samples listed are the minimum requirements for the Project Engineer’s acceptance of those materials and the minimum requirements necessary for the Region’s certification for the materials used on that project. The State Materials Laboratory will forward the Record of Materials electronically to the Regional Materials Engineer, and Project Engineer shortly after the contract is awarded. The copy submitted to the Project Engineer is intended as a tool to assist the project office in tracking the samples approved, samples tested, Manufacturer’s Certificate of Compliance, shop drawings, catalog cuts received, and other pertinent data necessary for the Project Engineers and the Regions certification of materials.

The acceptance requirements shown on the Record of Material may be modified by the Contractors specific Requests for Approval of Material. In addition the ROM is based on the State Material Laboratory’s review of the major items of construction identified by the contract Summary of Quantities. Reviewing the contract plans and provisions may also identify additional materials documentation requirements as well as major construction items that require additional materials not accounted for in the State Material Laboratory’s initial review of the project. These additional materials documentation requirements should be added to the ROM and tracked for completion throughout the course of the project work.

The accuracy of the ROM and Certification of Materials is largely the responsibility of the Project Engineer.

Where the ROM is not clear or there appear to be opportunities to adjust the acceptance requirements that have been identified, the Project Engineer is encouraged to contact the Region Materials Engineer or the State Materials Laboratory for assistance.

In order to ensure clarity upon completion of the work and to allow for easy certification of the project by both the Project Engineer and the Region, it is important that the project ROM be accurate and actively maintained throughout the course of the project. Any changes to the acceptance requirements, additional materials used, or any additional materials added to the project by change order should be accurately documented and tracked in the project Record of Materials.

9-1.5B Approval of Materials

To fulfill the requirements of Standard Specifications Section 1-06.1, the Contractor must notify the Engineer of all proposed permanently incorporated materials prior to use. Some temporary items may require approval if required by the Contract Documents. This may be accomplished by a Qualified Product List (QPL) submittal or by submitting a Request for Approval of Material (RAM) (DOT Form 350-071).

When the materials are approved, it does not necessarily constitute acceptance of the materials for incorporating them into the work. Additional acceptance actions, as noted by the code on the RAM or QPL must be completed prior to the materials being used in the work.

Qualified Products List — Submittals

Products listed in the QPL have been found capable of meeting the requirements of the Standard Specification, General Special Provision, Bridge Special Provision and Standard Plans under which they are listed and, therefore, have been “Approved.” These products may be “Accepted” by fulfilling the requirements of the Acceptance Code and any notes that apply to the product. During the life of the contract, acceptance criteria for materials in the QPL may change, becoming more stringent or less stringent. The
acceptance criteria detailed on the originally submitted QPL page will continue to be the acceptance criteria for the life of the contract, unless the Contractor submits a new QPL page for the material. This is the case regardless of whether the criteria become more stringent or less stringent. Instructions are given in the QPL for processing QPL submittals. It is encouraged that Contractors and Project Engineer Offices use the QPL database for submittals. The QPL database is constantly updated with additions and/or deletions and can be accessed @ www.wsdot.wa.gov/biz/mats/QPL/QPL.cfm.

The Engineer shall review the submittal of the material for consistency with the Bid Item and shall promptly notify the Contractor of any concerns, working toward resolving these with the Contractor. QPL submittals inconsistent with the intended use for the Bid Item should be marked “unacceptable for intended use” and returned to the Contractor. Copies of QPL pages for materials that are to carry a WSDOT Fabrication Inspection ‘Stamp/Tag’ or Sign Inspection ‘Decal’ shall be forwarded to the WSDOT Headquarters Fabrication Inspection Office.

Request for Approval of Material — Submittals

The Contractor shall submit all Request for Approval of Materials (RAM) to the Project Engineer Office using RAM for DOT 350-071 EF.

If a RAM is submitted with a material that is found on the QPL, the Project Engineers office may code the RAM as defined below.

If a RAM is submitted with a material not identified under the ‘Project Engineer’s Office Approval Coding’ area, the Project Engineer’s Office shall submit the RAM to the State Materials Laboratory Documentation Section for coding.

The coding of the RAM is to determine if the proposed material on the RAM is capable of meeting the established standards and defining the acceptance criteria. Acceptance determines if the material being placed on the contract does meet the established standards.

When unable to approve a RAM as outlined below, the Project Engineer’s office will sign, date, and code the items with a “7” – “Approval Pending” and forward it to the State Materials Laboratory Documentation Section. If the RAM is not filled out correctly it will be returned to the Project Engineer’s Office prior to any action being taken. It is recommended that the RAM submittal should be submitted in a timely manner. The RAM may be forwarded by mailing, electronically transferring or faxing. A copy should also be returned to the Contractor at this point to inform them that the RAM has been sent to the State Materials Laboratory for approval. Submit any additional documentation, including appropriate transmittals, that may assist the RAM Engineer in approving the proposed material; such as Test Reports, Catalog Cuts, Manufacturer’s Certificate of Compliance, etc. The page number of the Special Provision or Plan Sheet will aid in expediting the approval process.

The State Materials Laboratory Documentation Section may elect to delegate approval of some specialty items.

All RAMs shall be signed and dated by the Engineer. All copies of the RAM’s processed through the Project Engineers Office shall be sent to the State Materials Laboratory Documentation Section. Copies shall be distributed as indicated at the bottom of the RAM form. Acceptance requirements should be noted on the maintained ROM and/or Materials Tracking Program (MTP). This is especially important since the maintained ROM and/or MTP will be used for auditing purposes.

Project Engineer’s Office Approval Coding

- QPL Reference Materials:
  The Engineer may code the RAM if the product listed on the RAM is identified in the QPL by make, model, batch, color, size, part no., etc. The product must also be listed in the QPL under the appropriate Standard Specification for the intended use as indicated by the Bid Item and Specification Reference shown on the RAM. The RAM should be coded with the 4-digit QPL acceptance code and any notes and/or restrictions restated as “Remarks” on the RAM.

- Aggregates:
  Aggregate Sources will be approved by consulting the Aggregate Source Approval database for the use intended. The RAM should be coded when there is a sampling frequency in Section 9-5.7 of this Manual with a “1” – “Conditionally Approved: Acceptance based upon Satisfactory Test Report”. Aggregates that do not have sampling frequency should be coded per requirements of the ASA database. Print the ASA Report and attach it to the approved RAM.

- Proprietary Materials:
  Where the Contract Documents state “shall be…” and list products by specific name and model, the Contractor needs only to complete the RAM indicating to the Engineer the intended choice. The Engineer shall approve the RAM, coding with an “8” – “Source Approved” and note the page number where it is listed in the Contract Documents as a proprietary product. Occasionally some proprietary materials will have additional acceptance criteria and these criteria need to be noted on the RAM. On occasion the Subject Matter Expert for the material being placed may ask for additional documentation.

- Agency Supplied Materials:
  An approved RAM is not required for Agency Supplied Materials. If a RAM is submitted to the PEO, then the Engineer shall approve the RAM, coding with an “8” – “Source Approved” and note the page number where it is listed in the Contract Documents as an Agency Supplied Material. Addition acceptance criteria may be required if listed in the Contract Special Provisions or Plans.

- Concrete and Asphalt Batch Plants
  For Concrete Batch Plants, the Project Engineer Office shall ensure submittals and requirements of 6-02.3(4) of the Standard Specification are met prior to approving the RAM.
For Asphalt Mixing Plants, the Project Engineer Office shall ensure requirement of Section 5-04.3(1) of the Standard Specification are met. There is no approval of Asphalt Mixing Plants required, however coding the RAM with an “8” – “Source Approved” would be appropriate.

**Low Risk Materials**

There are low risk materials that may be used in the project without contractor identification per Section 1-06 of the Standard Specifications or any other documentation unless stipulated in the Contract Documents. Please note however, that if the project is federally funded, the requirements of the “Buy America” provisions apply. The following is a listing of these materials. Other items can be considered for addition to this list. Suggestions are encouraged and may be made to the State Construction Office or the State Materials Laboratory.

- Asphaltic felt for bridge approach slabs
- Coloidal copper compound
- Duct tape for bridge approach slab anchors
- Electrical pull string
- Electrical tape
- Friction tape, and moisture proof varnish for friction tape
- Expanded polystyrene for bridge approach slab anchors
- Galvanized wire mesh and hardware for screens on sign bridges and cantilever sign structure bases
- Grout for cosmetic purposes
- Locknuts for terminating conduit
- Nails
- Pea gravel for decorative purposes
- Pipe wrap and spacers for electrical conduit
- Polypropylene rope for induction loop centralizers
- Premolded joint filler for expansion joints in sidewalks
- PVC pipe for bridge approach slab anchors
- PVC solvent cement
- Rebar tie wire (plain and epoxy-coated)
- Silicone sealant for electrical service cabinets
- Spacers for electrical conduit duct bank
- Spacers for rebar columns
- Straw bales not used as mulch

**9-1.5C Field Verification of Materials**

All materials permanently incorporated into a contract shall be field verified and documented by the inspector. The field verification or visual inspection shall occur prior to or during placement of materials by means of a note in the Inspector’s Daily Report (IDR), a note added to the Field Note Record, a completed Field Acceptance Report, by completing the QPL page, or notes kept in a pocket notebook or other form developed by the PE office. Field verification documentation should contain sufficient information to identify what was used including manufacturer and/or source, product identity, quantities, Fabrication Inspection information and retainage of additional documentation if required per the contract documents. The field verification documentation needs to be initialed or signed and dated by the inspector at the time of verification. The field verification information should be the link between what was placed and paid for to what was approved on the RAM or QPL and its proper acceptance criteria.

Material that has acceptance criteria of ‘visual inspection’ only requires that the field inspector sign and date the Field Note Record representing each pay quantity identified. When the project inspector signs/initials the FNR for payment, they are also affirming that items requiring visual inspection have been checked and have been found to be acceptable. All other forms of acceptance criteria require normal Field Verification documentation per this section.

If the Field Note Record is used for field verification, the materials documentation on the record has to be adequate to verify what was used and approved. For lump sum or large items of work, it may necessitate the field inspector to ‘field verify’, sign, and date the Field Note Record more than once over the duration of the work on the bid item. This would show that each ‘component’ of the bid item was verified prior to or during the time it was placed.

For DOT fabrication inspected items, the field verification required is the quantity, the Tag/Stamp ID number, and Materials Origin, Foreign or Domestic (F or D) designation. For signs, the field verification shall document the quantity, and a notation that all signs had the WSDOT inspected decal. The field inspector will need to document that the sign mounting hardware package supplied by the sign fabrication facility bears a “WSDOT INSPECTED” stamp, is ‘sealed’ and the contains either a Materials Origin F or D.

Field Verification for Traffic Control Cabinet will be by a passing test report and the documentation of the date and name of the region electrical inspector approving the cabinet for turn on. Field Verification for Electrical Service Cabinet will be the documentation of the date and name of the region electrical inspector approving the “turn on”.

**9-1.5D Materials Fabrication Inspection Office — Inspected Items Acceptance**

Items that are inspected and found to meet contract documents by the Materials Fabrication Inspection Office are identified by a tag or stamp. This type of inspection is generally performed at the manufacturing or fabrication plants. There are various types of stamps or tags used for acceptance of inspected items, which attest that the item was in full conformance with the specifications at the time of inspection. The inspected items along with the type of stamp designation is covered under Section 9-1.5D(1) of this manual.

The following is the process for the acceptance of inspected items:

1. The manufacturing or fabrication plant must be approved via the “Request for Approval of Material,” (RAM) or the Qualified Products List (QPL)

2. The Materials Fabrication Inspection Office Inspector, who will obtain the necessary mill tests or other documentation from the manufacturer and reference them to the stamp or tag shown in Figures 9-3 through 9-7, must inspect the item of work. This number can be used for tracking of the item.
3. Once the fabricated item arrives on the job, check for item of work. This number can be used for tracking of item from the manufacturer and reference them to the stamp office.

2. The Materials Fabrication Inspection Office Inspector, who will obtain the necessary mill tests or other documentation (RAM) or the Qualified Products List (QPL) and tagged or marked appropriately.

1. The manufacturing or fabrication plant must be inspected items.

The following is the process for the acceptance of acceptance of inspected items, which attest that the item was in full conformance with the specifications at the time of manufacture, with the exception that they will not track the quantities of foreign materials used on the project. Steel items containing foreign steel will be stamped with an “F” identifier in addition to the appropriate stamp. Steel items that do not contain foreign steel will be stamped with a “D” identifier in addition to the appropriate stamp.

3. Once the fabricated item arrives on the job, check for approval stamp or tag.

a. If there is an approval stamp or tag, record the type of tag or stamp along with the ID number when applicable, quantity, and brief description of the item for project records. The Project Engineer’s representative should note in a report that the material was in satisfactory visual condition when installed and forward all information to the project office. In case of questions concerning an inspected item, contact the appropriate Materials Fabrication Inspection Office. The offices are:

- State Materials Laboratory, Tumwater, Mail Stop 47365
- Seattle Inspection Office, Mail Stop NB-82, Northwest, MS-501
- Spokane Inspection Office, Mail Stop Eastern, Materials Lab
- Vancouver Inspection Office, Mail Stop Southwest S-15, Materials Lab

b. If there are no stamps or tags, inform the Contractor that the item may not be acceptable, and contact the Materials Fabrication Inspection Office to determine the status of the inspection. Items lacking tags or stamps or damaged during shipping should be rejected and tagged or marked appropriately.

9-1.5D(1) Inspected Items, Stamps and Tagging Identification

The following are examples of the types of stamps and tags used by the Materials Fabrication Inspection Office. The letter on the stamp or tag represents the inspector who performed the inspection.

- W.S.D.O.T. INSPECTED
- M
- M

The stamps shown in Figure 9-3 identifies inspection and the inspector of the following items:

1. Precast Concrete Barrier
2. Precast Concrete Catch Basins, Manholes and Inlets. This includes all sections and risers 6 inch and above.
3. Concrete Utility Vaults
4. Concrete Junction Boxes
5. Galvanized Steel

All Documentation associated with these stamps in Figure 9-3 will be reviewed and approved by the Materials Fabrication Inspection Office and kept at the point of Manufacture. The stamps shown in Figure 9-3 identifies inspection and the inspector of the following items:

- Concrete Wall Panels — Stamped or tagged
- Three Sided Structures — Stamped or tagged
- Prestressed Concrete Products — Stamped or tagged
- Steel for Bridges — Stamped or tagged
- Signal, Luminaire, ITS and Strain Poles — Stamped or tagged
- Miscellaneous Welded Shop Items (see RAM or QPL for special items) — Stamped or tagged
- Sign Structures and associated hardware — Stamped or tagged
8. Anchor Bolts for Luminaires, Signal Poles and Sign Structures — A representative number of bolts shall be stamped with the inspector’s I.D. # and the shipment will be accompanied by an “Approved for Shipment Tag”.

9. Epoxy Coated Reinforcing Steel Bars for Concrete — Representative bundles of rebar shall be tagged per shipment to the project.

10. Metal Bridge Rail — Each bundle of rail shall be tagged.

11. Concrete Culvert, Sewer Pipe (30 inches and above) — Stamped.

12. Concrete Wall Panels — Stamped or tagged.

13. Sign Mounting Hardware – stamp. All Documentation associated with the stamp in Figure 9-4 or the tag in Figure 9-5 will be reviewed and approved by the Materials Fabrication Inspection Office and kept at the Materials Fabrication Inspection Office, with the exception of the adjacent mating surfaces to each other. This alignment is critical as the leveling pads are ground to prevent rocking of the grates in the frames.

All Documentation associated with the stamp in Figure 9-7 will be reviewed and approved by the Materials Fabrication Inspection Office and kept at the Materials Fabrication Inspection Office, with the exception of the quantities of foreign materials used on the project. Steel and Iron items containing foreign steel will be stamped with an “F” identifier in addition to the appropriate stamp. Steel items that do not contain foreign steel will be stamped with a “D” identifier in addition to the appropriate stamp.

Tag

Figure 9-6

The tag in Figure 9-6 identifies inspection and inspector of Treated Timber, Piling and Poles.

1. Bundles of treated timber may be randomly tagged “Approved for Shipment” referencing the inspector’s identification number.

2. Treated Piling and Poles shall be individually tagged “Approved for Shipment” referencing the inspector’s identification number.

All Documentation associated with the tag in Figure 9-6 will be reviewed and approved by the Materials Fabrication Inspection Office and kept at the Materials Fabrication Inspection Office.

WSDOT-A

Stamp

Figure 9-7

The stamp shown in Figure 9-7 identifies inspection and inspector of the following items:


2. Rectangular Frames and Grates — Each set shall be stamped aligning the adjacent mating surfaces to each other. This alignment is critical as the leveling pads are ground to prevent rocking of the grates in the frames.

All Documentation associated with the stamp in Figure 9-7 will be reviewed and approved by the Materials Fabrication Inspection Office and kept at the Materials Fabrication Inspection Office, with the exception of the quantities of foreign materials used on the project. Steel and Iron items containing foreign steel will be stamped with an “F” identifier in addition to the appropriate tag or stamp. Steel and Iron items made entirely of domestic steel and iron will be stamped with a “D”.

9-1.5E Manufacturer’s Certificate of Compliance

As designated by the specifications and contract 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 submitted Qualified Products List page or approved Request for Approval of Material shall stipulate the items for which a compliance certification is an acceptable basis of acceptance. The Manufacturer’s Certificate of Compliance is required prior to installation of the material. See Section 1-2.8C(3) of this manual for guidance on allowing material to be placed without certification.

Acceptance by Manufacturer’s Certificate of Compliance will be permitted where designated by the contract documents. The original Record of Material will provide a summary of requirements combining the special as well as general requirements of the contract.

The form of the Manufacturer’s Certificate of Compliance will vary considerably based on both the material and the origin and may take the form of standard state certificate forms, individual letters from manufacturers, or 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 Manufacturer’s Certificate of Compliance is required for each delivery of material to the project and the lot number, where lot numbers apply, of material being certified shall be identified.

Upon receipt of the Manufacturer’s Certificate of Compliance at the project office, 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 Check List – DOT Form 350-572. The manufacturer of the material must make
the certification. 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. The Project Engineer’s Office is required to retain the signed and dated Manufacturer’s Certificate of Compliance Check List Form for each submittal.

**9-1.5E(1) Certification of Materials Origin**

On projects that include FHWA Federal funding, the requirements of “Buy America” (23 CFR 635.410, 23 U.S.C. 313) apply. This provision, incorporated into the contract by General Special Provision, applies to all manufactured products containing steel or iron permanently incorporated into the project. It is the responsibility of the Project Office to ensure that the Certification of Materials Origin is on file prior to placing or paying for steel or iron materials.

**9-1.5F Concrete Pipe Acceptance Report**

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 Specifications. For a 90-day period of manufacture from the date of inspection, concrete pipe less than 30 inches 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 will indicate the date and original test results as performed by the Fabrication Inspector and will bear appropriate certification from the fabricator. Verify the conformance of the shipment with the contract requirements and examine the manufacture and shipping dates of the pipe for conformance with specifications and with the Acceptance Report.

**9-1.5G Sign Fabrication Inspection**

The Sign Fabricator Inspector is to verify that signs for an individual contract were inspected and approved for shipment to the project by having a “FABRICATION APPROVED” decal, see Figure 9-8.

Pre-approval of the Sign Fabricator is required by Traffic Operations and /or the Materials Fabrication Office. The Sign Fabricator is approved via the Request for Approval of Material (DOT Form 350-071).

**Sign Fabrication Inspectors**

Seattle, Yakima, Tacoma, and other Western Washington area — Contact the State Materials Lab- Seattle Inspection Office, Mail Stop NB82-501, (206) 464-7770.

Vancouver-Portland area — Contact Vancouver Inspection Office, Mail Stop S15, (360) 905-2193.

Spokane-Eastern Washington area — Contact the Eastern Region Materials Lab, Spokane, (509) 324-6169

Sign Inspection documentation requirements:

1. **Sign blanks or panels**: Manufacturer’s Certificate of Compliance with accompanying mill certifications will be kept at the Sign Fabrication facility.

2. **Reflective Sheeting and Cutout Legend**: Manufacturer’s Certificate of Compliance, this certificate will verify that the product(s) meets all the requirements of Standard Specification 9-28.12. The Manufacturer’s Certificate of Compliance will be kept at the Sign Fabrication facility.

3. **When sign mounting hardware is supplied by Sign Fabrication Facility**, a Manufacturer’s Certificate of Compliance is required to verify that the product(s) meet all the requirements of Standard Specification 9-28.11. The Manufacturer’s Certificate of Compliance will be kept at the Sign Fabrication facility. For high strength sign mounting hardware supplied by the contractor, a certification will be required that shows the hardware meets Standard Specification 9-28. A 307 bolts, where allowed, will not require certification.
4. The Project Engineer Representative will accept for installation and payment only those signs which have a “FABRICATION APPROVED” decal affixed. The representative will also verify the sign mounting hardware package supplied by the sign fabrication facility bears a “WSDOT INSPECTED” stamp or that contractor supplied high strength mounting hardware for overhead and large multiple post roadside signs are certified to meet the requirements of Standard Specification 9-28.11. In the event there is no “FABRICATION APPROVED” decal on the signs, or if the hardware does not have “WSDOT INSPECTED” stamp or Manufacturer’s Certificate of Compliance as described in section 3 above, they may be rejected. Contact the appropriate Sign Fabricator Inspector for status, or have the Contractor ship the signs back to Sign Fabricator, if this does not delay the project.

Double-faced signs, which do not receive decals, will be approved on visual inspection at the fabricator’s facility and in the field.

A list/invoice of all inspected and accepted signs will kept in the Sign Fabricator Inspector’s files.

9-1.5H Catalog Cuts

As designated by the contract documents, certain materials may require the acceptance criteria be based on a Catalog Cut. A Catalog Cut may also be required in support of approving a Request for Approval of Materials (RAM) per 9-1.5B. The approved Catalog Cut is required prior to installation of the material.

Upon receipt of the Catalog Cut information at the project office, an initial review for compliance with the established specifications and contract documents should be performed. All information shall be accompanied by the ‘Transmittal of Catalog Cuts’ form generated with the Record of Materials. The project office shall follow the directions on the ‘Transmittal of Catalog Cuts’ form and submit the package to the State Materials Lab Documentation Section for approval, or as per the original Record of Material. The ‘Transmittal of Catalog Cuts’ form and catalog cuts for those materials listed in Section 9-14 and 9-15 of the Standard Specifications, and accepted based on approved catalog cuts, should be submitted to the Region Landscape Architect or to the Landscape Liaison for approval.

The Catalog Cut may be forwarded by mailing, electronically transferring or faxing.

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 be incorporated into the project, the cost of replacement may exceed the original cost.

Chapter 9-4, Specific Requirements for each type of material, includes the following information:

1. Approval of Material
2. Preliminary Samples
3. Acceptance Samples

4. Field Inspection
5. 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, 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 9-8, WSDOT Test Methods/Field Operating Procedures, are the testing procedures that are used in the field.

9-2 Vacant

9-3 Vacant

9-4 Specific Requirements for Each Material

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9-4.1 Portland Cement or Blended Hydraulic Cement

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, product is listed under appropriate specification.

2. Preliminary Samples: Preliminary samples will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. Acceptance/Verification
   a. Acceptance
      (1) Bulk Cement: 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.
      (2) Bagged Cement: If the quantity of bagged cement exceeds 400 bags, then it will be accepted by “SATISFACTORY” test reports from the State Materials Laboratory. If a sample is needed, acquire a 10-pound sample from one of every 400 bags and ship to the State Materials Laboratory for testing. Allow a minimum of 14 days from receipt of the sample at the Laboratory for testing.
DO NOT permit the use of bagged cement until a “SATISFACTORY” test report has been received from the State Materials Laboratory.

b. Verification: Manufacturing mills will provide samples directly to the State Materials Laboratory on a quarterly basis to compare with the manufacturing mill test report. The Engineer may take samples for testing as described in Standard Specification Section 9-01.3.

4. Field Inspection: Field verify per Section 9-1.5C of this manual.


9-4.2 Bituminous Materials

1. Approval of Material: Approval of the materials are required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071). A preliminary sample consists of two 1-quart cans.

3. Acceptance/Verification

   a. Acceptance: Bituminous materials may be used after receipt by the Engineer of Asphalt Supplier’s Certification of Compliance incorporated in their Bill of Lading with the information required by the Standard Specification 9-02. Examine these certificates to make sure the material is of the grade required and that it comes from the approved supplier and point of shipment.

   b. Verification: Samples for verification conformance will be taken based on the frequencies as stated in Section 9.5-7 of this manual. Because the entire sample may be used in testing, it is necessary to take a backup for each sample. The samples shall be taken and labeled in duplicate by the Engineer with both samples forwarded promptly to the State Materials Laboratory. Asphalt Binder’s (PG, AR, etc.) shall be taken at a frequency corresponding to every other HMA acceptance sample. The first, third, fifth, and every fifth sample thereafter will be tested. Emulsions and cutbacks (such as MC and RC grades) shall be sampled from every other shipment. Emulsion used exclusively for tack coat (such as STE-1 and CSS-1) do not require sampling.

   Consult the FOP for AASHTO T40 for detailed sampling procedures. 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 cutback asphalt’s, sampling 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. Asphalt binder for use in a plant should be sampled by drawing from either the supply line between the storage tank and the mixer or the storage tank. Specifications require the Contractor to install a valve for this purpose.

   If samples cannot be taken from the distributor, as outlined above, they may be taken from the storage tank. Samples taken directly from storage tanks must be taken with a “thief,” so that they do not include surface material and are from near the middle of the asphalt 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 asphalt shall be taken as close as possible to the location the materials are used, but they must be taken before any dilution of the material takes place.

   The containers for all liquid asphalt products except emulsions will be approximately 1-quart cans with 1/4-inch screw caps. Containers for emulsions shall be 1-quart plastic. 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. Enter complete data on gummed label DOT Form 350-016 and attach to each of the two cans. Complete a Sample Transmittal (DOT Form 350-056) and attach it, in its envelope, to the container. If tape is used to attach envelope to container, or the containers together, be sure the tape is not contacting the label(s).

4. Field Inspection: Check the “Bill of Lading” that the liquid asphalt delivered complies with the requirements of the approved mix design. Check temperature to which material is heated to make sure specified limits are not exceeded, see Standard Specification 9-02.3.


9-4.3 Hot Melt Traffic Button Adhesive

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071). Submit Manufacturers Certificate of Compliance meeting the requirements of Standard Specifications Section 1-06.3, including supporting tests reports to State Materials Laboratory for evaluation.
3. **Acceptance/Verification**
   
a. **Acceptance**: Field Verify per Section 9-1.5C of this manual.

b. **Verification**: Submit a sample of each lot of material to the State Materials Laboratory for testing.

4. **Field Inspection**: Field Verify per Section 9-1.5C of this manual. Verify correct heating of product per manufacturers recommendations.


### 9-4.4 Concrete Aggregates

1. **Approval of Material**: Consult the Aggregate Sources Approval (ASA) database for approval of material for each source prior to use.

2. **Preliminary Samples**: A preliminary sample of the material will be required only if requested on the Request for Approval of Material (DOT Form 350-071) or if the ASA database indicated that the aggregate source has expired. Contact the Regional Materials Office if preliminary samples are required. Preliminary samples for Concrete Aggregate shall be made up of 50-100 pounds of clean, washed coarse aggregate and 30-40 pounds of clean washed fine aggregate. The sample is to be shipped in increments, using satisfactory containers, not exceeding 30 pounds.

3. **Acceptance**: After the source has been approved, concrete aggregates may be accepted upon satisfactory field tests for grading, cleanliness and free from excessive organic matter, silt, and soft or foreign pieces. Acceptance samples shall be obtained, tested, and recorded in accordance with the Standard Specifications Section 9-03.1, the contract special provisions, and Chapters 9-5 of this manual.

4. **Field Inspection**: Field verify per Section 9-1.5C of this manual. Check for uniformity of plants within each lot and for representative sample lost based on the following:

5. **Specification Requirements**: See Standard Specifications Section 9-02 and 9-03.1. 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 Material**: Consult the Aggregate Sources Approval (ASA) database for approval of material for each source prior to use.

2. **Preliminary Samples**: A preliminary sample of the material will be required only if requested on the Request for Approval of Material (DOT Form 350-071) or if the ASA database indicated that the aggregate source has expired. Contact the Regional Materials Office if preliminary samples are required. Preliminary samples for Surfacing Aggregate made up of 80-120 pounds are required to perform the qualifying tests. The sample is to be shipped in increments, using satisfactory containers, not exceeding 30 pounds.

3. **Acceptance**: After the source has been approved, surfacing aggregates may be accepted upon satisfactory field tests. Acceptance samples shall be obtained, tested, and recorded in accordance with the contract special provisions, and Chapters 9-5 and 9-8 of this manual.

4. **Field Inspection**: See Chapters 9-8 for Sampling Methods and Testing Procedures. Discuss test results with the Contractor’s representative. Enforce provisions of the Standard Specifications regarding stockpiling.

5. **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 Hot Mix Asphalt (HMA) and Asphalt Treated Base

1. **Approval of Material**: Consult the Aggregate Sources Approval (ASA) database for approval of material for each source prior to use.

2. Preliminary Samples
   
a. **Preliminary Samples**: A preliminary sample of the material will be required only if requested on the Request for Approval of Material (DOT Form 350-071) or if the ASA database indicated that the aggregate source has expired. Contact the Regional Materials Office if preliminary samples are required. Preliminary samples for the aggregate shall be made up of 80-120 pounds as required to perform the quality tests. The sample is to be shipped in increments, using satisfactory containers, not exceeding 30 pounds.

b. **Preliminary Mix Design Samples**: These samples are used to determine if the aggregate source is capable of meeting the mix design specification requirements. Preliminary samples shall be made up of 200 pounds of rock or pit run gravel and 25 pounds of blend sand if utilized. Contact the Regional Materials Office if preliminary samples are required. Give full details of type of construction proposed. The sample is to be shipped in increments, using satisfactory containers, not exceeding 30 pounds.

3. **Acceptance**: After the source has been approved, the aggregates may be accepted upon satisfactory field tests. Acceptance samples shall be obtained, tested, and recorded in accordance with the Standard Specifications, the contract special provisions, and Chapters 9-5 and 9-8 of this manual. Aggregates produced for use on the current contract shall be sampled and tested for fracture and sand equivalent as the material is placed into stockpile. When material is used from a stockpile that has not been tested as provided above, the requirements for fracture, sand equivalent, flat and elongated, and uncompacted void content of fine aggregate shall apply at the time of its introduction to the cold feed of the mixing plant. Acceptance of the aggregate for gradation shall be based on samples taken from the Hot Mix Asphalt.
If the aggregates are being produced for use on a future contract, they shall be sampled and tested for gradation as well as fracture, sand equivalent, flat and elongated, and uncompacted void content of fine aggregate at the time the material is placed in stockpile.

4. **Field Inspection:** See Chapter 9-8 for Sampling Methods and Testing Procedures. Discuss test results with the Contractor’s representative. Enforce provisions of the *Standard Specifications* regarding stockpiling.

5. **Specification Requirements:** See *Standard Specifications* Sections 3-02, 9-03.6 and 9-03.8. Review contract documents to determine if supplemental specifications apply.

**9-4.7 Hot Mix Asphalt (HMA) and Asphalt Treated Base**

1. **Approval of Material:** Approval of the materials for Hot Mix Asphalt (HMA) and asphalt treated base are required prior to use.

A current approved mix design is required for each contract. An approved mix design is only valid for a single construction season.

   a. **Job Mix Design:** Send a total of 600 pounds of aggregate proportion as the Contractors’ proposal to the State Materials Laboratory for testing. For example, the Contractors’ proposal consists of five stockpiles with following blending ratio.

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<tr>
<th>Material</th>
<th>Ratio</th>
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<tr>
<td>¾” - No. 4</td>
<td>20%</td>
</tr>
<tr>
<td>½” – No. 8</td>
<td>30%</td>
</tr>
<tr>
<td>¾ – No. 16</td>
<td>30%</td>
</tr>
<tr>
<td>No. 4 – 0</td>
<td>15%</td>
</tr>
<tr>
<td>Blend Sand</td>
<td>5%</td>
</tr>
</tbody>
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Calculate the amount of aggregate needed from each stockpile in the following manner.

<table>
<thead>
<tr>
<th>Material</th>
<th>Pounds of aggregate needed per stockpile</th>
</tr>
</thead>
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<tr>
<td>¾” – No. 4</td>
<td>600 pounds x 0.20 = 120 pounds</td>
</tr>
<tr>
<td>½” – No. 8</td>
<td>600 pounds x 0.30 = 180 pounds</td>
</tr>
<tr>
<td>¾ – No. 16</td>
<td>600 pounds x 0.30 = 180 pounds</td>
</tr>
<tr>
<td>No. 4 – 0</td>
<td>600 pounds x 0.15 = 90 pounds</td>
</tr>
<tr>
<td>Blend Sand</td>
<td>600 pounds x 0.05 = 30 pounds</td>
</tr>
</tbody>
</table>

The sample is to be shipped in increments, using satisfactory containers, not exceeding 30 pounds.

The aggregate samples must be accompanied by completed sample transmittals from the Project Engineer and the contractor’s proposal containing the following data: individual stockpile average gradations, proposed combining ratios of aggregate stockpiles, which when calculated will reflect the proposed gradation of the completed mix. Also include the asphalt supplier(s) and grade of the asphalt binder.

b. **Reference Mix Design:** A reference mix design can be used if there is a current valid mix design previously developed using the same materials and JMF as the one proposed. Contact the State Materials Laboratory, Bituminous Section for availability.

2. **Preliminary Samples:** Not required.

3. **Acceptance:** After the sources have been approved, the aggregates may be accepted upon satisfactory field tests, for gradation and asphalt binder content. Acceptance samples shall be obtained, tested, and recorded in accordance with the *Standard Specifications*, the contract special provisions, and Chapters 9-5 and 9-8 of this manual. The sampling will be on a random basis using the procedures shown in WSDOT Test Method 716. The sampling and testing frequency for each lot is indicated in Chapter 9-5.7.

4. **Field Inspection:** The Engineer should perform a plant inspection prior to production. Contact the Regional Materials Office for assistance with this inspection. See Chapters 9-8 for Sampling Methods and Testing Procedures. Discuss test results with the Contractor’s representative.

5. **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 Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Sample:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071). Ship 3 pounds in polyethylene bag.

3. **Acceptance:** Acceptance of mineral filler (commercial stone dust) shall be based on “SATISFACTORY” laboratory tests only for each lot of 50 tons or less. Portland cement may be accepted without test if it is furnished in original factory sacks and is not lumpy.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. See that the mineral filler does not contain foreign material or lumps.

5. **Specification Requirements:** See *Standard Specifications* Section 9-03.8(5). Review contract documents to determine if supplemental specifications apply.

**9-4.9 Gravel Base and Bank Run Gravel for Trench Backfill**

1. **Approval of Material:** Consult the Aggregate Sources Approval (ASA) database for approval of material for each source prior to use.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on the Request for Approval of Material (DOT Form 350-071) or if the ASA database indicated that the aggregate source has expired.
Contact the Regional Materials Office if preliminary samples are required. Preliminary samples for the aggregate shall be made up of 50-100 pounds are required to perform the quality tests. The sample is to be shipped in increments, using satisfactory containers, not exceeding 30 pounds.

3. **Acceptance:** After the source has been approved, the aggregates may be accepted upon satisfactory field tests. Acceptance samples shall be obtained, tested, and recorded in accordance with the Standard Specifications, the contract special provisions, and Chapters 9-5 and 9-8 of this manual.

4. **Field Inspection:** See Chapter 9-8 for Sampling Methods and Testing Procedures. Discuss test results with the Contractor’s representative. Enforce provisions of the Standard Specifications regarding stockpiling.

5. **Specification Requirements:** See Standard Specifications Section 3-02, 9-03. Review contract documents to determine if supplemental specifications apply.

### 9-4.10 Pit Run Aggregates (Gravel Backfill for Foundation CL, B, Walls, Pipe Zone Bedding, Drains and Drywells; Backfill for Sand Drains, Sand Drainage Blanket, Bedding Material for Rigid Pipe, Thermoplastic Pipe; Foundation Material Class A, B, and C, Gravel Borrow, Common Borrow, Select Borrow)

1. **Approval of Material:** Consult the Aggregate Sources Approval (ASA) database for approval of material for each source prior to use. For Borrow sources, approval of source can be performed in the field by confirming that the gradation and SE meets the requirements as defined in Section 9-03 of the Standard Specifications.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on the Request for Approval of Material (DOT Form 350-071) or if the ASA database indicated that the aggregate source has expired. Contact the Regional Materials Office if preliminary samples are required. Preliminary samples for the aggregate shall be made up of 80-120 pounds are required to perform the quality tests. The sample is to be shipped in increments, using satisfactory containers, not exceeding 30 pounds.

3. **Acceptance:** After the source has been approved, and prior to use, the gradation and SE tests shall be performed to determine if the material does in fact meet specifications for intended use. The aggregates may be accepted upon satisfactory field tests. Acceptance samples shall be obtained, tested, and recorded in accordance with the Standard Specifications, the contract special provisions, and Chapters 9-5 and 9-8 of this manual.

4. **Field Inspection:** See Chapter 9-8 for Sampling Methods and Testing Procedures. Discuss test results with the Contractor’s representative. Enforce provisions of the Standard Specifications regarding stockpiling.

5. **Specification Requirements:** See Standard Specifications Section 3-02, 9-03. Review contract documents to determine if supplemental specifications apply.

### 9-4.11 Vacant

### 9-4.12 Premolded Joint Filler for Expansion Joints

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification. See Section 9-1.5B for Low Risk Materials when premolded joint filler for expansion joints is used for sidewalks.

2. **Preliminary Samples:** When a preliminary sample is required, it shall consist of a 1 square foot section from each lot of material used. Submit sample to the State Materials laboratory for testing.

3. **Acceptance:** Materials shall be accepted on receipt of “SATISFACTORY” test reports from the State Materials Laboratory. If the lot can be identified and proven to have prior satisfactory acceptance test results, it may be used without testing on current projects per Section 9-5.2D of this manual.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for accuracy in cutting, stapling, and care in handling.

5. **Specification Requirements:** See Standard Specifications Section 9-04.1. Review contract documents to determine if supplemental specifications apply.

### 9-4.13 Elastomeric Expansion Joint Seals

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** When a preliminary sample is required, it shall consist of a 2 feet section from each lot of material used. Submit sample to the State Materials laboratory for testing.

3. **Acceptance:** The material/product may be accepted on a “SATISFACTORY” test report from the State Materials Laboratory. If the lot can be identified and proven to have prior satisfactory acceptance test results, it may be used without testing on current projects per Section 9-5.2D of this manual.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual.

5. **Specification Requirements:** See Standard Specifications Section 9-04.1. Review contract documents to determine if supplemental specifications apply.
9-4.14 Two Component Poured Rubber Joint Sealer

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: When a preliminary sample is required, it shall consist of an unopened container of each component from each lot of material used unless specifically exempted by the State Materials Laboratory. Submit sample to the State Materials Laboratory for testing.

3. Acceptance: Material shall be accepted on “Satisfactory” test report or lot approval by the State Materials Laboratory. If the lot can be identified and proven to have prior satisfactory acceptance test results, it may be used without testing on current projects per Section 9-5.2D of this manual.

4. Field Inspection: Field verify per Section 9-1.5C of this manual. Make certain that application is in accordance with requirements of Standard Specifications and manufacturer’s written recommendations. In order to obtain satisfactory adhesion of the sealer, joints must be thoroughly cleaned before the sealer is applied.


9-4.15 Hot Poured Joint Sealant

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, product is listed under appropriate specification, and a “Satisfactory” test report from the State Materials Laboratory prior to use.

2. Preliminary Samples: When a preliminary sample is required, submit one box sample to the State Materials Laboratory for testing.

3. Acceptance: The material/product shall be accepted on a “Satisfactory” test report from the State Materials Laboratory. If the lot can be identified and proven to have prior satisfactory acceptance test results, it may be used without testing on current projects per Section 9-5.2D of this manual.

4. Field Inspection: Field verify per Section 9-1.5C of this manual. Ensure that application is in accordance with requirements of the Standard Specifications Section 5-04.3(5C), 5-05.3(8)B and the manufacturer’s recommendation.


9-4.16 Concrete Drain, Perforated Underdrain, Culvert and Storm Sewer Pipe

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). Notify Materials Fabrication Inspection Office of need to provide Inspection Services. An on-site inspection of the manufacturing facilities prior to approval will be required only if requested on Request for Approval of Material (DOT Form 350-071). When approved, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. Acceptance:
   a. Concrete pipe less than 30 inches in diameter will be accepted based on “Concrete Pipe Acceptance Reports” which shall accompany the pipe to the job. Individual pipes are not stamped.
   b. Concrete pipe 30 inches in diameter and larger are individually inspected at the plant prior to shipment. Accepted pipe will be stamped “APPROVED FOR SHIPMENT” with ID number (Figure 9-5) on each piece of pipe, numbers repeated per inspection visit, number will differ for different diameters. An “F” or “D” will be stamped to indicate whether the steel or iron is of foreign or domestic origin.

4. Field Inspection:
   a. Concrete pipe less than 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 “Concrete Pipe Acceptance 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) Concrete sewer pipe requires testing after installation in conformance with the Standard Specifications Section 7-04.3.
      (5) Complete the upper portion of the “Concrete Pipe Acceptance Report” and forward to the contract files.
b. Concrete pipe 30 inches in diameter and larger:
   (1) Verify that each pipe in the shipment is stamped “APPROVED FOR SHIPMENT.” Only properly stamped pipe may be accepted.
   (2) Check for the Inspector’s approved stamp (Figure 9-5) and the “F” or “D” indicator for foreign or domestic steel and document it. Only properly stamped pipe may be accepted.
   (3) Verify that pipe is free from damage from shipping and handling.
   (4) Concrete sewer pipe requires testing after installation in conformance with the Standard Specifications Section 7-04.


9-4.17 Corrugated Galvanized Steel, Aluminized Steel, Aluminum: Drain, Perforated Underdrain, Culvert Pipe Arch, and Storm Sewer Pipe

1. Approval of Material: Approval of material and fabrication facility is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). Notify Materials Fabrication Inspection Office if protective treatment is specified. Approval of fabrication facility as well as the base metal must be obtained. An on-site inspection of the fabricating facilities prior to approval will be required only if requested on Request for Approval of Material (DOT Form 350-071). When approved, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. Acceptance:
   a. Treated:
      1) The Materials Fabrication Inspection Office will inspect all asphalt or polymer treated metal culvert and sewer pipe at the point of fabrication. A representative number of pipes in each shipment will display “WSDOT INSPECTED” stamp (Figure 9-3). If none of the treated pipe bears the “WSDOT INSPECTED” stamp, contact the Fabrication Inspection Office to arrange for an on-site inspection prior to installation.
   b. Untreated:
      1) QPL Acceptance: Untreated pipe may be accepted at the job site by Visual Inspection per 9-1.5 of this manual provided they are manufactured by a facility listed in the QPL.

2) Non-QPL Acceptance: Untreated metal culvert and drain pipe may be accepted at the job site by obtaining a Manufacturer’s Certificate of Compliance with supporting Mill Test Reports prior to use.

Verify that the appropriate AASHTO specification for the steel sheet, gauge thickness, and heat number is stamped on the pipe. Pipe not bearing this stamp shall not be installed. Any pipe, which is damaged in any way from shipping or handling, should not be accepted. If the manufacturer of the pipe delivered to the job site can not be identified, a Bill of Lading showing the manufacturer should be requested prior to accepting or installing the pipe.

It is the responsibility of the project office to obtain a Certificate of Materials Origin, which is required prior to incorporating the steel pipe and pipe arch into the project.

4. Field Inspection: Field verify per Section 9-1.5C of this manual. 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 documentation for all pipes not accepted under provisions established in the QPL. Contact the Materials Fabrication Inspection Office for assistance.


9-4.18 Polyvinyl Chloride (PVC) and Corrugated Polyethylene (PE) Drain, Perforated Underdrain, Culvert, and Storm Sewer Pipe

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). When the RAM process is being used, attach Catalog Cuts and/or other appropriate documents to the proper transmittal and submit to the RAM Engineer, to assist in the approval process. When approved, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. Acceptance: Pipe may be accepted on Manufacturer’s Certificate of Compliance and field inspection.
   a. Drain Pipe, Perforated Underdrain Pipe, Solid Wall PVC Culvert and Storm Sewer Pipe – Visual inspection per section 9-1.5 of this manual.
   b. Profile Wall PVC Culvert and Storm Sewer Pipe, Corrugated PE Culvert and Storm Sewer Pipe - Manufacturer’s Certificate of Compliance shall accompany materials delivered to the project and shall include production lots for all materials represented.
4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for compliance with specifications, and for shipment and handling damage.

5. **Specification Requirements:** See Standard Specifications Section 9-05. Review contract documents to determine if supplemental specifications apply.

### 9-4.19 Structural Plate Pipe, Pipe Arch, Arch, and Underpass

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). When approved, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Acceptance may be on the basis of manufacturer’s certificate of compliance, with accompanying mill test reports. The mass of zinc coating for each heat number in the shipment must be present on the “manufacturer’s Certificate of Compliance.” The mill test report will contain both chemical and physical analysis of the base metal.

   All suppliers of structural plate pipe, arches and underpass are to transmit four copies of the certificate 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.

   It is the responsibility of the project office to obtain a Certificate of Materials Origin prior to incorporating the plate pipe, pipe arch, arch or underpass into the project.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for breaks in zinc or asphalt coating and for damage from shipment. Material in the shipment must be properly identified as to heat number.

5. **Specification Requirements:** See Standard Specifications Section 9-05.6. Review contract documents to determine if supplemental specifications apply.

### 9-4.20 Steel Castings, Gray-Iron Castings, Ductile-Iron Castings: Manhole Rings and Covers, Catch Basin and Inlet Frames, Grates, Covers, Monument Cases and Covers

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). Notify Materials Fabrication Inspection Office of need to provide Inspection Service. An on-site inspection of the manufacturing facilities prior to approval will be required only if requested on Request for Approval of Material (DOT Form 350-071). When approved, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Acceptance will be based on WSDOT-A (Figure 9-7) impressed stamped into all castings. In Figure 9-7, the “A” is an inspector identifier, and will be different for each individual inspector. An “F” or “D” will be stamped to indicate the steel or iron is of foreign or domestic origin. Only properly stamped castings may be accepted.

   It is the responsibility of the project office to obtain a “Certificate of Materials Origin” prior to incorporating the material into the project.

   a. For Rectangular Frames and Grates, the frame and grate will each be stamped in such a fashion as to align adjacent mating surfaces to each other. This alignment is critical as the leveling pads are ground to prevent rocking of the grates in the frames.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual Check for defects listed in the Standard Specifications. See 6-03.3(43). Check for the Inspector’s approved stamp (Figure 9-7) and the “F” or “D” indicator for foreign or domestic steel and document it. Check for shipping and handling damage.


### 9-4.21 Sanitary Sewers

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). Notify Materials Fabrication Inspection Office of need to provide Inspection Service. An on-site inspection of the manufacturing facilities prior to approval will be required only if requested on Request for Approval of Material (DOT Form 350-071). When approved, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Material may be accepted upon receipt of an “Approved” document in lieu of sampling as shown below:

   (1) Plain Concrete Storm Sewer Pipe and Reinforced Concrete Storm Sewer Pipe — Concrete Pipe Acceptance Report (see section 9-4.16 of this manual)

   (2) Vitrified Clay Sewer Pipe and Ductile Iron Sewer Pipe — Manufacturer’s Certificate of Compliance

   (3) PVC Sewer Pipe and ABS Composite Sewer Pipe — Visual Inspection per Section 9-1.5 of this manual.

   It is the responsibility of the project office to obtain a “Certificate of Material Origin” for all steel or iron products prior to incorporating the material into the project.
4. **Field Inspection:**
   a. Non-Concrete Pipe
      1. Field verify per Section 9-1.5C of this manual. Check material delivered to the project for damage, and conformance to the contract documents.
   b. Concrete pipe less than 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 “Concrete Pipe Acceptance Report”. Also verify that shipment was made after the required reton 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 of damage from shipping and handling.
      4.) Concrete sewer pipe requires testing after installation in conformance with Standard Specification section 7-04.3.
      5.) Complete the upper portion of the “Concrete Pipe Acceptance Report” and retain in the project files.
   c. Concrete pipe 30 inches in diameter and larger:
      1) Verify that each pipe in the shipment is stamped “APPROVED FOR SHIPMENT”. Only properly stamped pipe may be accepted.
      2) Check for the Inspector’s approved stamp (Figure 9-5) and the “F” or “D” indicator for foreign or domestic steel and document it. Only properly stamped pipe may be accepted.
      3) Verify that the pipe is free of damage from shipping and handling.
      4) Concrete Sewer pipe requires testing after installation in conformance with Standard Specification 7-04.3.

5. **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 Material:** Approval of the fabricator is required prior to use. Upon receipt of the “Request for Approval of Material,” the Materials Fabrication Inspection Office will inspect the fabrication shop to ensure it meets all contract requirements. A copy of the Request for Approval of Material will be sent to the Materials Fabrication Inspection Office. Approval of Fabrication Facility will include approval of steel sources used by the facility.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Materials and fabrication will be accepted on Approved for Shipment stamps or tags (Figure 9-4 or 9-5) except in the case of minor parts. An “F” or “D” will be stamped to indicate the steel or iron is of foreign or domestic origin. As soon as the fabricator receives the materials, the Materials Fabrication Inspection Office Inspector will check the accompanying mill test certificates to ensure the materials meet contract requirements. Project offices will not be required to maintain Manufacturer’s Certificates of Compliance for items from approved fabricators that have the “APPROVED FOR SHIPMENT” tag or stamp. Certificates of Material Origin will be maintained by the project office. The Materials Fabrication Inspection Office Inspector will also provide weekly written shop inspection reports to the Project Engineer while major steel structures are being fabricated.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for “APPROVED FOR SHIPMENT” tags or stamps (Figure 9-4 or 9-5) and the “F” or “D” indicator for foreign or domestic steel and document it. Check for shipping and handling damage.

5. **Specification Requirements:** See Standard Specifications Sections 6-03 and 9-06. Review contract documents to determine if supplemental specifications apply.
9-4.24 High Strength Bolts, Nuts and Washers

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. Acceptance: Material may be accepted on receipt of “SATISFACTORY” test reports from the State Materials Laboratory. When the materials are received on the job site, sample each shipment of the bolts, nuts, and washers in accordance with the table in Section 9-06.5(3) of the Standard Specifications. A separate transmittal and materials certification shall accompany each sample of bolts, each sample of washers, and each sample of nuts.

4. Field Inspection: Field verify per Section 9-1.5C of this manual. Make certain that material being used is from a lot represented by “SATISFACTORY” test report.


9-4.25 Anchor Bolts

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification. Notify the Materials Fabrication Inspection Office of need to provide Inspection Services.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. Acceptance: Acceptance may be based on “Approved for Shipment” tags and/or stamp (Figure 9-4 or 9-5). An “F” or “D” will be stamped to indicate the steel or iron is of foreign or domestic origin. Certificate of Material Origin will be the responsibility of the project office.

4. Field Inspection: Field verify per Section 9-1.5C of this manual. Check for “APPROVED FOR SHIPMENT” tags and/or stamp (Figure 9-4 or 9-5) and the “F” or “D” indicator for foreign or domestic steel and document it. Check for damage due to shipping and handling.


9-4.26 Reinforcing Bars for Concrete

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071).

2. Preliminary Samples: May be required if requested on Request for Approval of Material (DOT Form 350-071).

3. Acceptance: Acceptance will be by the Fabricators 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 State Materials Laboratory, General Materials Engineer for guidance.

Representative of the Materials Fabrication Inspection Office may take random samples at the point of fabrication.

4. Field Inspection: Field verify per Section 9-1.5C of this manual. 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 contract documents.


9-4.27 Epoxy Coated Reinforcing Steel Bars for Concrete

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071). Notify Materials Fabrication Inspection Office of need to provide Inspection Services.

3. Acceptance: Material may be accepted on “APPROVED FOR SHIPMENT” stamp or tag (Figure 9-4 or 9-5). An “F” or “D” will be stamped to indicate the steel or iron is of foreign or domestic origin. Certificate of Material Origin will be the responsibility of the project office.

Note: If bar is not tagged “APPROVED FOR SHIPMENT” do not incorporate steel into the project and contact the Materials Fabrication Inspection Office for guidance.

Representatives of the Materials Fabrication Inspection Office may take random samples at the point of fabrication and at the coating facility. The Fabricator shall provide the Mill Certificates to the Materials Fabrication Inspection Office Inspector.
4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check shipment for “APPROVED FOR SHIPMENT” stamp or tag (Figure 9-4 or 9-5) and the “F” or “D” indicator for foreign or domestic steel and document it. Check coating for shipping damage, check steel fabrication and bends for compliance with contract documents.

5. **Specification Requirements:** See Standard Specifications Section 9-07. Review contract documents to determine if supplemental specifications apply.

### 9-4.28 Mechanical Splices

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Sample:** A preliminary sample for qualifying the rebar coupling system, will be required only if requested on Request for Approval of Material (DOT Form 350-071). The sample to include a made up splice for each size bar to be used and include the manufacturers product information. The overall length of spliced rebars should be approximately 5 to 6 feet.

3. **Acceptance:** Material may be accepted on receipt of a “SATISFACTORY” Test Report from the State Materials Laboratory from contractors assembled samples (see Note) taken from the project. A Manufacturer’s Certificate of Compliance and other technical data MUST be submitted with the samples. The overall length of spliced rebars should be at least 5 feet.

**Note:** This is a test of the Contractors ability to properly assemble the splice as much as it is a test of the quality of the materials. For this reason the spliced bars must be assembled by the contractors personnel, witnessed by the inspector and transmitted intact to the State Material Lab for testing.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual and that the material has “Satisfactory” test results.

5. **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 Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Sample:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:**
   a. **Dobie Blocks:** Material may be accepted on receipt of Manufacturer’s Certificate of Compliance with supporting test reports. See Standard Specifications Section 6-02.3(24)C.
   b. **Rebar Chairs and Spacers:** May be accepted based upon inclusion in the QPL as an “Approved” product.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual.

5. **Specification Requirements:** See Standard Specifications Section 6-02.3(24)C. Review contract documents to determine if supplemental specifications apply.

### 9-4.30 Dowels and Tiebars for Concrete Pavement, incl. Epoxy Coated

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Sample:** A preliminary sample of two dowels will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Acceptance may be on Manufacturer’s Certificate of Compliance with accompanying Mill Test Reports for both steel and coating process.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for dimensional conformance and if proper mill test certificates have been provided. Check epoxy coating for damage and uniformity.

5. **Specification Requirements:** See Standard Specifications Section 9-07.5 and 9-07.6. Review contract documents to determine if supplemental specifications apply.

### 9-4.31 Wire Reinforcement for Concrete

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** May be required if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Acceptance will be by the Manufacturer’s Certificate of Compliance and Certified Mill Test Reports that accompany the shipment.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for excessive rust on wire, and check the spacing of the wires and weight per square yard.
5. **Specification Requirements:** See *Standard Specifications* Section 9-07.7, 9-07.8, and 9-07.9. Review contract documents to determine if supplemental specifications apply.

9-4.32 **Bridge Approach Slab Anchors**

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Sample:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:**
   
   a. **Anchors Type A:** These anchors may be accepted on a Manufacturers Certificate of Compliance for the Steel Rod and Plate.
   
   b. **Anchors Type B:** These anchors may be accepted on a Manufacturers Certificate of Compliance for the Threaded Steel Rod and Steel Plate and Manufacturers Product Information on inch stop coupling.
   
   c. **Other Anchor Rod materials:** Such as plastic pipe, polystyrene, and duct tape may be accepted on visual inspection.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check the strand for dirt, grease or rust.

5. **Specification Requirements:** See *Standard Specifications* Section 9-07.10. Review contract documents to determine if supplemental specifications apply.

9-4.33 **Prestressing/Post Tensioning Reinforcement — Strand**

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance /Verification:**
   
   a. **Acceptance:** The strand may be accepted upon receipt of a Manufacturer’s Certificate of Compliance, a mill certificate with supporting test report, and the stress/strain curve.
   
   b. **Verification:** The strand shall be tested for verification prior to placement. Samples for verification of conformance will be taken from each reel furnished to the project site or the fabrication facility. The samples shall not be less than 5 feet in length. All samples must include the Manufacturer’s Certificate of Compliance, a mill certificate with supporting test report, and the stress/strain curve.

   Submit 1 sample for each 5 reels to the State Materials Laboratory for testing. A copy of the Manufacturer’s Certificate of Compliance, a mill certificate with supporting test report, and the stress/strain curve MUST accompany each sample submitted for testing. Upon receipt of a passing test report, the other 4 retained samples may be discarded. If the submitted sample fails the testing, submit the 4 retained samples taken before and the 4 retained samples taken after the failing sample for additional testing.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check the strand for dirt, grease or rust.

5. **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 Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Acceptance will be on “SATISFACTORY” laboratory test report only. Send two samples from each heat. If supplemental requirements apply, send additional samples of two bars from each heat. See contract documents. The samples must be a minimum of 5 feet in length. A copy of the Manufacturer’s Certificate of Compliance shall accompany each heat of reinforcing bar.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check material delivered to the project for damage.

5. **Specification Requirements:** Review contract documents to determine specification requirements.
3. **Acceptance:** Paint will be sampled at the point of manufacture by the manufacturer, supplied to WSDOT Fabrication Inspection Office, Seattle, WA (206) 464-7770 and tested by the State 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 20 gallons of one kind of paint are involved, its use without laboratory tests may be approved upon the Manufacturer’s Certificate of Compliance 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 State Materials Laboratory for approval.

4. **Field Inspection:** No field samples are required. Material shall be accepted on satisfactory test report or lot approval by the State Materials Laboratory. Field verify per Section 9-1.5C of this manual. To verify approved lot numbers contact The State Materials Lab, Chemical Section (360) 709-5431.

See that paint is not caked in the container, that it is free from skins and is well stirred before withdrawing portions for use. After application the paint should dry to a uniform film without running, streaking or sagging.

5. **Specification Requirements:** See Standard Specifications Section 9-08. Review contract documents to determine if supplemental specifications apply.

### 9-4.36 Timber and Lumber — Untreated

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:**
   a. Timber and Lumber require a Grading Certificate conforming to the requirements of the Standard Specifications. The Grading Certificate 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 in the QPL, Appendix B:
   b. Sign posts, mileposts, sawed fence posts, and mailbox posts will be accepted by visual determination in the field that materials delivered to the job site bears the appropriate lumber grading stamp. 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 re-inspection upon delivery to the project.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check that all lumber and timber has the proper lumber grade stamps.

5. **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 Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:**
   a. Structural Timber and Lumber, sign posts 6 inches x 6 inches and larger. Check for “APPROVED FOR SHIPMENT” tag (Figure 9-6). Approved 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.
   b. Sign posts less than 6 inches x 6 inches, mileposts, sawed fence posts, and mailbox posts shall be accepted as listed under 9-4.36.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check primarily for damage caused by handling. Check pieces for “APPROVED FOR SHIPMENT” stamp or tag (Figure 9-6).

5. **Specification Requirements:** See Standard Specifications Sections 9-09 and 9-10. Review contract documents to determine if supplemental specifications apply.

### 9-4.38 Timber Piling — Untreated

1. **Approval of Material:** Approval of material is not required prior to use for temporary structures.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Field inspection for compliance with contract requirements.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for compliance with specifications.

5. **Specification Requirements:** See Standard Specifications Section 9-10.1(1). Review contract documents to determine if supplemental specifications apply.
9-4.39 Steel Piling All Types

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: Samples are not required unless requested on Request for Approval of Material (DOT Form 350-071). Submit a 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. Certificate of Material Origin is the responsibility of the Project Engineer’s Office.

4. Field Inspection: Field verify per Section 9-1.5C of this manual. Check material in each shipment against heat numbers shown on Mill Test Certificates. Check for damage due to shipping and handling.


9-4.40 Coated Steel Piling

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Sample: Samples are not required unless requested on Request for Approval of Material (DOT Form 350-071). Submit a 1-square foot section of the piling if requested.

3. Acceptance: Coated piling will be inspected prior to coating at the facility applying the coating. Piling will be stamped or tagged “Approved for Shipment” when coating requirements have been met. An “F” or “D” will be stamped to indicate the steel or iron is of foreign or domestic origin. Manufacturer’s Certificate of Compliance will be checked and maintained by Fabrication Inspection Office. Certificate of Material Origin will be the responsibility of the Project Engineer’s Office.

4. Field Inspection: Field verify per Section 9-1.5C if this manual. Check shipment for “APPROVED FOR SHIPMENT” stamp or tag (Figure 9-3) and the “F” or “D” indicator for foreign or domestic steel and document it. Check for shipping and handling damage. Only properly stamped manholes, catch basins, inlet, or drywells may be accepted.

5. Specification Requirements: See Standard Specifications Section 9-10.5 and 6-07.3(1)a. Review contract documents to determine if supplemental specifications apply.

9-4.41 Precast Concrete Manholes, Catch Basins, Inlets, and Drywells

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Request for Approval of Material (DOT Form 350-071). Notify Materials Fabrication Inspection Office of need to provide Inspection Services. An on-site inspection of the manufacturing facilities prior to approval will be required only if requested on Request for Approval of Material (DOT Form 350-071). When approved, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. Acceptance: Acceptance will be based on “WSDOT Inspected” stamp (Figure 9-3) provided by the Materials Fabrication Inspection Office Inspector. An “F” or “D” will be stamped to indicate the steel or iron is of foreign or domestic origin. It is the responsibility of the project office to obtain a “Certificate of Material Origin” prior to incorporating the material into the project.

4. Field Inspection: Field verify per Section 9-1.5C of this manual. Check shipment “WSDOT Inspected” stamp (Figure 9-3) and the “F” or “D” indicator for foreign or domestic steel and document it. Check for shipping and handling damage. Only properly stamped manholes, catch basins, inlet, or drywells may be accepted.


9-4.42 Riprap, Quarry Spalls, Slope Protection, and Rock for Rock Wall

1. Approval of Material: Consult the Aggregate Source Approval Report generated from the ASA database for approved materials for each source prior to use. The Regional Materials Engineer may approve a source for non-structural applications.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on the Request for Approval of Material (DOT Form 350-071) or if the Aggregate Source Approval Report indicates that the aggregate source is not approved for the intended application. Contact the Regional Materials Office if preliminary samples are required. Preliminary samples shall be made up of 50 to 80 pounds of material sampled in a manner consistent with this manual. The sample is to be shipped in satisfactory containers, not exceeding 30 pounds in weight.

When the usage is for non-structural applications, the Region Materials Engineer may waive the requirement for preliminary samples.
3. **Acceptance:**
   a. When project quantities are less than or equal to 150 cubic yards, the Project Engineer may accept the material by visual inspection.
   b. When project quantities exceed 150 cubic yards, the Project Engineer shall determine that the grading is in conformance with the *Standard Specifications* and contract special provisions.
   c. When usage is for non-structural applications the Project Engineer may accept the material by visual inspection.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. See that the gradation remains constant.

5. **Specification Requirements:** See *Standard Specifications* Section 9-13 or Section 9-27. Review contract documents to determine if supplemental specifications apply.

### 9-4.43 Semi-Open Slope Protection

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Material may be accepted on receipt of Manufacturer’s Certificate of Compliance.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check material delivered to the project for conformance with the contract plan and specifications. Also check for shipping damage.


### 9-4.44 Plant Material

1. **Approval of Material:** Approval of material is required prior to use. This approval will be submitted to the field office by listing the nursery to supply the plant material on a Request for Approval of Material (DOT Form 350-071).

2. **Preliminary Site Inspection:** When requested on the RAM, will be performed by the Region Landscape Architect or the State Horticulturist.

3. **Acceptance:** After the approval of the material, the plants will be accepted based on field inspection on the job site. Sample lots as provided in (4), Field Inspection will be the inspection of samples delivered to the site. Acceptable samples will be incorporated into the project.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for uniformity of plants within each lot and for representative sample lot based on the following:

   \[ N \text{ (total number of plants in lot)} \times \frac{n}{N} \text{ (number of plants in sample lot)} \]

   Should 5 percent or less of the sample lot fail, the entire lot may be accepted. Should over 5 percent of the acceptance sample lot fail to meet nominal specification requirements, the entire lot shall be rejected and removed from the job. The Engineer may accept the plants if there is a large percentage of plants that appears to be exceptionally hearty and vigorous after 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 5 percent or less of this sample lot fail, the sorted lot may be accepted.

5. **Specification Requirements:** See *Standard Specifications* Section 9-14.6. Review contract documents to determine if supplemental specifications apply.

### 9-4.45 Topsoil Type A

1. **Approval of Material:** Approval of Topsoil Type A prior to use is required by a Request for Approval of Material (DOT Form 350-071).

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071). Samples of 5 to 10 pounds are required to perform the qualifying tests.

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. **Field Inspection:** Field verify per Section 9-1.5C of this manual. The material shall be inspected for roots, weeds, subsoil, rocks, and other debris.

5. **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 Material:** Approval of materials is required prior to use. This approval will be by Request for Approval of Material (DOT Form 350-071). If there is a question on the intended use of the seed, contact the State Horticulturist.
2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Material may be accepted on analysis shown on the label.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Each individual sack of seed must contain a label (tag) as to the contents, which must meet all requirements specified in the special provisions for each component of the seed mix 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.

5. **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 Material:** Fertilizer will be approved prior use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If there is a question on the intended use of the fertilizer, contact the State Horticulturist or the Region Landscape office.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:**
   a. Fertilizer for General Use. Fertilizer may be accepted based on approval of material and chemical content shown on container labels meeting contract requirement. No fertilizer shall be used from unidentified or unlabeled containers.
   b. Fertilizer for Erosion Control. For Erosion Control on projects with total quantities less than 5 acres, acceptance of fertilizer may be made by verification of the components based on stamped or printed bag analysis. Projects involving 5 acres or more shall require a certified analysis of each component furnished meeting the requirements of a Manufacturer’s Certificate of Compliance (Section 1-06.3 of the Standard Specifications).
   c. Fertilizer for Landscaping. Fertilizer for landscaping projects may be accepted on the basis of examination of the labeled contents for conformance to the project specifications.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. 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. Retain label showing analysis for contract records.

5. **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 Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval action is by OPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

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 or wood chips— Field gradation test (WSDOT Test Method 123)
   d. Bonded Fiber Matrix / Mechanically Bonded Fiber Matrix – Catalog Cut
   e. Tackifier — Catalog Cut
   f. Compost — Satisfactory test report from an independent STA program certified laboratory, documentation stating that the compost facility is STA certified, waste handling permit, etc. see contract provisions. To purchase Solvita Compost Maturity Test Kits for field office use contact: Woods End Research Laboratory, Inc. Box 297, Mount Vernon, Maine 04352 (207)-293-2457 E-mail: info@woods.end.org

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. A visual inspection shall be made to ensure uniformity of the mulch. Also check for detrimental contamination.

5. **Specification Requirements:** See Standard Specifications Section 9-14.4. Review contract documents to determine if supplemental specifications apply.

### 9-4.49 Irrigation System

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval action is being requested via the RAM process, attach Catalog Cuts or other appropriate documents, using proper transmittal, to assist in the approval process. All Irrigation System materials being requested via RAM process will be sent to the Region Landscape Architect or the Region Liaison Landscape Architect, except for Electrical Wire and Splices, which will be sent to the State Materials Laboratory. Atmospheric vacuum breaker assemblies (AVBA), pressure vacuum breaker assemblies (PVBA), double check valve assemblies (DCVA) and reduced pressure backflow devices (RBFD) shall be of a manufacturer and model approved for use by the Washington State Department of Health. When approved, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.
2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Material may be accepted upon receipt of and “Approved” document in lieu of sampling as shown below:
   a. **QPL Acceptance**
      1. PVC Pipe and Fittings, Automatic Controllers, Spray Heads, Valve Boxes and Protective Sleeves, Automatic Control Valves with Pressure Regulator, Quick Coupling Equipment, Electrical Wire and Splices – Visual Inspection per Section 9-1.5 of this manual.
   2. Cross-Connection Control Devices – Document that the model number of the device is from the current Washington State Department of Health (WSDOH) listing and Visual Inspection per Section 9-1.5 of this manual.
   b. **Non-QPL Acceptance**
      1. PVC Pipe, Polyethylene Pipe, and Detectable Marking Tape – Visual Inspection per section 9-1.5 of this manual.
      2. Galvanized Iron Pipe – Manufacturer’s Certificate of Compliance
      4. Cross Connection Control Devices – Manufacturer’s Certificate of Compliance indicating device is approved by WSDOH and Catalog Cut per section 9-1.5H of this manual.

It is the responsibility of the project office to obtain a “Certificate of Material Origin” for all steel or iron products prior to incorporating the material into the project.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for damage to the galvanized coatings in shipping and handling. See that damaged areas and field cut threads are protected with an approved galvanized repair paint formula, standard formula A-9-73.


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### 9-4.50 Fencing & Gates

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** The following items will be accepted on receipt of “SATISFACTORY” test report from the State 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 roll for each 50 rolls.
   b. Wire Mesh — One 12-inch sample across full width of roll, from one roll for each 50 rolls.
   c. Tension and Barbed Wire — One 3-foot piece from one roll for each 50 spools.
   d. Grade 1 Post Material
      • Rails and Grade 1 Posts for Chain Link Fence — Sample to consist of one post and 12" sample from each end of the rail, where appropriate, for each 500 post or rails or fraction thereof.
      • Corner Post or brace posts — One complete post assembly per 10 corner or brace posts.
   e. Wire Fence Line Posts — One complete post with plate for each 500 posts or fraction thereof.
   f. Misc. Fence Hardware — These materials includes such items as tie wire, hog rings, galvanized bolts and nuts, fence clips, stays, post caps, tension band and bars, rail end caps, etc. The Engineer shall visually inspect and approve for use.
   g. Grade 2 Post Material will be accepted with a Manufacturer’s Certificate of Compliance adhering to Section 9-16.1 of the Standard Specifications.
   h. Gates will be accepted based upon a Shop Drawing showing conformance to the Contract documents. Shop Drawings will list component specifications required per 9-16.2(1) and 9-16.2(1)I of the Standard Specifications. Submit shop drawings to the State Materials Laboratory for approval.

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, if applicable, 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. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for damage to zinc or other coating on posts, rails, hardware, etc.


### 9-4.51 Beam Guardrail, Guardrail Anchors, and Glare Screen

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Materials listed on the Qualified Products List may be accepted as outlined on the QPL or by Manufacturers Certificate of Compliance meeting the requirements of Standard Specifications Section 1-06.3 including supporting test reports. A307 bolts will be accepted by field verification and documentation that bolt heads are stamped 307A.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check material delivered to the project for damage to galvanizing.

5. **Specification Requirements:** See Standard Specifications Section 9-16.3.

### 9-4.52 Guardrail Posts and Blocks

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on the Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Materials listed on the Qualified Products List may be accepted as outlined on the QPL. Materials not listed on the QPL will be accepted by receipt of an acceptable certificate of treatment and by visual determination in the field that materials delivered to the job site bears the appropriate lumber grading stamp.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check material delivered to the project for conformance with the contract plan and specifications.

5. **Specification Requirements:** See Standard Plans.

### 9-4.53 Miscellaneous Precast Concrete Products (Block Traffic Curb, Precast Traffic Curb)

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** In general, the Materials Fabrication Inspection Office will not, undertake inspection of these products. When large quantities are involved, the Regional Administrator should arrange for inspection during manufacturer, including the sampling of materials and the making of test cylinders.

   a. **Precast Traffic Curb:** Acceptance on field inspection. Unless the curb sections have been inspected prior to shipping they are to be carefully inspected upon arrival on the project site. Check for surface color and damage, such as cracks, broken corner or edges, contour and alignment. Surface color and texture should match advanced sample provide by the manufacturer. See Standard Plans for details.

   b. **Block Traffic Curb:** Acceptance on visual inspection. Check exposed faces of curb sections for damage such as chips, cracks, and air holes. See Standard Specifications Section 9-18.3 for details. Compressive strength may be determined in accordance with the FOP for ASTM C 805.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for damage due to shipping and handling.


### 9-4.54 Prestressed Concrete Products

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071. Notify Materials Fabrication Inspection Office of need to provide Inspection Services, or to verify that the precast plant’s annual review and approval are current.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).
Certificate of Material Origin will be the responsibility of the shipping and handling. An “F” or “D” will be stamped to indicate the steel or iron is of foreign or domestic origin. Certificate of Material Origin will be the responsibility of the project office.

Field Inspection: Field verify per Section 9-1.5C of this manual. Check for damage due to shipping and handling. Check and record “APPROVED FOR SHIPMENT" stamp or tag (Figure 9-4 or 9-5) and the “F” or “D” indicator for foreign or domestic steel and document it.

Specification Requirements: See Standard Specifications Section 6-02.3(25), 6-02.3(26), 6-02.3(28), 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 Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. Acceptance:
   a. Type 1 Markers.
   b. Type 2 Markers: Only markers listed on the QPL may be accepted, visually inspect markers as to brand and model listed.
   c. Type 3 Markers: Only markers listed on the QPL may be accepted, visually inspect markers as to brand and model listed.

4. Field Inspection: Field verify per Section 9-1.5C of this manual. A visual inspection shall be made to ensure that cracked or damaged lane markers are not incorporated in the work.


9-4.56 Signing Materials

1. Approval of Material: Approval of the sign fabricator as well as the manufacturer of the sign blanks, panels and the reflective sheeting is required prior to use. Approval of the sign fabricator will be by a Request for Approval of Material (DOT Form 350-071). A RAM will not be required for sign mounting hardware provided by the sign fabricator. Mounting hardware from a source other than the sign fabrication facility will require approval by the or an approved Request for Approval of Material (DOT Form 350-071). Approval of the sign blanks, panels and the reflective sheeting may be by the Qualified Products List or by an approved Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that product is in fact qualified for its intended use; product is listed under appropriate specification. The fabrication facility will notify Sign Fabrication Inspector of need to provide Inspection Services.

2. Preliminary Samples: A preliminary sample of the material may be requested on the Request for Approval of Material (DOT Form 350-071), or as requested by the Sign Fabricator Inspector.

3. Acceptance: Materials and fabrication will be accepted on “FABRICATION APPROVED” decal (Figure 9-8).

   a. Sign Blanks: As soon as the fabricator receives the materials, the Sign Fabricator Inspector will check the accompanying mill test certificates to ensure the materials meet contract requirements. These documents will be kept at the fabrication facility.

   b. Reflective Sheeting: The Sign Fabricator Inspector will check the Manufacturer’s Certificate of Compliance for the reflective sheeting and the cutout legend to ensure the materials meet contract requirements. These will be kept at the sign fabrication facility.

   c. Sign Mounting Hardware supplied by the Sign Fabricator will have the mounting hardware certifications verified at the sign fabricator’s facility by the Fabrication Inspector to ensure the materials meet the contract requirements. These records will be kept at the sign fabrication facility. Fabrication inspectors will verify sign mounting hardware as it is packaged for shipment and attach a “WSDOT INSPECTED” Tag to the sealed package.

Contractor’s who purchase sign mounting hardware separately from a source other than a WSDOT approved sign fabrication facility will be required to supply proper Manufacturer’s Certificates of Compliance and it will be the responsibility of the contractor to supply the certifications to the Project Engineer’s Office prior to use.

Where Standard Specifications 9-28.11 allows use of A307 bolts for roadside wood posts, field verify A307 lag bolts were used, no further certification will be required for A307 bolts.
4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for a “FABRICATION APPROVED” decal (Figure 9-8) on the back of the sign and document Inspector’s Daily Report. Check for a “WSDOT INSPECTED” stamp on sign mounting hardware and document. Check that all overhead signs are mounted with stainless steel bolts, u-bolts, washers, nuts, locknuts, mounting brackets and straps. Mounting hardware shall include bolts, nuts, washers, locknuts, rivets, post clips, windbeams, angles, “Z” bar, straps and mounting brackets. Check for damage due to shipping, handling, and installation.

5. **Specification Requirements:** See Standard Specifications Section 9-28, and Section 9-1.5G of this manual. Review contract documents to determine if supplemental specifications apply.

9-4.57 **Concrete Curing Compounds**

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Material will be accepted based on “SATISFACTORY” test results from the State Materials Laboratory. No curing compound shall be used on WSDOT work prior to testing of each lot. If the lot can be identified and proven to have prior satisfactory acceptance test results in the same calendar year in which it is to be used, it may be used without testing per Chapter 9-5.2 of this manual. Submit a one-quart sample taken by, or in the presence of, an agency representative for each lot. Samples must be submitted for testing 10 days prior to use of curing compound.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check that the lots being used have “Satisfactory” test reports from the State Materials Laboratory.


9-4.58 **Admixtures for Concrete**

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Acceptance will be on the basis of Certified Concrete Delivery Ticket, Standard Specifications Section 6-02.3(5)B, indicating the brand/product and dosage of the admixture as shown on the concrete mix design.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check Concrete Delivery Ticket for proper admixture usage.

5. **Specification Requirements:** See Standard Specifications Section 6-02.3(5)B and 9-23. Review contract documents to determine if supplemental specifications apply.

9-4.59 **Plastic Waterstop**

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Material may be accepted on basis of Manufacturer’s Certificate of Compliance.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for uniformity of product in lot, and for damage in shipment or handling.


9-4.60 **Epoxy Systems**

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance/Verification**
   a. **Acceptance:** Material may be accepted for use on receipt of a passing test report from the State Materials Laboratory. For epoxy bonding agents, submit mix ratios, intended use and a representative sample of each component for each batch or lot number. A representative sample may consist of 1 pint of each component for bulk lots or a pre-packaged kit. Containers shall be identified as “Component A” (contains the Epoxy Resin) and “Component B” (contains the Curing Agent) and shall be marked with the name of the manufacturer, the date of manufacture and the lot number. If the material is to be used as an epoxy grout, mortar or concrete, include a 5-pound representative sample of aggregate. Samples shall be submitted to the State Materials Laboratory. Epoxy Adhesive for Lane Markers does not require field sampling, but does require a Manufacturer’s Certificate of Compliance. A period of 15 working days should be allowed for testing.
9-4.61 Resin Bonded Anchors

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. Acceptance:
   a. Qualified Product Listed Product: If Product is listed on QPL, the acceptance of the resin adhesive shall be by field acceptance procedures documenting that brand and model of the resin system. Threaded rod, nut and washer or other inserts shall be accepted on the basis of a Manufacturer’s Certificate of Compliance with supporting Mill Test Reports indicating they meet the contract requirements.
   b. Non-qualified Product Listed Product: Submit independent test lab data indicating resin system meets specifications when tested in accordance with ASTM E 488, and threaded rod, nut and washer or other inserts shall be accepted on the basis of a Manufacturer’s Certificate of Compliance with supporting Mill Test Reports indicating they meet the contract requirements.

4. Field Inspection: Field verify per Section 9-1.5C of this manual. 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. Epoxies shall be mixed and applied in accordance with the manufacturers written instructions unless otherwise modified in writing by the manufacturer’s agent.


9-4.62 Gabion Baskets

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071). The sample shall consist of the following:
   a. One square yard of mesh including selvage and body wire.
   b. Three feet of tie wire.
   c. Three feet of lacing wire.
   d. Six each wire clips, fasteners.

3. Acceptance: Acceptance is based on receipt of a Manufacturer’s Certificate of Compliance with accompanying Mill Test Report.

4. Field Inspection: Field verify per Section 9-1.5C of this manual. Check for damage.


9-4.63 Sign Structures

1. Approval of Material: Approval of the fabricator is required prior to use. Upon receipt of the “Request for Approval of Material,” the Materials Fabrication Inspection Office will inspect the fabrication shop to ensure it meets all contract requirements. A copy of the Request for Approval of Material will be sent to the Materials Fabrication Inspection Office.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. Acceptance: The fabricated sign structure and associated hardware will be accepted on the basis of an “APPROVED FOR SHIPMENT” stamp (Figure 9-8) An “F” or “D” will be stamped to indicate the steel or iron is of foreign or domestic origin. 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 and hardware inspected prior to erection. Manufacturer’s Certificates of Compliance will be required to be delivered with the sign structures from out-of-state fabrication facilities.

Certificates of Material Origin will be the responsibility of the project office.
4. Field Inspection: Field verify per Section 9-1.5C of this manual. Check for “APPROVED FOR SHIPMENT” stamp (Figure 9-8) on the sign structure and associated hardware. Check for and the “F” or “D” indicator for foreign or domestic steel and document it. Check for damage due to shipping, handling and erection.


9-4.64 Conduit

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). Be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification. If approval action is being requested via the RAM process, attach Catalog Cuts or other appropriate documents along with the proper transmittal form (WSDOT Form 350-071 EF) to assist the RAM Engineer in the approval process.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071). A sample shall consist of 15 feet.

3. Acceptance: Conductors shall be accepted upon receipt of “Satisfactory” Test Report from State Materials Laboratory.

   a. Single Conductors: If using the QPL, be sure to verify appropriate means of acceptance, see applicable Acceptance Code within the QPL. For wire manufacturers not listed in the QPL, submit a sample. A sample shall be a length of wire that shall include the complete printed/stamped designation: manufacturer, size, and insulation type.

   b. Multiple Conductors: If using the QPL, be sure to verify appropriate means of acceptance, see applicable Acceptance Code within the QPL. For wire/cable manufacturers not listed in the QPL, submit a sample. A sample shall be a length of wire that shall include the complete printed/stamped designation: manufacturer, size, and insulation type.

   c. Fiber Optic Cable. A sample of the Fiber Optic cables shall be a minimum 2 feet long.

4. Field Inspection: Field verify per Section 9-1.5C of this manual. A visual inspection shall be made to ensure that no conductors with damaged insulation are incorporated into the project.


9-4.65 Electrical Conductors

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).
3. **Acceptance:** The fabricated poles and associated hardware will be accepted on the basis of an “Approved for Shipment” tag or stamp (Figure 9-8). If poles were inspected prior to shipment to job site, they will be stamped “APPROVED FOR SHIPMENT” (Figure 9-4). An “F” or “D” will be stamped to indicate if the steel or iron is of foreign or domestic origin. Certificate of Material Origin will be the responsibility of the project office. Poles not inspected prior to shipment must be inspected and approved at the job site by the Materials Fabrication Inspection Office prior to installation. Acceptance will be based on approved shop drawings per Chapter 8-20.2B of this manual and Mill Test Certificates supplied by the manufacturer.

Certificates of Material Origin will be the responsibility of the project office.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for “APPROVED FOR SHIPMENT” stamp (Figure 9-4) and the “F” or “D” indicator for foreign or domestic steel and document it. Check for damage due to shipping, handling and erection. Arrange for inspection if not tagged.

5. **Specification Requirements:** See Standard Specifications Section 9-29.6. Review contract documents to determine if supplemental specifications apply.

### 9-4.67 Anchor Bolts for Luminaires, Signal Poles, and Sign Structures

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification. Notify Materials Fabrication Inspection Office of need to provide Inspection Services.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071)

3. **Acceptance:** Acceptance may be based on “APPROVED FOR SHIPMENT” tag and/or stamp (Figure 9-4 or 9-5). An “F” or “D” will be stamped to indicate if the steel or iron is of foreign or domestic origin. Certificate of material origin will be the responsibility of the project office. The ID number on the tags that is attached to the bundles of anchor bolts will be stamped on a representative number of anchor bolts.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check and record the “APPROVED FOR SHIPMENT” tag and/or stamp (Figure 9-4 or 9-5) and the “F” or “D” indicator for foreign or domestic steel and document it. 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.

5. **Specification Requirements:** See Standard Specifications Section 9-29.6(5). Review contract documents to determine if supplemental specifications apply.

### 9-4.68 Luminaires and Lamps

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** Preliminary samples will be required only if requested on Request for Approval of Material (DOT Form 350-071). Submit Manufacturers Certificate of Compliance and catalog cut to the State Materials Laboratory for evaluation if requested.

3. **Acceptance:** Verify the materials received on the job site, is in fact the same make, model, lot, batch, size, color, blend, etc. as approved for use, be it by QPL or via the Request for Approval of Material (DOT Form 350-071).

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual.

   a. **Luminaires:** 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.

   b. **Lamps for Luminaires and Signal Heads:** Check that all lamps are of the proper wattage, see contract documents.

5. **Specification Requirements:** See Standard Specifications Section 9-29.10. Review contract documents to determine if supplemental specifications apply.

### 9-4.69 Water Distribution System

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval action is being request via the RAM process, attach Catalog Cuts or other appropriate documents, using proper transmittal, to assist the RAM Engineer in the approval process.

When approved, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Material may be accepted upon receipt of an “Approved” document in lieu of sampling as shown below:

   a. **QPL Acceptance**

      1) Ductile Iron Pipe and Fittings, PVC Pipe and Fittings, Restrained Joints, Restrained Flexible Couplings, Gate Valves (3-inches to 16-inches), Butterfly Valves, Saddles, Corporation Stops – Visual Inspection per section 9-1.5 of this manual

      2) Copper Tubing and Polyethylene Tubing – Manufacturer’s Certificate of Compliance
b. Non-QPL Acceptance
   1) Ductile Iron Pipe, Steel Pipe, Polyvinyl Chloride (PVC) Pipe, Polyethylene (PE) Pressure Pipe, Polyethylene Encasement – Manufacturer’s Certificate of Compliance
   2) Fittings for Ductile Iron, Steel, PVC, and PE Pipe. Restrained Joints, Bolted Sleeve-type Couplings for Plain End Pipe, Restrained Flexible Couplings, Grooved and Shoulder Joints, Fabricated Mechanical Slip-type Expansion Joints, Gate Valves (3-inches to 16-inches), Butterfly Valves, Valve Stem Extensions, Combination Air Release/Vacuum Valves, Tapping Sleeve and Valve Assemblies, Hydrants, End Connections, Hydrant Extensions, Hydrant Restraints, Traffic Flanges, Saddles, Corporation Stops, Copper Tubing, Polyethylene Tubing, Service Fittings, Meter Setters, Bronze Nipples and Fittings, and Meter Boxes – Catalog Cut per Section 9-1.5H of this manual.
   3) Valve Boxes, Valve Marker Posts, and Guard Posts – Visual Inspection per Section 9-1.5 of this manual.

   It is the responsibility of the project office to obtain a “Certificate of materials Origin” for all steel or iron products prior to incorporation of the material into the project.

   4. Field Inspection: Field verify per Section 9-1.5C of this manual. Check material delivered to the project for damage to the galvanized coatings in shipping and handling and conformance to the contract documents. See that damaged areas and field cut threads are protected with an approved galvanized repair paint formula, standard formula A-9-73. Water distribution pipe requires testing after handling and conformance to the contract documents. See Standard Specifications Section 7-11.3.


9-4.70 Elastomeric Bearing Pads

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071).

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

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. Field Inspection: Field verify per Section 9-1.5C of this manual. Make certain that material to be used is from the certified batch.


9-4.71 Fabric Bearing Pad

1. Approval of Material: Approval is required for the fabricator of the bearings prior to the start of fabrication. For approved plants in Washington State, or the need for inspection, contact the Materials Fabrication Inspection Office.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. Acceptance: All Fabric Bearing Pads need to be inspected at the point of manufacture prior to shipping.

   Documentation will be checked and accepted by WSDOT Fabrication Inspection at the point of manufacture. Certification will be maintained by Fabrication Inspection office. An “F” or “D” will be stamped to indicate the steel or iron is of foreign or domestic origin.

   Certificate of Material Origin will be the responsibility of the project office.

4. Field Inspection: Field verify per Section 9-1.5C of this manual. Check and record the “APPROVED FOR SHIPMENT” tag and/or stamp (Figure 9-4 or 9-5) and the “F” or “D” indicator for foreign or domestic steel and document it. Check for damage caused by shipping and handling.

5. Specification Requirements: Review the contract documents to determine the specification requirements.

9-4.72 Precast Concrete Barrier and Wall Panels

1. Approval of Material: Approval of fabricator is required prior to the start of fabrication. Materials will be approved by the Request for Approval of Material (DOT Form 350-071). Notify Fabrication Office of need to provide Inspection Services, or to verify that the precast plants annual review and approval is current for wall panels only.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. Acceptance: Accept only barrier sections that are stamped “WSDOT INSPECTED” (Figure 9-3). Accept only wall panels, which are stamped “APPROVED FOR SHIPMENT” (Figure 9-4). An “F” or “D” will be stamped to indicate the steel or iron is of foreign or domestic origin. Certificate of Material Origin will be the responsibility of the project office. The “WSDOT INSPECTED” stamp on barrier will include the connecting pins, which will be inspected at the barrier fabricator’s facility.

4. Field Inspection: Field verify per Section 9-1.5C of this manual. Check for shipping and handling damage. Check for “APPROVED FOR SHIPMENT” stamp or “WSDOT INSPECTED” stamp and the “F” or “D” indicator for foreign or domestic steel and document it.
5. **Specification Requirements:** See *Standard Specifications* Section 6-10, 6-02.3(25), and 6-02.3(28). Review contract documents to determine if supplemental specifications apply.

### 9-4.73 Safety Bars, Cattle Guards, Sign Mounting Brackets, Steel and Special Guardrail Posts, Steel Sign Posts

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If fabrication or welding of the item is needed, contact the Materials Fabrication Inspection Office for disposition and possible inspection.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Materials may be accepted on receipt of Manufacturer’s Certificate of Compliance for the base metal including Mill Test Certificates.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check each lot of material delivered to the project for damage, and that accompanying Manufacturer’s Certificate of Compliance is present. Check galvanizing using procedures stated in FOP for ASTM D 1186. Identify lots with test reports. Check for handling or shipping damage.

5. **Specification Requirements:** See *Standard Specifications* Section 9-05.18, 9-16.3(2), 9-28.14(2) and *Standard Plans*. Review contract documents to determine if supplemental specifications apply.

### 9-4.74 Metal Bridge Rail

1. **Approval of Material:** Approval of fabricator is required prior to the start of fabrication. Materials will be approved by the Request for Approval of Material (DOT Form 350-071). Notify Fabrication Office of need to provide Inspection Services.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** If rails were inspected prior to shipment to job site, they will be stamped or tagged “APPROVED FOR SHIPMENT” (Figure 9-4 or 9-5). An “F” or “D” will be stamped to indicate the steel or iron is of foreign or domestic origin. Certificate of Material Origin will be the responsibility of the project office. If not, rails must be inspected on job site by the Materials Fabrication Inspection Office 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.

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for “APPROVED FOR SHIPMENT” tags or stamp and the “F” or “D” indicator for foreign or domestic steel and document it. 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.

5. **Specification Requirements:** See *Standard Specifications* Section 6-06.3(2). Review contract documents to determine if supplemental specifications apply.

### 9-4.75 Construction Geotextiles

1. **Approval of Material:** Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:**
   a. Satisfactory test reports from the State Materials Laboratory when quantities exceed the limits stated in *Standard Specifications* Section 9-33.4(4). Sample per WSDOT Test Method 914. A Manufacturer’s Certificate of Compliance MUST accompany all samples submitted for testing.
   b. Acceptance may be on Manufacturer’s Certificate of Compliance when quantities are within the limits stated in *Standard Specifications* Section 9-33.4(4).

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check each roll of geotextile fabric for proper identification as shown on either the Manufacturer’s Certificate of Compliance or on the State Materials Laboratory test report.

5. **Specification Requirements:** See *Standard Specifications* Sections 9-33. Review contract documents to determine if supplemental specifications apply.

### 9-4.76 Concrete

1. **Approval of Material:** Approval of all materials is required prior to use. Cement – see Section 9-4.1

Fine Aggregate (sand) – see Section 9-4.4

Coarse Aggregate – see Section 9-4.4

Admixtures for Concrete – see Section 9-4.58

Water – see Section 9-4.77

Contractor must submit a concrete mix design on DOT Form 350-040. All concrete except commercial and Lean Concrete must come from a pre-qualified Batch Plant. Contact the Regional Materials Engineer to determine if plant is pre-qualified.

For mix designs proposed for cement concrete pavement the contractor is required to submit flexural and compressive strength test results in accordance with Section 5-05 of the *Standard Specifications* as part of the concrete mix design.

**Note:** If the Aggregate Sources Tracking System requires Alkali Silica Reaction (ASR) mitigation the concrete mix design submittal may include the use of either a low alkali cement per Section 9-01.3(3), or fly ash per 9-23.9, as...
approved by the Engineer. The contractor shall provide test results for ASTM C 1260 or AASHTO T 303 showing the mitigating measures are effective (see Section 9-03 of the Standard Specifications). Contact the General Materials Engineer of the State Materials Laboratory or the State Bridge Construction Engineer if the contractor is proposing to use other mitigating measures.

2. **Preliminary Samples:** Not Required

3. **Acceptance:**
   a. **Commercial and Lean Concrete:** Is accepted based on a Certificate of Compliance to be provided by the supplier as described in Section 6-02.3(5) B of the Standard Specifications.
   b. **Cement Concrete Pavement:** Is accepted based on satisfactory field tests for air content and compressive strength (see Section 9-5 of this manual for testing frequency).
   c. **Structural Concrete:** Is accepted based on tests for Slump, Air Content, Compressive Strength, and Temperature (see Standard Specifications Section 6-02.3(5)G for testing frequency).

4. **Field Inspection:** The concrete mix provided shall match the mix the contractor submitted for review. The Mix design submittal shall include the Aggregate Correction Factor to be used in determining the Air Content, if the contractor fails to provide this information on DOT form 350-040 do not apply an aggregate correction factor.

5. **Specification Requirements:** See Standard Specifications Section 9-03.1, 5-05 and 6-02.

### 9-4.77 Water for Concrete

1. **Approval of Material:** Not required.

2. **Preliminary Samples:** Not required.

3. **Acceptance:** Is based on test results provided by the contractor. If the Contractor is using potable water that is clear and apparently clean, then no testing is required.
   a. **Physical Requirements:** conducted on a weekly interval for the first four weeks and thereafter on monthly interval.
   b. **Chemical Requirements:** conducted on a monthly interval.

4. **Field Inspection:** See Section 9-4.75 concrete.

5. **Specification Requirements:** See Standard Specifications Section 9-25.1.

### 9-4.78 Expansion Joints

1. **Approval of Material:** Approval is required for the fabricator and all material components of the expansion joints prior to the start of fabrication. Materials will be approved by the Request for Approval of Materials (DOT Form 350-071).

2. **Preliminary Samples:** A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Expansion joint systems containing steel will be inspected by Fabrication Inspection at the jobsite.

   All gland material will be accepted based on Manufacturer’s Certificate of Compliance. Manufacturer’s Certificates of Compliance for steel as well as the gland material will be approved and maintained by the project office. Certificates of Material Origin will be the responsibility of the project office. Expansion joints acceptable to the Fabrication Inspector will be stamped “WSDOT INSPECTED”.

   The Project Engineer shall collect all of the documentation from the fabricator for the various material items used in the Manufacturing of the expansion joints as listed below.
   a. **Gland Strip — Manufacturer’s Certificate of Compliance**
   b. **Steel Plates and shapes including — Manufacturer’s Certificate of Compliance and Certificate of Material Origin**
   c. **Coatings for steel parts — Manufacturer’s Certificate of Compliance**

4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. Check for damage caused by shipping and handling.

5. **Specification Requirements:** Review contract documents to determine if supplemental specifications apply.

### 9-4.79 Controller Cabinet Assembly

1. **Approval of Material:** Approval of all components in the Controller Cabinet Assembly are required. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. **Preliminary Samples:** A preliminary sample of the individual components will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. **Acceptance:** Final acceptance is based on a satisfactory test report. A satisfactory test report is defined as acceptable performance in the following tests:

   - WSDOT Test Method 421, Traffic Controller Inspection and Test Procedure
   - WSDOT Test Method 422, Transient Voltage Test (Spike Test) Procedure
   - WSDOT Test Method 423, Conflict Monitor Testing
   - WSDOT Test Method 424, Power Interruption Test Procedure
   - WSDOT Test Method 425, Environmental Chamber Test
   - WSDOT SOP 429, Method for Determining the Acceptability of Traffic Signal Controller Assembly
   - WSDOT Test Method T427, Loop Amplifier Test
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4. Field Inspection: Field verify per Section 9-1.5C of this manual. Verify the controller cabinet assembly received on the job site, has satisfactory test reports if required. Check for damage due to shipping and handling.


9-4.80 Miscellaneous Temporary Erosion and Sediment Control Items

1. Approval of Material: Approval of materials is required prior to use. Materials will be approved by the Qualified Products List or Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that the product is in fact qualified for its intended use, and the product is listed under the appropriate specification.

2. Preliminary Samples: A preliminary sample of the material will be required only if requested on Request for Approval of Material (DOT Form 350-071).

3. Acceptance: Material will be accepted by visual inspection. The exception to this will be Geotextile for Silt Fence, which will be accepted on basis of Manufacturer’s Certificate of Compliance.

4. Field Inspection: Field verify per Section 9-1.5C of this manual.


9-4.81 Concrete Patching Material

1. Approval of Material: Approval of materials is required prior to use. This approval may either be by virtue of the inclusion of this material/product on the Qualified Products List or by approval of a Request for Approval of Material (DOT Form 350-071). If approval is by QPL, be certain to verify that product is in fact qualified for its intended use, and the product is listed under the appropriate specification. If the product is not listed on the QPL, submit test data from an accredited independent laboratory confirming that the concrete patching material meets specifications of Section 9-20.

2. Preliminary Samples:
   A. Prepackaged Concrete Patching Material: If the concrete patching material is not on the QPL, submit test data from an accredited independent laboratory confirming that the concrete patching material meets the requirements of Standard Specifications Section 9-01.2.
   B. Aggregate for Extension: A preliminary sample of the material will be required only if requested on the Request for Approval of Material (DOT Form 350-071) or if the ASA database indicates that the aggregate source approval has expired. Contact the State Materials Office if preliminary samples are required. Preliminary samples for Concrete Aggregate shall be made up of 50-100 pounds of clean, washed coarse aggregate and 20-25 pounds of clean washed fine aggregate. The samples are to be shipped in increments, using satisfactory containers, not exceeding 30 pounds.

3. Acceptance:
   a. Streambed Sediment: After the source has been approved, and prior to use, the gradation test shall be performed to determine if the material does in fact meet specifications for the intended use. The sediment may be accepted upon satisfactory field tests. Acceptance samples shall be obtained, tested, and recorded in accordance with the Standard Specifications, the contract provisions, and Chapters 9-5 and 9-8 of this manual.
   b. Streambed Cobbles: After the source has been approved, the Project Engineer may accept the materials by Visual Inspection per 9-1.5 of this manual or determine the grading per Section 9-03.11(2) of the Standard Specifications.
   c. Streambed Boulders and Habitat Boulders: After the source has been approved, the Project Engineer may accept the material by Visual Inspection per 9-1.5 of this manual or determine approximately size per Sections 9-03.11(3) or 9-03.11(4) of the Standard Specifications.
4. **Field Inspection:** Field verify per Section 9-1.5C of this manual. See that the gradation (streambed sediment only) remains constant.

5. **Specification Requirements:** See Standard Specification Section 9-03.11. Review contract documents to determine if supplemental specifications apply.

### Chapter 9

#### 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, (ROM), Request for Approval of Material, (RAM), and Chapter 9-4 of this manual. All items for acceptance, except for sampling and testing PCC cores, testing concrete cylinder and cement and as shown in Chapter 9-5.7 of this manual will be sampled and tested by the Project Engineers representative.

In some instances, certain items usually sampled by Project Engineers representative may be sampled and tested by representatives of the State Materials Laboratory or other representatives. Such items as shown in Chapter 9-1 of this manual, when properly identified with an “Approved for Shipment” tag, may be accepted for use by the Project Engineer without any further sampling or 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 of this manual 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 ensure 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 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 of this manual, will be followed in the production of those surfaced materials covered therein. A minimum of one acceptance test is required except for small quantities as shown in Chapter 9-5.2C of this manual.

##### 9-5.2B Reducing Frequency of Testing

In instances of uniform production where the material is running well within specification limits, the Project Engineer may initiate deviations from the schedule. Deviations exceeding a 10 percent reduction will require approval from the Construction Materials Engineer at the State Materials Laboratory and must be 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.

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.

#### 9-5.2C Sampling and Testing for Small Quantities of Materials

The Project Engineer may elect to accept small quantities of materials without meeting minimum sampling and testing frequencies using the following criteria.

An item can be accepted as a small quantity if the proposed quantity for a specific material is less than the minimum required frequency. For mainline paving, less than one-half the required frequency as defined in Chapter 9-5.7 of this manual.

Materials that will not be considered under the small quantity definition are:

- Concrete with a 28 day compressive strength of 4000 psi or greater

Some issues that the Project Engineer may consider prior to use of small quantity acceptance are:

- Has the material been previously approved?
- Is the material certified?
- Do we have a mix design or reference mix design?
- Has it been recently tested with satisfactory results?
- Is the material structurally significant?

Small quantity acceptance could be visual, by certification, or other methods. Acceptance of small quantities of materials by these methods must be documented. Documentation of materials under these methods must be provided by the Project Engineer or representative accepting the material in accordance with section 1.2-8A of this manual. For visual documentation, an entry should be made in the project records as to the basis of acceptance of the material, and the approximate quantity involved.

The small quantity acceptance may be used for any quantity of the following uses:

- Curbs and Sidewalks,
- Driveways, Road approaches,
- Paved ditches and slopes

Where jobsite mixing of concrete occurs in accordance with Standard Specification Section 6-02.3(4)B, Jobsite Mixing, small quantity acceptance can be used for acceptance of packaged concrete meeting the requirements of ASTM C 387. The packaged concrete bag will state that the concrete meets the requirements of ASTM C 387.
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9-5.2D Reference Test Report

When a Satisfactory Test Report is required, a Referenced Test Report may be used if allowed in Section 9-4 for a specific material. A Reference Test Report as listed below will not be allowed for HMA Mix Designs, or other materials unless allowed per Section 9-4.

A Reference Test Report may consist of one of the following:

- A copy of a previous WSDOT Satisfactory Test Report generated under another contract number as long as the manufacturer and lot number of the material to be used are the same as the material the test report represents.
- A printed copy of the electronic QPL database page showing ‘referenced’ lots previously tested. The lot number in the QPL must match the lot number of the material used. The information will be listed in the ‘description’ field for specific materials in the QPL.

All Referenced Test Reports must reflect the same specification as the material to be used and be received prior to installation of the intended material. A Reference Test Report for material can only be used in the same calendar year for when the material was incorporated into the contract.

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.

In the event sample testing during stockpiling shows the material to be marginal (i.e., within tolerance limits) 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 for a state-owned source. If stockpiles are constructed for general use, then materials for WSDOT projects shall be tested for acceptance from samples taken by the Project Engineer representative in accordance with WSDOT FOP for AASHTO T 2. The Engineer will determine the exact point of acceptance. 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 with appropriate test results from samples taken by the Project Engineer representative in accordance with WSDOT FOP for AASHTO T 2. The sampling and testing frequency shall conform to Chapter 9-5.7 of this manual.

9-5.4 Basis for Acceptance

The basis of acceptance of Hot Mix Asphalt and aggregates may be either by statistical evaluation or non-statistical evaluation methods. The method to be used is specified in Standard Specifications or Contract Documents.

The testing tolerances shown in Chapter 9-5.6 of this manual apply exclusively to the appropriate 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 contract documents, tolerances will be provided by the State Materials Laboratory upon request from the Regional Construction Manager.

Material that has been produced prior to rejection (i.e., HMA in storage silo, crushed materials hauled to the job site) 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 adopted testing procedures, shall not be incorporated in the work in any manner until it meets specifications.

9-5.4A Basis for Acceptance — Statistical Evaluation

For materials being accepted using statistical evaluation procedures, random samples will be evaluated to determine quality level within a defined tolerance band. Acceptance, bonus, and disincentive procedures are defined in the contract documents.

Test results with acknowledged errors or equipment deficiencies are to be immediately discarded without recourse and another sample run.

Test results for Hot Mix Asphalt may be challenged by the Contractor, as defined in the Standard Specifications Section 5-04.3(8)A. These specifications allow the Contractor to challenge results of any individual acceptance sample test in writing and within seven calendar days from receipt of the specified test results.

When the Contractor challenges a test, a split of the original field sample must be tested by different equipment and a different qualified tester. It therefore is necessary that a split of every field sample (i.e., opposite quarter from acceptance test) be saved in a secure area, accurately marked, and be available for challenge sample testing. The specifications require that the challenge sample testing be done in the Regional Materials Laboratory or the State Materials Laboratory. When the Contractor makes a challenge it is expected that the split sample be sent and tested as quickly as possible. This will require that testing of these samples be prioritized. By expediting the challenge sample testing, problems that may exist in testing or with the material being produced can be identified and corrected lessening the impact to both the Contractor and WSDOT.

9-5.4B Basis for Acceptance — Non-Statistical Evaluation

If statistical acceptance procedures are not specified nonstatistical acceptance method will be used.

Individual samples taken for acceptance by this method 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. Test results with acknowledged errors or equipment deficiencies are to be immediately discarded without recourse and another sample run.

When the test results for Hot Mix Asphalt fall outside the control points the material will be evaluated according to the Standard Specifications Section 5-04.5(1)A.

9-5.4C Basis for Acceptance — Asphalt Binder

The basis for acceptance of asphalt binder is compliance with existing specifications as modified to include the tolerance as follows:

1. If a binder sample fails to meet the required specifications, the binder samples prior and subsequent to the failed sample will be tested. Samples of asphalt binder will continue to be tested until samples taken both prior and subsequent to the failing samples meet the specifications. The quantity of out of specification HMA is determined from the tons of HMA represented by each of the asphalt binder samples that failed to meet the specifications.

2. If a binder sample does not meet the specifications but is not more than 10 percent outside the specification limits and the binder sample prior and subsequent to the out of specification binder both meet the specifications, there will be no price adjustment.

3. If the binder sample is more than 10 percent out of specification or if the binder sample is less than 10 percent out of specification and either the binder sample prior or subsequent to does not meet the specifications, the HMA will be rejected.

9-5.4D Basis for Acceptance — Other Aggregate Properties

The basis for acceptance of aggregates prior to completion of the placement of the material is compliance with existing specifications as modified to include tolerances established in Chapter 9-5.6 of this manual. The application of these tolerances shall be as follows:

1. Take the following actions any time a sample falls outside the specification limits, but within tolerance bands:
   a. Immediately take two separate additional samples representing current production in accordance with Chapter 9-4 of this manual. The contractor has the option of making plant adjustments prior to taking these samples.
   b. Production will be accepted until the second sample is checked for properties that were out of specification in the first sample.
   c. Do not accept any additional material if the second sample is also out of specification.
   d. If the second sample is within specification, immediately check the third sample. Do not accept any additional material if the third sample is out of specification.
   e. No further material will be accepted after the time of rejection until corrections are made in the operations. This will be confirmed by new tests within specification limits.
   f. Basis for acceptance after this correction will be in conformity with the procedure outlined above. All tests of material outside the specification limits must be listed and justified on the materials certification as required by Chapter 9-1.5 of this manual.

2. The acceptance of material shall cease with one or more of the following conditions:
   a. When a sample falls outside of the applicable tolerance bands.
   b. When any two out of three consecutive samples are within tolerance bands, but outside specification limits.
   c. When any sample has a gradation that falls within both the high and low tolerance bands.
   d. Any sample where the material is outside the specification limits, but within the tolerance bands, in any two of the following properties:
      • Gradation
      • Fracture
      • Sand Equivalent
      • Flat and Elongated
      • Uncompacted Void Content of Fine Aggregate (Fine Aggregate Angularity)

The basis for acceptance of aggregate when all of the material has been placed on the project prior to completion of the testing is compliance with the existing specifications (no tolerances). Materials that are not in compliance with the specification will be evaluated as defined in 1-2.8C(1) Defective Materials for Material in Place.

9-5.5 Testing Staff Qualifications and Independent Assurance Program

9-5.5A Testing Staff Qualification

9-5.5A(1) General

WSDOT personnel assigned with testing construction materials will be enrolled in the Construction Tester Qualification Program. The details of this program are contained in this section. This program establishes uniform testing procedures, insures that testing staff is qualified in performing the testing procedures, and provides a regular review. The review process, through inspection by the Region Independent Assurance Inspector (IAI) evaluates the performance of all testing staff, recognizes proficient performance, and improves substandard performance by recommending corrective action. The qualification program extends the State Materials Laboratory accreditation principles. This includes the assignment, management, and review of project level testing using elements of the State Materials Laboratory accreditation program to accommodate an interface with region and, project level materials testing.
operations and the use and understanding of national standard test procedures such as AASHTO and ASTM, and other test procedures such as WAQTC and WSDOT.

9-5.5A(2)  Construction Tester Qualification Rules

1. Responsibility: The construction tester qualification program requires detailed and specific attention to be paid to the testing procedures involved. The State Materials Engineer will address and resolve policy issues related to the qualification program.

2. Qualification Modules: The construction tester qualification modules have been set up in 5 areas of testing that represent most of the acceptance tests performed. The project acceptance testers will be evaluated for their proficiency in one or more of the construction tester qualification modules. Each module has a defined list of test procedures in which proficiency is evaluated, see Section 9-8 of this manual. The modules are listed as follows:
   - Aggregates
   - Hot Mix Asphalt
   - Structural Concrete
   - Embankment and Base Density
   - Hot Mix Asphalt Density

3. Qualification Categories: The tester can be qualified in one or more of three categories. The qualification categories are:
   a. Module Qualified Tester: Fully proficient in a testing module, normally works independently with only general supervision and is responsible for determining material compliance.
   b. Individual Method Qualified Tester: Has proficiency in one or more test procedures which may partially encompass methods in the qualification modules, but also extends to other infrequent acceptance procedures performed at the project level, and includes tests performed at the Regional or State Materials Laboratories.
   c. Interim Qualified Tester: Basically proficient in one or more tests but limited to an interim period of in training work. Works under the close supervision of a module or individual method qualified tester, refer to Paragraph 5 below.

Testing personnel at the Region may be either Module Qualified, Individual Method Qualified, or Interim Qualified Testers. Per the AASHTO accreditation, the State Materials Laboratory personnel are Individual Method Qualified Testers.

4. Attaining Qualification:
   a. Module Qualified Testers: To become a Module Qualified Tester the tester shall satisfactorily complete the required written tests and proficiency evaluations by the IAI, the Region Construction Trainer, or materials staff under the direction of the Materials Engineer. This can be accomplished in a field or region laboratory or State Materials Laboratory. Their qualification records reflect proficiency in the specific individual test methods.
   b. Individual Method Qualified Testers: To become a Individual Method Qualified Tester the tester shall satisfactorily complete the proficiency evaluation by the IAI, the Region Construction Trainer, or materials staff under the direction of the Materials Engineer. This can be accomplished in a field or region laboratory or State Materials Laboratory. Their qualification records reflect proficiency in the specific individual test methods.
   c. Interim Qualified Testers: To become an Interim Qualified Tester, the following conditions have to be met:
      (1) Individual study of the written test method(s) for a complete module,
      (2) Test demonstration by a proficient tester,
      (3) Allowance for practice or trial tests,
      (4) Successful completion conforming to testing checklist(s) without coaching, and
      (5) The Interim Qualified Tester works under close supervision by a Module or Individual Method Qualified Tester who is qualified in the same tests.

   The conditions as described above, leading to interim qualification, may be conducted by another tester currently qualified in the module or test concerned. Based on evaluation of prior experience by the supervisor, with concurrence of the region IAI or Region Construction Trainer, a non-qualified tester may be considered to have the equivalent of conditions 1 through 3 above. An individual will be considered an interim qualified tester when successful testing performance conforming to the checklists has been completed in the presence of another qualified tester.

5. Supervision of Interim Qualified Testers: An Interim Qualified Tester works under the close supervision of a Module or Individual Method Qualified Tester that is qualified in the same test or module containing the test. Close supervision means that the Module or Individual Method Qualified Tester is physically present when the Interim Tester performs the test. The Module or Individual Method Qualified Tester must review and endorse all test results and determinations of material conformance.

6. Criteria for Evaluating Performance: Satisfactory performance constitutes performance conforming to the method checklist or with limited deviations corrected on the spot. Unsatisfactory performance consists of repeated infractions from previous evaluations, or incorrect performance of individual critical items on the checklist. Unsatisfactory evaluations shall be subject to region review.

7. Qualification of Evaluating Staff: Staff participating in evaluation of testers for qualification operate under the professional responsibility of the Regional Materials Engineer, and are not themselves required to be qualified testers.
8. **Frequency of Equipment Verification:** Regional laboratory and field laboratory test equipment will be verified annually, usually during the first quarter of the year, utilizing State Materials Laboratory equipment verification criteria. A tag bearing the year the verification expires will identify verified equipment.

9. Test procedures that are not included in the testing modules, shall be considered infrequently performed test procedures and shall be individual method qualified. For those procedures the Regional Material’s Engineer, or his designated representative, will insure that the following process is employed in carrying out the procedure:
   a. The employee responsible for performing the test will study the test method, after first determining that the procedure is the applicable current version.
   b. The necessary test equipment will be assembled and confirmed as to its suitability and verification if required.
   c. The employee will review how to conduct of the test with the supervisor and clarify any questions.
   d. The test procedure will be performed in duplicate, using split portions of the test sample if possible. If not, a blank of other similar material will be run in duplicate prior to testing.
   e. The results of the duplicate determination will be compared with the expected precision and bias determinations, if any, from the test procedure.
   f. Lacking any defined basis of comparison, the results will be reported as the average of the two determinations with both the individual values and the average shown on the test report.

9-5.5A(3) **Personnel Qualification Policy**

1. All personnel performing acceptance testing will be either Module Qualified, Individual Method Qualified, or Interim Qualified Testers.

2. Module or Individual Method Qualified Tester designated as responsible for the performance of an Interim Qualified Tester must be in close contact, which means that the Module or Individual Method Qualified Tester is physically present when the Interim Tester performs the test. The Module or Individual Method Qualified Tester must review and endorse all test results and determinations of material conformance.

3. The Tester Qualification Tracking System will identify each tester, their specialty, level of qualification, and the results of ongoing evaluations. The IAI shall be the responsible person within the region for the accuracy of the information contained in the Tester Qualification Tracking System.

4. On-the-job performance will be evaluated by the IAI, the Region Construction Trainer, or materials staff under the direction of the Materials Engineer using the qualification checklists. Noted deficiencies will be reported in writing to the tester and his/her supervisor.

5. Supervisor action is required for notations of unsatisfactory performance.

6. The region tester performance review Chapter 9-5.5A(9) will consider continued qualification of individuals noted as deficient in performance. The supervisor shall submit to the Regional Materials Engineer the corrective action taken for unsatisfactory performance.

9-5.5A(4) **Laboratory Qualifications Policy**

A region or other subordinate laboratory to be considered qualified shall meet the following conditions:

1. Identify all test methods performed on a regular basis. Methods must conform to those established by WSDOT for materials acceptance.

2. Annually, verify laboratory and field test equipment, using State Materials Laboratory equipment verification criteria. An attached tag will identify the verified equipment.

3. Maintain staff qualification for all methods performed in the laboratory. Qualification shall be either by Module Qualified Tester or Individual Method Qualified tester.

4. Respond to the findings of the review program by the State Materials Laboratory staff, modeled on AASHTO Materials Reference Laboratory (AMRL) inspection program. Such reviews shall be conducted at least biennially.

5. With approval of the State Materials Engineer, a non-WSDOT contracting laboratories having an equipment calibration/verification policy, and a technician training and evaluation process meeting the requirements of AASHTO R-18 may be used to conduct acceptance testing. Documentation of equipment calibration/verification and tester qualification shall be maintained and available for review by the Contracting Agency upon request. The Contracting Agency may conduct an on site review of the laboratory facilities, witness the tester performing the tests, verify the testing equipment, and review records when deemed necessary.

9-5.5A(5) **Construction Tester Qualification Program**

1. Qualifications:
   a. **Module Qualified Tester:** Qualification in a module will require satisfactory completion of a written exam, followed by hands-on performance of testing procedures. Written examinations require an overall score of 70 percent, with not less than 60 percent on each module for satisfactory completion. Performance examination requires satisfactory performance in the presence of the Independent Assurance Inspectors, the Construction Trainers, or materials staff of all checklist steps, in sequential order, in each required method.
   
   b. **Individual Method Qualified Tester:** Qualification in an individual method requires satisfactory completion of hands on performance of the testing procedures in the presence of the Independent Assurance Inspectors, the Construction Trainers, or materials staff. Performance examination requires satisfactory performance of all checklist steps, in sequential order.
c. **Interim Qualified Tester:** Qualification as an Interim Qualified Tester requires satisfactory completion of hands-on performance of the testing procedures in the presence of a qualified tester that is qualified in the same test or module containing the test. Performance examination requires satisfactory performance of all checklist steps, in sequential order.

2. Equivalent programs, i.e., American Concrete Institute (ACI) Certification, may be accepted for qualification where feasible. The State Materials Engineer will determine acceptance of alternate programs.

3. Qualification examinations will be administered by Region IAI supported by Regional Construction Trainers and Regional laboratory supervisors.

4. Performance qualification will be determined from correct performance of all steps, in sequence, based on testing checklists derived from WSDOT adopted test methods as listed in the Materials Manual.

5. Failure of a qualification examination will allow for reexamination after a 3-day minimum period of preparation for retest.

6. Repeated failures will be referred to the candidate’s supervisor for regional performance review.

7. Tester will continue to be qualified under the following conditions:
   a. All unsatisfactory evaluations are resolved within 30 days.
   b. The IAI evaluates the Tester any time during the next calendar year (January to December).
   c. Testers that missed an annual demonstration of proficiency may be allowed to do acceptance testing for a 30-day period, if requested by the Project Engineer and approved by the IAI. An evaluation and checklist review by the IAI, the Region Construction Trainer, or materials staff under the direction of the Materials Engineer must be conducted within this 30-day period.
   d. Any tester missing two consecutive yearly annual evaluations will be required to retake the written test and achieve a satisfactory IAI performance evaluation.

8. Support of construction program testing including: density cores, nuclear gauge correlation and management, concrete 28-day cylinders (acceptance), density standards (Proctor and maximum density), and as needed, hot mix asphalt ignition furnace calibration.

### 9-5.5A(7) Project Engineer Responsibilities

The Project Engineer will:

1. Ensure that all personnel assigned the responsibility for testing materials are Module Qualified Testers, Individual Method Qualified Tester, or Interim Qualified Testers who work under close supervision of a Qualified Tester.

2. Provide an opportunity for on-the-job training, and/or mentoring of Interim Qualified Testers prior to assigning testing responsibilities.

3. Take corrective actions for unsatisfactory evaluations of Qualified Testers.

4. Advise the Regional Independent Assurance Inspector of changes in assigned testers, new testers needing qualification testing, and of follow up corrective actions.

### 9-5.5A(8) The State Materials Laboratory Responsibilities

The State Materials Laboratory will:

1. Attain and maintain AASHTO Accreditation of the Materials Quality System responding to the AASHTO Accreditation Program. The Materials Quality System shall include all test methods performed at the State Materials Laboratory.

2. Assist the Regional Materials Laboratories by providing standards and procedures derived from the Materials Quality System Manual for direct application to corresponding procedures in the Regional Laboratories.

3. Maintain testing standards and procedures in conformance with WSDOT, AASHTO, ASTM, and WAQTC.

4. As the departmental laboratory qualification authority, periodically review the performance and records of region and other subordinate laboratories for consistent practices in testing, equipment verification, and staff qualification.

5. Maintain examinations and checklists used to qualify all WSDOT testing personnel.
6. Provide oversight and coordination for establishment and revision of the qualification programs. Creation and revision of qualification program modules will be by a cross-functional work group.

7. Maintain Tester Qualification Tracking System computer program.


9-5.5A(9) Tester Performance Review

1. The IAI, the Region Construction Trainer, or materials staff under the direction of the Materials Engineer reviews performance of all Module qualified, Individual Method Qualified, and interim qualified testers as provided under the IA process.

2. Such reviews are documented in the form of checklists reflecting the degree of conformance to the test procedure. Copies of the review are provided to the tester and to the tester’s supervisor (normally the Project Engineer) at the conclusion of the review.

3. Remarks may be included to reflect commendable performance, attention to detail, cooperative attitude, or other performance beyond the expected norm. Satisfactory reports affirm tester proficiency and attest to proper operation of the materials acceptance process.

4. Expected satisfactory performance is that all steps of the checklist be performed correctly. However, incidences of single to several errors as isolated, first-time occurrences, which are acknowledged and corrected by on the spot, discussion with the IAI, also constitute satisfactory performance. (Note: Some procedures may have single steps of such criticality that their omission reflects unsatisfactory performance.)

5. Unsatisfactory performance constitutes repeated occurrences of previous on-the-spot corrections, incorrect performance of critical steps. IAI’s may also assign unsatisfactory performance based on observed falsification of test reports, violations of safety, hazardous materials or nuclear materials security standards, or failure to provide proper care of equipment. The Regional Materials Engineer shall promptly review all unsatisfactory performance reports.

6. Reports alleging improper performance of test procedures may be originated by other parties to a construction contract such as contractors, subcontractors or suppliers. Such allegations must be submitted in writing, to the Project Engineer for review. Allegations must identify the specific test procedure and alleged omissions or commissions and contain the name and signature of the individual making the allegation. These reports will be investigated.

9-5.5A(10) Review Actions for Unsatisfactory Performance

1. The tester’s supervisor is expected to review and act on all unsatisfactory performance reports.

2. For unsatisfactory performance, the Regional Materials Engineer will work with the Project Engineer for proposed corrective action. Mutual agreement on corrective action shall be documented by attachment to the performance report.

3. Unresolved reports shall be referred to the Regional Construction Manager.

4. Review of substandard performance shall afford the tester involved the opportunity for a personal appearance. In the case of written allegations of misconduct, the individual making the allegation shall also have the opportunity to appear. The Regional Construction Manager shall review recommendation for corrective action. All findings related to allegations of misconduct shall be made in writing by the Regional Construction Manager.

9-5.5B Independent Assurance (IA) Program

9-5.5B(1) General

The IA Program, through a combination of sampling and observation, is intended to determine the conformance of sampling and testing to the defined procedures. The Independent Assurance process is intended to verify procedures, confirm equipment verification, and, in some instances, obtain split samples (Independent Assurance Samples) for independent testing. These samples do not reflect on the specification conformance of the materials involved. IA evaluation will be on a system basis, focused on individuals testing activity rather than being project based on a sample frequency and materials quantity basis.

9-5.5B(2) Independent Assurance Inspector (IAI)

The Regional Construction Manager should assign a sufficient number of persons in each region to handle the program for independent assurance sampling, testing, and annual tester evaluation reviews. These IAI’s should be under the direction of the Regional Materials Engineer and should be well trained and experienced in all phases of the work.

It will be the duty of the IAI to conduct the IA Program in accordance with the requirements of WSDOT. The IA program requires the evaluation of all materials testers, observation of the techniques used to run the field tests, determination of the verification status and condition of testing equipment in use, and procurement of appropriate Independent Assurance Samples. The IAI’s should exercise tact and good judgment in securing maximum cooperation on the part of the testers and other project personnel. IAI’s will conduct the examination process under the Construction Tester Qualification Program.
The Tester Qualification Tracking System will identify each tester, their specialty, level of qualification, and the results of ongoing evaluations. The IAI shall be the responsible person within the region for the accuracy of the information contained in the Tester Qualification Tracking System.

The IAI may normally have other materials related functions to perform in addition to the IA functions. Typically, these may include:

1. Conducting initial training to establish interim qualification.
2. Mentoring interim or newly qualified testers to enhance efficiency and confidence.
3. Assisting in or conducting testing and inspection training in concert with the Regional Construction Trainer.
4. Reviewing materials, test-related records, and forms.
5. Radiation Safety Officer
6. Inspection and Certification of Concrete production facilities.

9-5.5B(3) Independent Assurance Evaluations

It is essential that the IAI evaluate all project and region materials testers, observe the techniques of running the field tests, ascertain the verification status of testing equipment in use, and obtain the appropriate Independent Assurance Samples.

The frequency of Independent Assurance Inspections is managed by the IAI’s. On-site evaluation by the IAI will be conducted at least once per calendar year, per module or test. The on-site evaluation will accrue the calendar year following qualification or requalification. The on-site evaluation shall include evaluation in all test methods in the applicable qualification module, or the individual method qualified tests. Tests included in a module but not evaluated on a project may be evaluated off-site, such as at the region laboratory. Additional visits are recommended based on the activity level of the individual tester. Further, additional evaluations may be required for follow up of deficient performance or for monitoring activities of Interim Qualified Testers.

Observations of performance and split sampling will be performed for hot mix asphalt and aggregate testing. Only observations of performance are required for testing of Portland cement concrete and for density testing.

Independent Assurance observations and evaluations will follow the Tester Qualification Checklists for the procedures involved. A copy of these checklists and observations will be provided to the Project Engineer upon request. Each observation will be cataloged to the tester that is observed, to maintain an ongoing account of his/her performance. A complete record should be made of the evaluation and sampling performed during this inspection, the personnel contacted, the testing equipment observed, and the suggestions or on-the-spot corrections that were left with job personnel. Observations other than test performance related to checklists are not normally considered in the evaluation of the individual tester, but may require action by management involved.

At the time of the Independent Assurance Inspection, where samples are required, the IAI will observe the initial sampling and participate in the sample splitting activity to ensure that an accurate split is obtained. The field split will then be tested, under observation. The split portion will be returned to the Regional Materials Laboratory and tested for comparison of results.

Additional separate comparison samples may be split by the field tester and forwarded to the Regional Materials Laboratory as initiated by the field tester or when directed by the IAI as follow up for observed deficient performance. This sample will be carefully split, identified as “Comparison Sample,” show the tester’s identity, and be forwarded to the Regional Materials Laboratory accompanied by the field test results.

All testing equipment involved will be examined for the presence of the required Region verification tags current for the present calendar year. In addition, evaluation of the condition of the equipment items is advised for determination of in service wear or damage.

9-5.5B(4) Evaluation of Independent Assurance Samples Testing

The companion tests of Independent Assurance Samples will be performed employing another qualified operator and set of verified testing equipment than that used for the field (acceptance) test results. When acceptance testing is performed at the Regional Materials Laboratory, the operators should be under the same degree of Independent Assurance oversight as for acceptance sampling performed in the field.

9-5.5B(5) Comparison of Independent Assurance and Acceptance Test Results

Independent Assurance results or comparison results will be compared with the acceptance results. Reports of the comparison of results will be provided to the Project Engineer and the Region IAI. Comments reflecting the degree of conformance will be entered in the remarks section of the report by the Regional 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.

<table>
<thead>
<tr>
<th>Test</th>
<th>Normal Range of Deviation</th>
<th>Maximum Range of Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand Equivalent</td>
<td>± 8 points</td>
<td>± 15 points</td>
</tr>
<tr>
<td>Fracture</td>
<td>± 5 percent</td>
<td>± 10 percent</td>
</tr>
<tr>
<td>Asphalt Binder Content (HMAAATB)</td>
<td>± 0.3 percent</td>
<td>± 0.6 percent</td>
</tr>
<tr>
<td>Sieve Analysis — All Items:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 4 sieve and larger</td>
<td>± 5 percent</td>
<td>± 8 percent</td>
</tr>
<tr>
<td>No. 6 sieve to No. 80 sieve</td>
<td>± 3 percent</td>
<td>± 6 percent</td>
</tr>
<tr>
<td>No. 100 sieve to No. 200 sieve</td>
<td>± 2 percent</td>
<td>± 4 percent</td>
</tr>
</tbody>
</table>
In the table above, “Normal Range” indicates an acceptable range of variation between test results and no action is required. Test results that fall in this category will be so indicated by the wording “normal deviation” on the 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 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. The IAI will take the same actions relative to the test operator in the region laboratory.

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 IAI and/or Region Construction Trainer for their services in corrective action. Corrective action involving both the field tester and the region laboratory tester will include review of sampling procedures, sample splitting procedures, testing procedures, and testing equipment.

The Project Engineer will document actions and results of these investigations by a notation or attachment to the independent assurance sample test report. The Independent Assurance Inspector shall document the actions and results of these investigations on the individual’s checklist evaluation with notations as to his/her findings in reviewing region lab procedures. Lacking any other actions, these results shall be considered in scheduling repeat evaluations of a tester and entered into the individual’s qualification record. These may include comments or findings by the Region Construction Trainer.

The focus of Independent Assurance sampling is based on individual tester’s activity and is not intended to provide independent assurance sample reports on all projects or on all materials on any particular project.
### 9-5.6 Tolerance Limits

#### Crushed Screenings ¾″ — ½″ for B.S.T.  
<table>
<thead>
<tr>
<th>% Passing 1″</th>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100</td>
<td>95-100</td>
</tr>
<tr>
<td>% Passing ¾″</td>
<td>95-100</td>
<td>90-100</td>
</tr>
<tr>
<td>% Passing ½″</td>
<td>0-20</td>
<td>0-25</td>
</tr>
<tr>
<td>% Passing ¼″</td>
<td>0-5</td>
<td>0-10</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>0-1.5</td>
<td>0-2.0</td>
</tr>
<tr>
<td>Fracture</td>
<td>90% Min.</td>
<td>85% Min.</td>
</tr>
</tbody>
</table>

#### Crushed Screenings ⅝″ — No. 4 for B.S.T.  
<table>
<thead>
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<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>95-100</td>
<td>90-100</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>0-10</td>
<td>0-15</td>
</tr>
<tr>
<td>% Passing No. 10</td>
<td>0-3</td>
<td>0-7</td>
</tr>
<tr>
<td>% Passing No. 200</td>
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<td>0-2.0</td>
</tr>
<tr>
<td>Fracture</td>
<td>90% Min.</td>
<td>85% Min.</td>
</tr>
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</table>

#### Crushed Screenings ½″ — No. 4 for B.S.T.  
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<th>Tolerance Limits</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td>95-100</td>
</tr>
<tr>
<td>% Passing ½″</td>
<td>97-100</td>
<td>92-100</td>
</tr>
<tr>
<td>% Passing ⅛″</td>
<td>0-15</td>
<td>0-20</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>0-5</td>
<td>0-10</td>
</tr>
<tr>
<td>% Passing No. 10</td>
<td>0-2</td>
<td>0-6</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>0-1.5</td>
<td>0-2.0</td>
</tr>
<tr>
<td>Fracture</td>
<td>90% Min.</td>
<td>85% Min.</td>
</tr>
</tbody>
</table>

#### Crushed Screenings ⅜″ — US No. 4  
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<th>Tolerance Limits</th>
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<tbody>
<tr>
<td>% Passing ¼″</td>
<td>100</td>
<td>95-100</td>
</tr>
<tr>
<td>% Passing ⅜″</td>
<td>70-90</td>
<td>65-95</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>0-5</td>
<td>0-10</td>
</tr>
<tr>
<td>% Passing No. 8</td>
<td>0-3</td>
<td>0-7</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>0-1.5</td>
<td>0-2.0</td>
</tr>
<tr>
<td>Fracture</td>
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<td>85% Min.</td>
</tr>
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</table>

#### Crushed Screening ⅜″ — No. 10  
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<td>100</td>
<td>95-100</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>95-100</td>
<td>90-100</td>
</tr>
<tr>
<td>% Passing No. 8</td>
<td>0-35</td>
<td>0-40</td>
</tr>
<tr>
<td>% Passing No. 10</td>
<td>0-10</td>
<td>0-12</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>0-1.5</td>
<td>0-2.0</td>
</tr>
<tr>
<td>Fracture</td>
<td>90% Min.</td>
<td>85% Min.</td>
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#### Crushed Screenings No. 4 — 0″ for B.S.T.  
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<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Passing ⅛″</td>
<td>100</td>
<td>95-100</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>76-100</td>
<td>71-100</td>
</tr>
<tr>
<td>% Passing No. 8</td>
<td>30-60</td>
<td>26-64</td>
</tr>
<tr>
<td>% Passing No. 10</td>
<td>0-10.0</td>
<td>0-11.0</td>
</tr>
<tr>
<td>Fracture</td>
<td>90% Min.</td>
<td>85% Min.</td>
</tr>
</tbody>
</table>
### Ballast

<table>
<thead>
<tr>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Passing 2½&quot;</td>
<td>100</td>
</tr>
<tr>
<td>% Passing 2&quot;</td>
<td>65-100</td>
</tr>
<tr>
<td>% Passing 1&quot;</td>
<td>50-85</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>26-44</td>
</tr>
<tr>
<td>% Passing No. 40</td>
<td>16 Max.</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>9.0 Max.</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>35 Min.</td>
</tr>
<tr>
<td>Dust Ratio</td>
<td>½ Max.</td>
</tr>
</tbody>
</table>

### Shoulder Ballast

<table>
<thead>
<tr>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
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<td>100</td>
</tr>
<tr>
<td>% Passing 2&quot;</td>
<td>65-100</td>
</tr>
<tr>
<td>% Passing ¾&quot;</td>
<td>40-80</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>0-5</td>
</tr>
<tr>
<td>% Passing No. 100</td>
<td>0-2.0</td>
</tr>
<tr>
<td>Fracture</td>
<td>75% Min.</td>
</tr>
</tbody>
</table>

### Crushed Surfacing Base Course

<table>
<thead>
<tr>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Passing 1¼&quot;</td>
<td>100</td>
</tr>
<tr>
<td>% Passing 1&quot;</td>
<td>80-100</td>
</tr>
<tr>
<td>% Passing ¾&quot;</td>
<td>50-80</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>25-45</td>
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<tr>
<td>% Passing No. 40</td>
<td>3-18</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>7.5 Max.</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>40 Min.</td>
</tr>
<tr>
<td>Fracture</td>
<td>75% Min.</td>
</tr>
</tbody>
</table>

### Streambed Sediment

<table>
<thead>
<tr>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>% Passing 2&quot;</td>
<td>65-95</td>
</tr>
<tr>
<td>% Passing 1&quot;</td>
<td>50-85</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>26-44</td>
</tr>
<tr>
<td>% Passing No. 40</td>
<td>16 max.</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>5.0-9.0</td>
</tr>
</tbody>
</table>

### Crushed Surfacing Top Course

<table>
<thead>
<tr>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Passing ¾&quot;</td>
<td>100</td>
</tr>
<tr>
<td>% Passing ½&quot;</td>
<td>80-100</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>46-66</td>
</tr>
<tr>
<td>% Passing No. 40</td>
<td>8-24</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>10.0 Max.</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>40 Min.</td>
</tr>
<tr>
<td>Fracture</td>
<td>75% Min.</td>
</tr>
</tbody>
</table>

### Maintenance Rock

<table>
<thead>
<tr>
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<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Passing 5¾&quot;</td>
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</tr>
<tr>
<td>% Passing 5½&quot;</td>
<td>90-100</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>45-66</td>
</tr>
<tr>
<td>% Passing No. 40</td>
<td>10-25</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>7.0 Max.</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>40 Min.</td>
</tr>
<tr>
<td>Fracture</td>
<td>75% Min.</td>
</tr>
</tbody>
</table>
### Gravel Base

<table>
<thead>
<tr>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Passing 2&quot;</td>
<td>75-100</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>22-100</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>10.0 Max.</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>30 Min.</td>
</tr>
<tr>
<td>Dust Ratio</td>
<td>⅔ Max.</td>
</tr>
</tbody>
</table>

### Gravel Backfill for Walls

<table>
<thead>
<tr>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Passing 4&quot;</td>
<td>100</td>
</tr>
<tr>
<td>% Passing 2&quot;</td>
<td>75-100</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>22-66</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>5.0 Max.</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>60 Min.</td>
</tr>
<tr>
<td>Dust Ratio</td>
<td>⅔ Max.</td>
</tr>
</tbody>
</table>

### Gravel Backfill for Pipe Zone Bedding

<table>
<thead>
<tr>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Passing 1½&quot;</td>
<td>100</td>
</tr>
<tr>
<td>% Passing 1&quot;</td>
<td>75-100</td>
</tr>
<tr>
<td>% Passing ¾&quot;</td>
<td>50-100</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>20-80</td>
</tr>
<tr>
<td>% Passing No. 40</td>
<td>3-24</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>10.0 Max.</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>35 Min.</td>
</tr>
</tbody>
</table>

### Gravel Backfill for Drains

<table>
<thead>
<tr>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
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<td>100</td>
</tr>
<tr>
<td>% Passing ¾&quot;</td>
<td>80-100</td>
</tr>
<tr>
<td>% Passing ½&quot;</td>
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<td>0-4</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>0-2</td>
</tr>
</tbody>
</table>

### Gravel Backfill for Drywells

<table>
<thead>
<tr>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Passing 1½&quot;</td>
<td>100</td>
</tr>
<tr>
<td>% Passing 1&quot;</td>
<td>50-100</td>
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<tr>
<td>% Passing ¾&quot;</td>
<td>0-20</td>
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<tr>
<td>% Passing ½&quot;</td>
<td>0-2</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>0-1.5</td>
</tr>
</tbody>
</table>

### Backfill for Sand Drains

<table>
<thead>
<tr>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
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<td>90-100</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>57-100</td>
</tr>
<tr>
<td>% Passing No. 10</td>
<td>40-100</td>
</tr>
<tr>
<td>% Passing No. 50</td>
<td>3-30</td>
</tr>
<tr>
<td>% Passing No. 100</td>
<td>0-4</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>0-3.0</td>
</tr>
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### Sand Drainage Blanket

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</tr>
</thead>
<tbody>
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<td>90-100</td>
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<tr>
<td>% Passing No. 4</td>
<td>24-100</td>
</tr>
<tr>
<td>% Passing No. 10</td>
<td>14-100</td>
</tr>
<tr>
<td>% Passing No. 50</td>
<td>0-30</td>
</tr>
<tr>
<td>% Passing No. 100</td>
<td>0-7</td>
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<tr>
<td>% Passing No. 200</td>
<td>0-3.0</td>
</tr>
<tr>
<td>Gravel Borrow</td>
<td>Specification Limits</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>% Passing 4&quot;</td>
<td>100</td>
</tr>
<tr>
<td>% Passing 2&quot;</td>
<td>75-100</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>50-80</td>
</tr>
<tr>
<td>% Passing No. 40</td>
<td>30 Max.</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>7.0 Max.</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>50 Min.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Select Borrow</th>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Passing 6&quot;</td>
<td>100</td>
<td>95-100</td>
</tr>
<tr>
<td>% Passing 3&quot;</td>
<td>75-100</td>
<td>70-100</td>
</tr>
<tr>
<td>% Passing No. 40</td>
<td>50 Max.</td>
<td>55 Max.</td>
</tr>
<tr>
<td>% Passing No. 200</td>
<td>10.0 Max.</td>
<td>12.0 Max.</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>30 Min.</td>
<td>25 Min.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Foundation Material Class A</th>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Passing 2½&quot;</td>
<td>98-100</td>
<td>93-100</td>
</tr>
<tr>
<td>% Passing 2&quot;</td>
<td>92-100</td>
<td>87-100</td>
</tr>
<tr>
<td>% Passing 1½&quot;</td>
<td>72-87</td>
<td>67-92</td>
</tr>
<tr>
<td>% Passing 1¼&quot;</td>
<td>58-75</td>
<td>53-80</td>
</tr>
<tr>
<td>% Passing ¾&quot;</td>
<td>27-47</td>
<td>22-52</td>
</tr>
<tr>
<td>% Passing ¼&quot;</td>
<td>3-14</td>
<td>2-16</td>
</tr>
<tr>
<td>% Passing No. 4</td>
<td>0-1</td>
<td>0-2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Foundation Material Class B</th>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Passing 2½&quot;</td>
<td>95-100</td>
<td>90-100</td>
</tr>
<tr>
<td>% Passing 2&quot;</td>
<td>75-100</td>
<td>70-100</td>
</tr>
<tr>
<td>% Passing 1½&quot;</td>
<td>30-60</td>
<td>25-65</td>
</tr>
<tr>
<td>% Passing 1¼&quot;</td>
<td>0-15</td>
<td>0-17</td>
</tr>
<tr>
<td>% Passing ¾&quot;</td>
<td>0-1</td>
<td>0-2</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Hot Mix Asphalt</th>
<th>Specification Limits</th>
<th>Tolerance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt Binder-Performance Grade (PG)</td>
<td>AASHTO M320</td>
<td>±10% of spec</td>
</tr>
<tr>
<td>Fracture</td>
<td>90% min.</td>
<td>85% min.</td>
</tr>
<tr>
<td>Uncompacted Void Content of Fine Aggregate</td>
<td>&lt; 3 million ESAL's</td>
<td>40% min</td>
</tr>
<tr>
<td></td>
<td>≥ 3 million ESAL's</td>
<td>44% min</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>45 min.</td>
<td>40 min.</td>
</tr>
</tbody>
</table>
### 9-5.7 Acceptance Sampling and Testing Frequency Guide

<table>
<thead>
<tr>
<th>Item</th>
<th>Test</th>
<th>Acceptance Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel Borrow</td>
<td>Grading &amp; SE</td>
<td>1 – 4000 Ton</td>
</tr>
<tr>
<td>Select Borrow</td>
<td>Grading &amp; SE</td>
<td>1 – 4000 Ton</td>
</tr>
<tr>
<td>Sand Drainage Blanket</td>
<td>Grading</td>
<td>1 – 4000 Ton</td>
</tr>
<tr>
<td>Gravel Base</td>
<td>Grading, SE &amp; Dust Ratio</td>
<td>1 – 4000 Ton</td>
</tr>
<tr>
<td>CSTC</td>
<td>Grading, SE &amp; Fracture</td>
<td>1 – 2000 Ton</td>
</tr>
<tr>
<td>CSBC</td>
<td>Grading, SE &amp; Fracture</td>
<td>1 – 2000 Ton</td>
</tr>
<tr>
<td>Streambed Sediment</td>
<td>Grading</td>
<td>1 – 500 tons</td>
</tr>
<tr>
<td>Maintenance Rock</td>
<td>Grading, SE &amp; Fracture</td>
<td>1 – 2000 Ton</td>
</tr>
<tr>
<td>Ballast</td>
<td>Grading, SE &amp; Dust Ratio</td>
<td>1 – 2000 Ton</td>
</tr>
<tr>
<td>Shoulder Ballast</td>
<td>Grading &amp; Fracture</td>
<td>1 – 2000 Ton</td>
</tr>
<tr>
<td>Backfill for Sand Drains</td>
<td>Grading</td>
<td>1 – 2000 Ton</td>
</tr>
<tr>
<td>Crushed Coverstone</td>
<td>Grading, SE &amp; Fracture</td>
<td>1 – 1000 Ton</td>
</tr>
<tr>
<td>Crushed Screening</td>
<td>⅜ – No. 4 Grading &amp; Fracture</td>
<td>1 – 1000 Ton</td>
</tr>
<tr>
<td></td>
<td>½ – No. 4 Grading &amp; Fracture</td>
<td>1 – 1000 Ton</td>
</tr>
<tr>
<td></td>
<td>No. 4 – 0 Grading &amp; Fracture</td>
<td>1 – 1000 Ton</td>
</tr>
<tr>
<td>Gravel Backfill For</td>
<td>Grading &amp; SE</td>
<td>1 – 1000 Ton</td>
</tr>
<tr>
<td>Foundations</td>
<td>Grading</td>
<td>1 – 1000 Ton</td>
</tr>
<tr>
<td>Walls</td>
<td>Grading, SE &amp; Dust Ratio</td>
<td>1 – 1000 Ton</td>
</tr>
<tr>
<td>Pipe Zone Bedding</td>
<td>Grading &amp; SE</td>
<td>1 – 1000 Ton</td>
</tr>
<tr>
<td>Drains</td>
<td>Grading</td>
<td>1 – 100 Ton</td>
</tr>
<tr>
<td>Dry Wells</td>
<td>Grading</td>
<td>1 – 100 Ton</td>
</tr>
<tr>
<td>PCC Paving</td>
<td>Grading</td>
<td>1 – 2000 CY</td>
</tr>
<tr>
<td>Coarse Aggregate See Note 7</td>
<td></td>
<td>1 – 2000 CY</td>
</tr>
<tr>
<td>Fine Aggregate See Note 7</td>
<td></td>
<td>1 – 2000 CY</td>
</tr>
<tr>
<td>Combined Aggregate See Note 7</td>
<td></td>
<td>1 – 2000 CY</td>
</tr>
<tr>
<td>Air Content</td>
<td>Air</td>
<td>1 – 500 CY</td>
</tr>
<tr>
<td>Cylinders (28-day)</td>
<td>Compressive Strength</td>
<td>1 – 500 CY</td>
</tr>
<tr>
<td>Core</td>
<td>Density</td>
<td>1 – 500 CY</td>
</tr>
<tr>
<td></td>
<td>Thickness</td>
<td>1 – 500 CY</td>
</tr>
<tr>
<td>Cement</td>
<td>Chemical &amp; Physical Certification</td>
<td></td>
</tr>
<tr>
<td>See Note 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCC Structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coarse Aggregate See Note 7</td>
<td>Grading</td>
<td>1 – 1000 CY</td>
</tr>
<tr>
<td>Fine Aggregate See Note 7</td>
<td>Grading</td>
<td>1 – 1000 CY</td>
</tr>
<tr>
<td>Combined Aggregate See Note 7</td>
<td>Grading</td>
<td>1 – 1000 CY</td>
</tr>
<tr>
<td>Consistency</td>
<td>Slump</td>
<td>1 for every 5 trucks, See Note 8</td>
</tr>
<tr>
<td>Air Content</td>
<td>Air</td>
<td>1 for every 5 trucks, See Note 8</td>
</tr>
<tr>
<td>Cylinders (28-day)</td>
<td>Compressive Strength</td>
<td>1 for every 5 trucks, See Note 8</td>
</tr>
<tr>
<td>Cement</td>
<td>Chemical &amp; Physical Certification</td>
<td></td>
</tr>
<tr>
<td>Grouts</td>
<td>Compressive Strength</td>
<td>1 set per day</td>
</tr>
<tr>
<td>See Note 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot Mix Asphalt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed Mix, See Note 3 and 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grading &amp; Asphalt Content</td>
<td></td>
<td>1 – 800 Ton</td>
</tr>
<tr>
<td>Compaction</td>
<td></td>
<td>5 – 400 Ton</td>
</tr>
</tbody>
</table>
### Hot Mix Asphalt

<table>
<thead>
<tr>
<th>Description</th>
<th>Grading &amp; Asphalt Content</th>
<th>Compaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed Mix, See Note 3 and 4</td>
<td>1 – 800 Ton</td>
<td>5 – 400 Ton</td>
</tr>
<tr>
<td>Open Graded, See Note 3 Class D and D Mod.</td>
<td>Grading (Agg. from cold feed)</td>
<td>1-800 Ton</td>
</tr>
</tbody>
</table>

### Hot Mix Asphalt Aggregate

<table>
<thead>
<tr>
<th>Description</th>
<th>SE, Fracture, Uncompacted Void Content of Fine Aggregate, See Note 3</th>
<th>1 – 1600 Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate</td>
<td>SE, Fracture, Uncompacted Void Content of Fine Aggregate, See Note 3</td>
<td>1 – 1600 Ton</td>
</tr>
<tr>
<td>Blend Sand See Note 1</td>
<td>SE</td>
<td>1 – Project</td>
</tr>
</tbody>
</table>

### Asphalt Treated Base

<table>
<thead>
<tr>
<th>Description</th>
<th>Grading &amp; Asphalt Content</th>
<th>Compaction, See Note 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate</td>
<td>Grading &amp; Asphalt Content</td>
<td>1 – 1000 Ton</td>
</tr>
<tr>
<td>Completed Mix</td>
<td>Grading &amp; Asphalt Content</td>
<td>1 – 1000 Ton</td>
</tr>
<tr>
<td>See Note 4</td>
<td>Compaction, See Note 2</td>
<td>5 – Control Lot</td>
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</tbody>
</table>

### Asphalt Materials Certification

<table>
<thead>
<tr>
<th>Description</th>
<th>Verification</th>
<th>Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binder Asphalt (AR, PG, Etc.)</td>
<td>2-1 quart</td>
<td>every other mix acceptance sample, see Note 6</td>
</tr>
<tr>
<td>liquid Asphalt (Cutback, Emulsion)</td>
<td>2-1 quart</td>
<td>every other shipment</td>
</tr>
<tr>
<td>Emulsion for ACP Tack Coat</td>
<td>None required</td>
<td></td>
</tr>
<tr>
<td>Rubberized Asphalt</td>
<td>2-1 quart</td>
<td>every other mix acceptance sample</td>
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</table>

### Compaction

<table>
<thead>
<tr>
<th>Description</th>
<th>Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embankment</td>
<td>1 – 2500 CY</td>
</tr>
<tr>
<td>Cut Section</td>
<td>1 – 500 LF</td>
</tr>
<tr>
<td>Surfacing</td>
<td>1 – 1,000 LF (per layer)</td>
</tr>
<tr>
<td>Backfill</td>
<td>1 – 500 CY</td>
</tr>
</tbody>
</table>

---

**Note 1** Tests for grading will be performed only when aggregates are being produced and stockpiled for use on a future project.

**Note 2** A control lot shall be a normal days production.

**Note 3** For projects under statistical acceptance, the sampling shall be performed on a random basis and the sublot size shall be determined to provide not less than three uniform-sized sublots with a maximum sublot size of 800 tons. Should a lot contain less than three sublots, acceptance will be in accordance with nonstatistical evaluation. For projects under nonstatistical acceptance, sample frequency shall be one sample per sublot, and the sublots shall be approximately uniform in size with a maximum sublot size of 800 tons.

**Note 4** Mix design conformation samples shall be submitted to the State Materials Laboratory Bituminous Concrete Section. For all projects, submit one sample per day from the first five days of production for each plant and one sample every fifth day of production thereafter. The conformation samples should be taken in conjunction with and be a representative quarter, of the acceptance samples taken for the project as described in WSDOT Test Method 712. If no acceptance sample is required for any day of production no conformation sample will be required either.

**Note 5** Cement may be accepted by the Engineer based on the Manufacturer’s Mill Test Report number indicating full conformance to the Specifications. The Engineer has the option of taking samples at the job site for submission to the State Materials Laboratory for testing.

**Note 6** The first sample of asphalt binder will be taken with the second Hot Mix Asphalt (HMA) mix sample. For nonstatistical HMA, take one sample for every 1,600 tons of mixture.

**Note 7** The frequency for fine, course, and combined concrete aggregate samples for PCC Paving and PCC Structures shall be based on the cubic yard (CY) of concrete.

**Note 8** Sample the first truck, and each load until two successive loads meet specifications, and then randomly test one load for every five loads. If at any time one load fails to meet specifications, continue testing every load until two successive loads meet specifications, and then randomly test one load for every five loads.

**Note 9** For materials placed in a non-structural application outside the roadway prism such as slope flattening or shoulder dressing, acceptance for compaction may be based on visual inspection to the satisfaction of the engineer.
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, nuclear density gauges. 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 a nuclear density gauge containing radioactive materials.

Each Region shall have a Regional Radiation Administration Officer (RAO) and a Regional Radiation Safety Officer (RSO) whose duties are described in Chapter 9-6.2 and 9-6.3. All Regional RAO and RSO personnel must have radiation safety training. Only personnel who have successfully completed the WSDOT “Nuclear Gauge Safety and Operations” course are authorized to use or transport the nuclear density gauge. Personnel transporting gauges through a common carrier are required to have training that satisfies USDOT training requirements of 49 CFR 172, subpart H (HAZMAT). Recurrent training is required every 3 years (every 2 years if gauges are to be shipped by air). To perform acceptance testing with the nuclear density gauge all personnel must become a qualified or interim tester in either TM-8, In-Place Density of Bituminous Mixtures Using the Nuclear Moisture Gauge, and or, T-310, In-Place Density and Moisture Content of Soils and Soil-Aggregate by Nuclear Method. The operator’s responsibilities for safety and security of the gauges are described in Chapter 9-6.4.

All personnel using or responsible for the nuclear density gauge shall be:

1. Thoroughly familiar with the safe handling techniques for using radioactive materials.
2. Fully informed of the hazards to health that exists 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.

Copies of the above publications will be kept by the Region Radiation Safety Officer and at the storage location of the gauge. A copy of the Radiation Emergency Handbook will also be supplied with each nuclear density gauge. Authorized Operator(s) 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 nuclear density gauge:

1. Radiation Safety Officer.
2. Radiation Administration Officer

The RSO or the RAO will notify, the following people or agencies:

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. State Radiation Administration Officer or Radiation Safety Officer, at the Materials Laboratory.

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 nuclear density gauge.

It is paramount to the Department that its employees work in a healthy and safe environment. To this end each employee that works around or with nuclear gauges needs to know the potential hazards of working with nuclear gauges and their individual rights. Each office that uses or stores nuclear gauges shall have a copy of the latest “Sealed Source Edition Rules & Regulations for Radiation Protection” published by the Department of Health. Every employee that uses or works near the storage location of the nuclear gauges must sign the “Acknowledgment of the Hazards of Working with Radiation Sources” form after being instructed to review the applicable Chapters 246-220 Radiation - General Provisions; 246-221 Radiation Protection Standards; 246-222 Radiation Protection - Worker Rights. This form is available through the Radiation Safety Officer.

Personal monitoring of radiation received from the nuclear density gauge is one of the major items in the Health Safety Program. Any individual using radioactive sources or receiving on the job training with 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. Attention is to be made to the conditions outlined in WAC 246-221-010 and WAC 246-221-055 regarding the radiation exposure during pregnancy and dose limits to the embryo/fetus. Personnel with valid safety or health concerns may be released from the operation of nuclear gauges without prejudice to their career opportunities with the Department.

The acquisition of radiation exposure badges as needed by each Region shall be the responsibility of the Regional Radiation Safety Officer or a designated individual with radiation safety training. These badges can be obtained from U.S. Dosimeter 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 (Thermal Luminescent Dosimeter) badges indicating exposure to gamma, beta, x-ray, and neutron radiation will be used as a minimum.

Each nuclear density gauge will be supplied in the manufacture’s shipping container with an adequate latch. While transporting and when storing the nuclear density gauge, it must be secured with a minimum of 3 levels of security using locks:
1. Security level one is considered to be a combination of a lock on the handle of the nuclear density gauge, and a lock on the manufacturer’s shipping container.

2. Security level two is considered to be the chain and lock combination, or other locking mechanism, used to secure the manufacturers shipping container to the vehicle or toolbox.

3. Security level three is considered to be:
   a. If a passenger vehicle is used for transporting, the manufacturers shipping container containing the nuclear density gauge, which is secured and locked in the trunk.
   b. If a station wagon, van, or panel truck is used, the manufacturer’s shipping container containing the nuclear density gauge, which is secured and locked in the back of the vehicle in such a manner as to prevent it from moving during transport. Note, if the manufacturer’s shipping container can be seen through a window or other opening it must be covered.
   c. If a six-passenger pickup with a utility box is used, the manufacturer’s shipping container containing the nuclear density gauge, which is secured in the utility box with the storage lid locked. The nuclear density gauge shall not be transported in the cab of the truck.
   d. If a pickup is used, the manufacturer’s shipping container containing the nuclear density gauge, which is secured to the inside of a suitable utility box. The utility box must be secured to the bed of the pickup and locked to prevent theft.

At all times, the key(s) for the security locks will be in the possession of the individual responsible for the nuclear density gauge.

Every effort shall be made to store and transport nuclear density gauges in an effort to minimize its view from the general public.

When the nuclear density gauges are not in use or in transit, they must be stored with three levels of security in licensed storage locations, or temporary storage facilities approved by the Regional RSO.

Performance audits shall be conducted randomly by the Region Radiation Safety Officer or designee to ensure that each gauge user:
1) Understands the security and transportation requirements described above.
2) Has the necessary means available to use three levels of security in each of their transport vehicles.
3) Is actively employing the three levels of security while gauges are out of a licensed storage area.

The Region Radiation Safety Officer shall retain records of performance audits.

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 (RSO) will notify the Department of Health and request an appropriate amendment.

The Radiation Safety Officer must be listed on the license. Individual operators are not required to be on the license, but the Radiation Administration Officer or RSO must maintain a list of authorized operators. This list of authorized operators should include the operator’s name, type of training, final test score, and a copy of the training certificate. The RAO or RSO will be responsible for the storage of the nuclear density gauge when not in field use, and the assignment of nuclear density gauge to the individual project offices. The RAO or RSO 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 nuclear density gauge 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. The State Materials Laboratory shall be notified of any repairs or calibration that is needed to the nuclear density gauge. When the nuclear density gauges 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.”
4. DOH Form “Notification of a Radiation Emergency.”
9-6.3 Radiation Safety Officer

The Radiation Safety Officer (RSO) will have the responsibility for the Regional radiation protection program. The RSO will be responsible for maintaining the following records:

1. Leak test records.
2. Medical records.
5. The Acknowledgment of the Hazards of Working with Radiation Sources form.

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 Regional RSO shall be responsible for having each source wiped every six months. The analysis of leak tests shall be done by a commercial firm licensed to do this work.

The service contract will be obtained by individual regions. Records of leak test results shall be kept in units of micro-curies and maintained for inspection. Any leak test revealing the presence of 1850 Bq or more of removable radioactive material shall be reported to the Department of Health, Division of Radiation Protection, P.O. Box 47827, Olympia, WA 98504-7827, 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 regions 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 0.005 mSv per hour in order to comply with U.S. Postal Regulations.

The RSO will be responsible for radiation exposure reports for their 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 Authorized Operators

The Authorized Operators will be directly responsible to the RAO for the use and storage of the nuclear density gauge in the field and to the RSO for all safety in regard to the nuclear density gauge.

The Authorized 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.”
4. DOH Form “Notification of a Radiation Emergency.”

The Authorized Operator must keep the RAO or RSO informed of the location of the nuclear density gauge 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 nuclear density gauge will be used is known in advance, it should be noted before leaving the Region office, and if unknown, shall be forwarded to the RAO or RSO as soon as it is known.

The operation of the shutter-operating device should be continuously checked and any malfunction reported to the RAO or RSO 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 15 feet (5 meters) of the gauge.

9-7 Vacant

9-8 WSDOT Testing Methods

9-8.1 Calibrated/Verified Equipment for Testing

The following listed equipment used in the Region Laboratory and in the Field Laboratory for acceptance testing is required to be verified and/or calibrated annually, and shall bear a tag indicating when the calibration or verification will expire. It is the responsibility of the testing personnel (i.e., Module Qualified Testers, Method Qualified Testers, or Interim Qualified Testers and Independent Assurance Inspectors) to check all equipment for serviceability and conformance to the requirements of the test procedure. No equipment with an expired calibration or verification shall be used for testing.
Aggregates Testing:  Drying Ovens (AASHTO T-255, 265), General Purpose Balances, Scales and Weights (AASHTO M-231), Mechanical Sieve Shaker (AASHTO T-27), Sand Equivalent Shaker (AASHTO T-176), Sand Equivalent Weighted Foot Assembly (AASHTO T-176), Sand Equivalent Irrigation Tube (AASHTO T-176), Sieves (AASHTO M-92), Thermometers, Timing Devices (AASHTO T-176), Fine Aggregate Apparatus (AASHTO T-304), Flat and Elongated Particle Shape Apparatus (ASTM D-4791), Hot Mix Asphalt Testing, Drying Ovens (AASHTO T-255, 265, and WAQTC TM-6), General Purpose Balances, Scales and Weights (AASHTO M-231), Ignition Furnace (AASHTO T-308), Mechanical Sieve Shaker (AASHTO T-30), Sieves (AASHTO M-92), Thermometer - ASTM 17C or 17F (AASHTO T-209), Thermometer – drying temperature, Timing Devices, Vacuum System (AASHTO T-209), Water Bath - if used (AASHTO T-209), Pycnometer (AASHTO T-209), Gyratory Compactor (AASHTO T-312), Weighting Bath (AASHTO T-166), Concrete Testing, Concrete Air Meters - Pressure gauge (AASHTO T-152), Concrete Air Meters - Volumetric gauge (AASHTO- T152), Cube Molds and Tamper (AASHTO T106 and WSDOT T-813) (no tag on tamper required), General Purpose Balances, Scales and Weights (AASHTO M-231), Rebound Hammer Type N (ASTM C-805), Single Use Molds (AASHTO M-205) (no tag required), Slump Cone and Rod (AASHTO T-119) (no tag on rod required), Thermometer (AASHTO T-309), Compression Testing Devise and associated equipment (AASHTO T-22, WSDOT T-802), Beam Molds (WSDOT T-808), Embankment and Base Density Testing, Drying Ovens (AASHTO T-255, 265), General Purpose Balances, Scales and Weights (AASHTO M-231), Manual Hammer (AASHTO T-99), Mechanical Sieve Shaker (AASHTO T-27), Maximum Density Devise (WSDOT T-606), Nuclear Density Gauge (AASHTO T-310), Sieves (AASHTO M-92), Speedy Moisture Meter (AASHTO T-217), Soil Mold (AASHTO T-99 and WSDOT T-606), Straight Edge (AASHTO T-99), Hot Mix Asphalt Density Testing, Nuclear Density Gauge (WAQTC TM-8), Thermometer

9-8.2 Field Test Methods for Materials

The test method as specified by WSDOT Materials Manual will be used to perform the testing. All testing will be performed by Module Qualified Testers, Individual Method Qualified Testers, or Interim Qualified Testers as defined in Chapter 9-5 of this manual. The tester can be qualified in a testing module, or by individual test methods. Section 9-8.2A is the list of the tests that are included in each of the modules. A tester can be Individual Method Qualified in any test that are included in the modules or from the list of individual tests in Section 9-8.2B, however the tester is not limited to just these tests. All of the test methods listed in each of the testing modules can be found in the blue pages following this section, see Section 9-8.2C for the Contents. In addition the WSDOT and WAQTC test methods that are performed in the field and that are listed in Section 9-8.2B are included.
### 9-8.2A Testing Modules

**Testing Modules Procedures**

**Aggregate Module**

<table>
<thead>
<tr>
<th>Procedure Number</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>AASHTO T-2</td>
<td>WSDOT FOP for AASHTO for the Sampling of Aggregates</td>
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<tr>
<td>AASHTO T-27/T11</td>
<td>FOP for WAQTC/AASHTO for the Sieve Analysis of Fine &amp; Coarse Aggregates</td>
</tr>
<tr>
<td>AASHTO T-176</td>
<td>WSDOT FOP for AASHTO for Determining the Plastic Fines in Graded Aggregate by Use of the Sand Equivalent Test</td>
</tr>
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<td>WSDOT FOP for AASHTO for Reducing Field Samples of Aggregates to Testing Size</td>
</tr>
<tr>
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<td>WSDOT FOP for AASHTO for Determining the Total Moisture Content of Aggregate by Drying</td>
</tr>
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<tr>
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</tr>
<tr>
<td>AASHTO T-27/T11</td>
<td>FOP for WAQTC/AASHTO for the Sieve Analysis of Fine &amp; Coarse Aggregates</td>
</tr>
<tr>
<td>AASHTO T-40</td>
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<tr>
<td>AASHTO T-308</td>
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<td>AASHTO T-329</td>
<td>FOP for AASHTO Moisture Content of Hot Mix Asphalt (HMA) by Oven Method</td>
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</tr>
<tr>
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</tr>
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<tr>
<td>WSDOT SOP 615</td>
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<tr>
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<tr>
<td>T 22</td>
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</tr>
<tr>
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</tr>
<tr>
<td>T 88</td>
<td>AASHTO</td>
<td>Particle Size Analysis of Soils</td>
</tr>
<tr>
<td>T 99</td>
<td>WSDOT</td>
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<tr>
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</tr>
<tr>
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<td>Weight per Cubic Foot, Yield, and Air Content of Concrete</td>
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<tr>
<td>T 123</td>
<td>WSDOT</td>
<td>Method of Test for Bark Mulch</td>
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<tr>
<td>T 166</td>
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<td>FOP for AASHTO for Bulk Specific Gravity of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens</td>
</tr>
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</tr>
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<td>T 217</td>
<td>WSDOT</td>
<td><strong>FOP for AASHTO</strong> for Determination of Moisture in Soils by Means of a Calcium Carbide Gas Pressure Moisture Tester</td>
</tr>
<tr>
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</tr>
<tr>
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<td>T 304</td>
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<td>FOP for AASHTO for Standard Method of Test for Uncompacted Void Content of Fine Aggregate</td>
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<tr>
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<td>FOP for AASHTO for Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor</td>
</tr>
<tr>
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<td>FOP for ASTM for Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)</td>
</tr>
<tr>
<td>D 1186</td>
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</tr>
<tr>
<td>D 4791</td>
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<td>FOP for ASTM for Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate</td>
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<td>WSDOT</td>
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</tr>
<tr>
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<td><strong>FOP for WAQTC for</strong> Sampling Freshly Mixed Concrete</td>
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<tr>
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<td><strong>FOP for WAQTC for</strong> In-Place Density of Bituminous Mixes Using the nuclear Moisture-Density</td>
</tr>
<tr>
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<td><strong>FOP for AASHTO for</strong> Making and Curing Concrete test Specimens in the Field</td>
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<td>T 166</td>
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WSDOT FOP for AASHTO T 2¹

Standard Practice for Sampling Aggregates

1. Scope

1.1 This practice covers sampling of coarse and fine aggregates for the following purposes:

1.1.1 Preliminary investigation of the potential source of supply,
1.1.2 Control of the product at the source of supply,
1.1.3 Control of the operations at the site of use, and
1.1.4 Acceptance or rejection of the materials.

1.2 The values stated in English units are to be regarded as the standard.

1.3 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 AASHTO Standards:

T 248 Reducing Samples of Aggregate to Testing Size

2.2 ASTM Standards:

C 702 Practice for Reducing Field Samples of Aggregate to Testing Size
D 2234 Test Method for Collection of a Gross Sample of Coal
D 3665 Practice for Random Sampling of Construction Materials
E 105 Practice for Probability Sampling of Materials
E 122 Practice for Choice of Sample Size to Estimate the Average Quality of a Lot or Process
E 141 Practice for Acceptance of Evidence Based on the Results of Probability Sampling

¹ This Procedure is based on AASHTO T 2-91 (2000) and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
3. Significance and Use

3.1 Sampling is equally as important as the testing, and the sampler shall use every precaution to obtain samples that will show the nature and condition of the materials which they represent.

3.2 When sampling of aggregate sources for preliminary testing, the sampling must be witnessed or taken by a designated representative of the Regional Materials Engineer. The Acceptance samples will be taken by a qualified tester employed by the contracting agency or their designated qualified representative.

Note 2: The preliminary investigation and sampling of potential aggregate sources and types occupies a very important place in determining the availability and suitability of the largest single constituent entering into the construction. It influences the type of construction from the standpoint of economics and governs the necessary material control to ensure durability of the resulting structure, from the aggregate standpoint. This investigation should be done only by agency guidelines. For more comprehensive guidance, see the Appendix.

4. SECURING SAMPLES

4.1 General — Where practicable, samples to be tested for quality shall be obtained from the finished product. Samples from the finished product to be tested for abrasion loss shall not be subject to further crushing or manual reduction in particle size in preparation for the abrasion test unless the size of the finished product is such that it requires further reduction for testing purposes.

Native soils within the contract limits to be used for embankment construction and/or backfill material do not require the sampling by a qualified tester. For material that requires gradation testing such as but not limited to manufactured aggregates and Gravel Borrow, a qualified tester shall be required for sampling.

4.2 Inspection — The material shall be inspected to determine discernible variations. The seller shall provide suitable equipment needed for proper inspection and sampling.

4.3 Procedure

4.3.1 Sampling from a Flowing Aggregate Stream (Bins or Belt Discharge) — Select units to be sampled by a random method, from the production. Obtain a field sample whose mass equals or exceeds the minimum recommended in 4.4.2. Take the sample from the entire cross section of the material as it is being discharged. The Standard Specifications require an mechanical, automatic or semi-automatic sampling device be used for processed materials.

Note 3: Sampling the initial discharge or the final few tons from a bin or conveyor belt increases the chances of obtaining segregated material and should be avoided.
4.3.2 Sampling from the Conveyor Belt (Stopped)— Select units to be sampled by a random method, from the production. Obtain a field sample selected at random, from the unit being sampled and combine to form a field sample whose mass equals or exceeds the minimum recommended in 4.4.2. Stop the conveyor belt while the sample increments are being obtained. Insert two templates, the shape of which conforms to the shape of the belt in the aggregate stream on the belt, and space them such that the material contained between them will yield an increment of the required weight. Carefully scoop all material between the templates into a suitable container and collect the fines on the belt with a brush and dust pan and add to the container.

4.3.3 Sampling from Stockpiles or Transportation Units — Avoid sampling coarse aggregate or mixed coarse and fine aggregate from stockpiles or transportation units whenever possible, particularly when the sampling is done for the purpose of determining aggregate properties that may be dependent upon the grading of the sample. If circumstances make it necessary to obtain samples from a stockpile of coarse aggregate or a stockpile of combined coarse and fine aggregate, design a sampling plan for the specific case under consideration. The sampling plan shall define the number of samples necessary to represent lots and sublots of specific sizes. General principles for sampling from stockpiles are applicable to sampling from trucks, rail cars, barges or other transportation units. For general guidance in sampling from stockpiles, see the Appendix.

4.3.4 Sampling from Roadway (Bases and Subbases) — WSDOT has deleted this section.

4.4 Number and Masses of Field Samples

4.4.1 The number of field samples (obtained by one of the methods described in 4.3) required depends on the criticality of, and variation in, the properties to be measured. Designate each unit from which a field sample is to be obtained prior to sampling. The number of field samples from the production should be sufficient to give the desired confidence in test results.

*Note 4:* Guidance for determining the number of samples required to obtain the desired level of confidence in test results may be found in Test Method D 2234, Practice E 105, Practice E 122, and Practice E 141.

4.4.2 The field sample masses cited are tentative. The masses must be predicated on the type and number of tests to which the material is to be subjected and sufficient material obtained to provide for the proper execution of these tests. Standard acceptance and control tests are covered by ASTM standards and specify the portion of the field sample required for each specific test. Generally speaking, the amounts specified in Table 1 will provide adequate material for routine grading and quality analysis. Extract test portions from the field sample according to T 248 or as required by other applicable test methods.
5. SHIPPING SAMPLES

5.1 Transport aggregates in bags or other containers so constructed as to preclude loss or contamination of any part of the sample, or damage to the contents from mishandling during shipment. The weight limit for each bag of aggregate is 30 pounds maximum.

5.2 Shipping containers for aggregate samples shall have suitable individual identification attached and enclosed so that field reporting, laboratory logging, and test reporting may be facilitated.

All samples submitted for testing to the Region or State Materials Laboratories shall be accompanied by completed sample transmittal (WSDOT Form 350-056) or equivalent.

<table>
<thead>
<tr>
<th>Nominal Maximum Size A* in (mm)</th>
<th>Minimum Mass B lb (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>US No. 4 (4.75)</td>
<td>5 (2)</td>
</tr>
<tr>
<td>¼ (6.3)</td>
<td>10 (4)</td>
</tr>
<tr>
<td>⅜ (9.5)</td>
<td>10 (4)</td>
</tr>
<tr>
<td>½ (12.5)</td>
<td>20 (8)</td>
</tr>
<tr>
<td>⅝ (16.0)</td>
<td>20 (8)</td>
</tr>
<tr>
<td>¾ (19.0)</td>
<td>30 (12)</td>
</tr>
<tr>
<td>1 (25.0)</td>
<td>55 (25)</td>
</tr>
<tr>
<td>1¼ (31.5)</td>
<td>70 (30)</td>
</tr>
<tr>
<td>1½ (37.5)</td>
<td>80 (36)</td>
</tr>
<tr>
<td>2 (50)</td>
<td>90 (40)</td>
</tr>
<tr>
<td>2½ (63)</td>
<td>110 (50)</td>
</tr>
<tr>
<td>3 (75)</td>
<td>140 (60)</td>
</tr>
<tr>
<td>3½ (90)</td>
<td>180 (80)</td>
</tr>
</tbody>
</table>

A* For aggregate, the nominal maximum size, (NMS) is the largest standard sieve opening listed in the applicable specification, upon which any material is permitted to be retained. For concrete aggregate, NMS is the smallest standard sieve opening through which the entire amount of aggregate is permitted to pass.

Size of Samples

Table 1

Note 5: For an aggregate specification having a generally unrestrictive gradation (i.e. wide range of permissible upper sizes), where the source consistently fully passes a screen substantially smaller than the maximum specified size, the nominal maximum size, for the purpose of defining sampling and test specimen size requirements may be adjusted to the screen, found by experience to retain no more than 5% of the materials.
APPENDIXES

XI. SAMPLING AGGREGATE FROM STOCKPILES OR TRANSPORTATION UNITS

X1.1 Scope

X1.1.1 In some situations it is mandatory to sample aggregates that have been stored in stockpiles or loaded into rail cars, barges, or trucks. In such cases the procedure should ensure that segregation does not introduce a serious bias in the results.

X1.2 Sampling From Stockpiles

X1.2.1 In sampling material from stockpiles it is very difficult to ensure unbiased samples, due to the segregation which often occurs when material is stockpiled, with coarser particles rolling to the outside base of the pile. For coarse or mixed coarse and fine aggregate, every effort should be made to enlist the services of power equipment, such as a front end loader, to develop a separate, small sampling pile composed of materials drawn from various levels and locations in the main pile after which several increments may be combined to compose the field sample. If necessary to indicate the degree of variability existing within the main pile, separate samples should be drawn from separate areas of the pile.

X1.2.2 Where power equipment is not available, samples from stockpiles should be made up of at least three increments taken from the top third, at the mid-point, and at the bottom third of the volume of the pile. A board shoved vertically into the pile just above the sampling point aids in preventing further segregation. In sampling stockpiles of fine aggregate the outer layer, which may have become segregated, should be removed and the sample taken from the material beneath. Sampling tubes approximately 1 ½ in. (30-mm) min by 6 ft. (2-m) min in length may be inserted into the pile at random locations to extract a minimum of five increments of material to form the sample.

X1.3 Sampling From Transportation Units

X1.3.1 In sampling coarse aggregates from railroad cars or barges, effort should be made to enlist the services of power equipment capable of exposing the material at various levels and random locations. Where power equipment is not available, a common procedure requires excavation of three or more trenches across the unit at points that will, from visual appearance, give a reasonable estimate of the characteristics of the load. The trench bottom should be approximately level, at least _ ft. (0.3 m) in width and in depth below the surface. A minimum of three increments from approximately equally spaced points along each trench should be taken by pushing a shovel downward into the material. Coarse aggregate in trucks should be sampled in essentially the same manner as for rail car or barges, except for adjusting the number of increments according to the size of the truck. For fine aggregate in transportation units, sampling tubes as described in X1.2 may be used to extract an appropriate number of increments to form the sample.
X2. EXPLORATION OF POTENTIAL AGGREGATE SOURCES

X2.1 Scope

X2.1.1 Sampling for evaluation of potential aggregate sources should be performed by a responsible trained and experienced person. Because of the wide variety of conditions under which sampling may have to be done it is not possible to describe detailed procedures applicable to all circumstances. This appendix is intended to provide general guidance and list more comprehensive references.

X2.2 Sampling Stone from Quarries of Ledges

X2.2.1 Inspection — The ledge or quarry face should be inspected to determine discernible variations or strata. Differences in color and structure should be recorded.

X2.2.2 Sampling and Size of Sample — Separate samples having a mass of at least 55 lbs (25 kg) should be obtained from each discernible stratum. The sample should not include material weathered to such an extent that it is no longer suitable for the purpose intended. One or more pieces in each sample should be at least 6 X 6 X 4 inch (150 by 150 by 100 mm) in size with the bedding plane plainly marked, and this piece should be free of seams or fractures.

X2.2.3 Record — In addition to the general information accompanying all samples the following information should accompany samples taken from ledges or quarry faces:

X2.2.3.1 Approximate quantity available. (If quantities is very large this may be recorded as practically unlimited.)

X2.2.3.2 Quantity and character of overburden.

X2.2.3.3 A detailed record showing boundaries and location of material represented by each sample.

*Note X2.1:* A sketch, plan, and elevation, showing the thickness and location of the different layers is recommended for this purpose.
X2.3 Sampling Roadside or Bank Run Sand and Gravel Deposits

X2.3.1 Inspection — Potential sources of bank run sand and gravel may include previously worked pits from which there is an exposed face or potential deposits discovered through air-photo interpretation, geophysical exploration, or other types of terrain investigation.

X2.3.2 Sampling — Samples should be so chosen from each different stratum in the deposit discernible to the sampler. An estimate of the quantity of the different materials should be made. If the deposit is worked as an open-face bank or pit, samples should be taken by channeling the face vertically, bottom to top, so as to represent the materials proposed for use. Overburdened or disturbed material should not be included in the sample. Test holes should be excavated or drilled at numerous locations in the deposit to determine the quality of the material and the extent of the deposit beyond the exposed face, if any. The number and depth of test holes will depend upon the quantity of the material needed, topography of the area, nature of the deposit, character of the material, and potential value of the material in the deposit. If visual inspection indicates that there is considerable variation in the material, individual samples should be selected from the material in each well defined stratum. Each sample should be thoroughly mixed and quartered if necessary so that the field sample thus obtained will be at least 25 lb (12 kg) for sand and 75 lb (35 kg) if the deposit contains an appreciable amount of coarse aggregate.

X2.3.3 Record — In addition to the general information accompanying all samples the following information should accompany samples of bank run sand and gravel:

X2.3.3.1 Location of supply.
X2.3.3.2 Estimate of approximate quantity available.
X2.3.3.3 Quantity and character of overburden.
X2.3.3.4 Length of haul to proposed site of work.
X2.3.3.5 Character of haul (kind of road, maximum grades, etc.)
X2.3.3.6 Details as to extent and location of material represented by each sample. Performance Exam Checklist
# Performance Exam Checklist

## Sampling of Aggregates

**FOP for AASHTO T 2**

<table>
<thead>
<tr>
<th>Participant Name</th>
<th>Exam Date</th>
</tr>
</thead>
</table>

### Procedure Element

**Preparation**

1. The tester has a copy of the current procedure on hand? 
   Yes ☐ No ☐

**Conveyor Belts –Stopped**

2. Belt stopped? ☐ ☐
3. Sampling device set on belt, avoiding intrusion of adjacent material? ☐ ☐
4. Sample, including all fines, scooped off? ☐ ☐

**Flowing Aggregate Sampler**

5. Container passed through full stream of material as it runs off end of belt? (Mechanical, Automatic or Semi Automatic Sampler Only) ☐ ☐

**Transport Units**

6. Three or more trenches cut across the unit? ☐ ☐
7. Trench bottom level and approximate 1 foot wide and 1 foot below surface of material in unit? ☐ ☐
8. Three samples taken at equal spacing along each trench? ☐ ☐

**Stockpiles**

9. Create vertical face, if one does not exist, or use mechanical equipment to build a small sampling pile? ☐ ☐
10. At least three increments taken, at various locations? ☐ ☐

**Procedure Element**

11. If vertical face cannot be created, increment taken from at least three locations from top, middle, and bottom? ☐ ☐
12. When sampling sand, outer layer removed and increments taken from a least five locations? ☐ ☐

First attempt: Pass ☐ Fail ☐ Second attempt: Pass ☐ Fail ☐

Signature of Examiner ________________________________
Comments:
SAMPLING FRESHLY MIXED CONCRETE

FOP FOR WAQTC TM 2

SCOPE
This method covers procedures for obtaining representative samples of fresh concrete delivered to the project site and on which tests are to be performed to determine compliance with quality requirements of the specifications under which concrete is furnished. The method includes sampling from stationary, paving and truck mixers, and from agitating and non-agitating equipment used to transport central mixed concrete.

This method also covers the procedure for preparing a sample of concrete for further testing where it is necessary to remove aggregate larger than the designated size for the test method being performed. The removal of large aggregate particles is accomplished by wet sieving.

Sampling concrete may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices.

Warning—Fresh Hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

APPARATUS
- Wheelbarrow
- Cover for wheelbarrow (plastic, canvas, or burlap)
- Shovel
- 5 gal (19 L) bucket for water

SAMPLING REQUIREMENTS
For placement of one class of concrete 50 cys or less
- Sample each truck, after ½ cy has been discharged from truck, until one truck meets all applicable acceptance test requirements.
- After one truck meets the acceptance test requirements, the remaining concrete may be visually inspected.

For placement of one class of concrete greater than 50 yds
- Sample initial truck after ½ cy has been discharged from the truck (this material may not be placed in the forms)
- Sample each truck until two successive loads meet all applicable acceptance test requirements. Once two loads meet the acceptable standard, the sampling and testing frequency may decrease to one for every five truck loads.
- For all trucks, after the initial truck, sample the concrete after a minimum of ½ yd³ (½ m³) of concrete has been discharged into the forms.
RANDOM SAMPLE SELECTION

Concrete samples other than initial load samples or samples for questioned acceptance will be taken from each sublot by a random selection. Sublots are determined by the designated sampling frequency in the Standard Specifications. Random selection will be accomplished by using WSDOT Test Method T 716, Method of Random Sampling for Locations of Testing and Sampling Sites.

PROCEDURE

Use every precaution in order to obtain samples representative of the true nature and condition of the concrete being placed being careful not to obtain samples from the very first or very last portions of the batch. The size of the sample will be 1.5 times the volume of concrete required for the specified testing, but not less than 1 ft\(^3\) (0.03 m\(^3\)) after wet-sieving, if required.

Note 1: Sampling should normally be performed as the concrete is delivered from the mixer to the conveying vehicle used to transport the concrete to the forms; however, specifications may require other points of sampling, such as at the discharge of a concrete pump.

- **Sampling from stationary mixers, except paving mixers**
  Perform sampling by passing a receptacle completely through the discharge stream, or by completely diverting the discharge into a sample container. If discharge of the concrete is too rapid to divert the complete discharge stream, discharge the concrete into a container or transportation unit sufficiently large to accommodate the entire batch and then accomplish the sampling in the same manner as given for paving mixers. Take care not to restrict the flow of concrete from the mixer, container, or transportation unit so as to cause segregation. These requirements apply to both tilting and nontilting mixers.

- **Sampling from paving mixers**
  Obtain material from at least five different locations in the pile and combine into one test sample. Avoid contamination with subgrade material or prolonged contact with absorptive subgrade. To preclude contamination or absorption by the subgrade, sample the concrete by placing a shallow container on the subgrade and discharging the concrete across the container. The container shall be of a size sufficient to provide a sample size that is in agreement with the nominal maximum aggregate size.

- **Sampling from revolving drum truck mixers or agitators**
  Do not obtain samples until after all of the water has been added to the mixer. Do not obtain samples from the very first or last portions of the batch discharge. Sample by repeatedly passing a receptacle through the entire discharge stream or by completely diverting the discharge into a sample container. Regulate the rate of discharge of the batch by the rate of revolution of the drum and not by the size of the gate opening.

- **Sampling from open-top truck mixers, agitators, non-agitating equipment or other types of open-top containers**
  Sample by whichever of the procedures described above is most applicable under the given conditions.
**Sampling from pump or conveyor placement systems**

Do not obtain samples until after all of the pump slurry has been eliminated. Sample by repeatedly passing a receptacle through the entire discharge system or by completely diverting the discharge into a sample container. Do not lower the pump arm from the placement position to ground level for ease of sampling, as it may modify the air content of the concrete being sampled. Do not obtain samples from the very first or last portions of the batch discharge.

Transport samples to the place where fresh concrete tests are to be performed and specimens are to be molded.

Combine and remix the sample minimum amount necessary to ensure uniformity. Protect the sample from direct sunlight, wind, rain, and sources of contamination.

Complete test for temperature and start tests for slump and air content within 5 minutes of obtaining the sample. Complete tests as expeditiously as possible. Start molding specimens for strength tests within 15 minutes of obtaining the sample.

Report results on concrete delivery ticket (i.e., Certificate of Compliance).

The name of the qualified tester who performed the field acceptance test is required on concrete delivery tickets containing test results.

**WET SIEVING**

When required for slump testing, air content testing or molding test specimens the concrete sample shall be wet-sieved, prior to remixing, by the following:

1. Place the sieve designated by the test procedure over dampened sample container.
2. Pass the concrete over the designated sieve. Do not overload the sieve (one particle thick.)
3. Shake or vibrate the sieve until no more material passes the sieve.
4. Discard oversize material including all adherent mortar.
5. Repeat until sample of sufficient size is obtained.
6. Mortar adhering to the wet-sieving equipment shall be included with the sample.

*Note 1:* Wet-sieving is not allowed for samples being utilized for density determinations according to the FOP for AASHTO T 121.
Performance Exam

Checklist Sampling Freshly Mixed Concrete
FOP for WAQTC TM 2

<table>
<thead>
<tr>
<th>Participant Name</th>
<th>Exam Date</th>
</tr>
</thead>
</table>

**Procedure Element**

1. The tester has a copy of the current procedure on hand?
   - Yes [ ] No [ ]

2. Obtain a representative sample:
   a. Sample the concrete after ½ cy (½ m³) discharged?
      - Yes [ ] No [ ]
   b. Pass receptacle through entire discharge stream or completely divert discharge stream into sampling container?
      - Yes [ ] No [ ]
   c. Transport samples to place of testing?
      - Yes [ ] No [ ]
   d. Sample remixed?
      - Yes [ ] No [ ]
   e. Sample protected?
      - Yes [ ] No [ ]
   f. Minimum size of sample used for strength tests 1 ft³ (0.03 m³)?
      - Yes [ ] No [ ]

3. Start tests for slump and air within 5 minutes of sample being obtained?
   - Yes [ ] No [ ]

4. Start molding cylinders within 15 minutes of sample being obtained?
   - Yes [ ] No [ ]

5. Protect sample against rapid evaporation and contamination?
   - Yes [ ] No [ ]

**First attempt:** Pass [ ] Fail [ ]

**Second attempt:** Pass [ ] Fail [ ]

Signature of Examiner ________________________________

This checklist is derived, in part, from copyrighted material printed in ACI CP-1, published by the American Concrete Institute.

Comments:
IN-PLACE DENSITY OF HOT MIX ASPHALT USING THE NUCLEAR
MOISTURE-DENSITY GAUGE
FOP FOR WAQTC TM 8

Scope
This test method describes a test procedure for determining the density of Hot Mix Asphalt (HMA) by means of a nuclear gauge employing either direct transmission or backscatter methods. Correlation with densities determined under the FOP for AASHTO T 166 is required by some agencies.

Radiation Safety
This method does not purport to address all of the safety problems associated with its use. This test method involves potentially hazardous materials. The gauge utilizes radioactive materials that may be hazardous to the health of the user unless proper precautions are taken. Users of this gauge must become familiar with the applicable safety procedures and governmental regulations. All operators will be trained in radiation safety prior to operating nuclear density gauges. Some agencies require the use of personal monitoring devices such as a thermoluminescent dosimeter or film badge. Effective instructions together with routine safety procedures such as source leak tests, recording and evaluation of personal monitoring device data, etc., are a recommended part of the operation and storage of this gauge.

Apparatus
- Nuclear density gauge with the factory matched standard reference block.
- Drive pin, guide, scraper plate, and hammer for testing in direct transmission mode.
- Transport case for properly shipping and housing the gauge and tools.
- Instruction manual for the specific make and model of gauge.
- Radioactive materials information and calibration packet containing:
  - Daily Standard Count Log
  - Factory and Laboratory Calibration Data Sheet
  - Leak Test Certificate
  - Shippers Declaration for Dangerous Goods
  - Procedure Memo for Storing, Transporting and Handling Nuclear Testing Equipment
  - Other radioactive materials documentation as required by local regulatory requirements.

Material
- Filler material: Fine graded sand from the source used to produce the asphalt pavement or other agency approved materials.
Calibration
1. WSDOT has deleted this section, WSDOT performs calibrations according to the manufacturer’s Operators Manual.

Standardization
1. Turn the gauge on and allow it to stabilize (approximately 10 to 20 minutes) prior to standardization. Leave the power on during the day’s testing.
2. Standardize the nuclear gauge at the construction site at the start of each day’s work and as often as deemed necessary by the operator or agency. Daily variations in standard count shall not exceed the daily variations established by the manufacturer of the gauge. If the daily variations are exceeded after repeating the standardization procedure, the gauge should be repaired and or recalibrated.
3. Record the standard count for both density and moisture in the Daily Standard Count Log. The exact procedure for standard count is listed in the manufacturer’s Operators Manual.

Test Site Location
1. Select a test location(s) randomly and in accordance with WSDOT Test Method T 716. Test sites should be relatively smooth and flat and meet the following conditions:
   a. At least 33 ft (10 m) away from other sources of radioactivity
   b. At least 10 ft (3 m) away from large objects
   c. No closer than 24 in. (600 mm) to any vertical mass, or less than 18 in. (450 mm) 300 mm (12 in.) from a vertical pavement edge.

Overview
There are two methods for determining in-place density of HMA. See agency requirements for method selection.

• Direct Transmission - The standard for WSDOT is to run density tests in “Direct Transmission mode.”
• Backscatter - When the depth of Hot Mix Asphalt is less than 0.11 foot or when the driving of the drive pin is not possible to achieve the required depth for the gauge probe (i.e., underlying concrete) then a “Thin Lift Density gauge” or a Moisture Density Gauge in the “Thin Layer mode” will be allowed.
Procedure

Direct Transmission Mode

1. Maintaining maximum contact between the base of the gauge and the surface of the material under test is critical.
2. Use the guide and scraper plate as a template and drill a hole to a depth of at least ¼ in. (7 mm) deeper than the measurement depth required for the gauge.
3. Place the gauge on the prepared surface so the source rod can enter the hole. Insert the probe in the hole and lower the source rod to the desired test depth using the handle and trigger mechanism. Position the gauge with the long axis of the gauge parallel to the direction of paving. Pull the gauge so that the probe is firmly against the side of the hole.
   WSDOT Note: For alignment purposes, the user may expose the source rod for a maximum of ten seconds.
4. Take one four-minute test and record the wet density (WD) reading.

Backscatter (THIN LIFT) MODE

WSDOT has removed this section and replaced it with the following:

a. Place the gauge on the test site and extend the probe to the backscatter position.

b. Take tests in accordance with manufacturer’s recommendation. Contact the materials laboratory for direction.

Calculation of Results

See WSDOT SOP 729 to determine the percent compaction. It should be stressed that the numbers obtained with the nuclear gauge are simply in-place densities and tell the operator nothing in regard to relative compaction. In-place densities are to be compared with theoretical maximum density as determined by the FOP for AASHTO T 209.

The density reported for each test site shall be the average of the two individual one-minute tests. Percent compaction is determined by comparing the in-place wet density as determined by this method to the appropriate agency density standard. See appropriate agency policy for use of density standards.

Correlation with Cores

WSDOT has deleted this section, refer to WSDOT SOP 730.
Report

Report the test results for each subplot on WSDOT Form 350-092 or other report approved by the State Materials Engineer.

Results shall be reported on standard forms approved by the agency. Include the following information:

- Location of test and thickness of layer tested
- Mixture type
- Make, model and serial number of the nuclear moisture-density gauge
- Mode of measurement, depth, calculated wet density of each measurement and any adjustment data
- Standard density
- Percent compaction and/or percent air voids
- Name and signature of operator
Tester Qualification Practical Exam Checklist

In-place Density of Hot Mix Asphalt (HMA) Using the Nuclear Moisture-Density Gauge

FOP for WAQTC TM 8

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Gauge turned on?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Gauge standardized and standard count recorded?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Test location selected appropriately?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
| 6. Direct Transmission Mode:  
  a. Hole made a minimum of ¼ inch deeper than measurement depth? | ☐ | ☐ |
  b. Gauge placed parallel to direction of paving, probe extended, gauge pulled back so probe against hole? | ☐ | ☐ |
  c. For alignment purposes did not expose the source rod for more than 10 seconds. | ☐ | ☐ |
  d. One four-minute test made? | ☐ | ☐ |
  e. Wet density recorded? | ☐ | ☐ |
| 7. Backscatter Mode (Thin Lift):  
  a. Gauge placed, probe extended to backscatter position? | ☐ | ☐ |
  b. One four minute test made; gauge placed as described in the manufacture recommendations? | ☐ | ☐ | ☑ |
  c. Wet Densities recorded? | ☐ | ☐ | ☑ |
| 8. All calculations performed correctly? | ☐ | ☐ |
| 9. Nuclear Gauge secured in a manner consistent with current DOH requirements? | ☐ | ☐ |

First attempt: Pass ☐ Fail ☐  Second attempt: Pass ☐ Fail ☐

Signature of Examiner  ________________________________
Comments:
WSDOT FOP for AASHTO T 23¹

Making and Curing Concrete Test Specimens in the Field

1. SCOPE

1.1 This method covers procedures for making and curing cylinder specimens from representative samples of fresh concrete for a construction project.

1.2 The concrete used to make the molded specimens shall be sampled after all on-site adjustments have been made to the mixture proportions, including the addition of mix water and admixtures, except as modified in Section 5.1. This practice is not satisfactory for making specimens from concrete not having measurable slump or requiring other sizes or shapes of specimens.

1.3 The values stated in SI units are to be regarded as the standard.

1.4 This standard does not purport to address the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. (Warning: Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to exposed skin and tissue upon prolonged exposure.)

2. REFERENCED DOCUMENTS

2.1 AASHTO Standards:

M 195 Lightweight Aggregates for Structural Concrete
M 201 Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
M 205 Molds for Forming Concrete Test Cylinders Vertically
R 39 Making and Curing Concrete Test Specimens in the Laboratory
T 197 Time of Setting of Concrete Mixtures by Penetration Resistance
T 231 Capping Cylindrical Concrete Specimens

ASTM Standards:

C 125 Terminology Related to Concrete and Concrete Aggregates

ACI Standards:

309 R Guide for Consolidation of Concrete

WAQTC:

TM 2 Sampling Freshly Mixed Concrete

¹ This FOP is based on AASHTO T 23-08, and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
3. Terminology
For definitions of terms used in this practice, refer to Terminology ASTM C 125.

4. SIGNIFICANCE AND USE
4.1 This practice provides standardized requirements for making, curing, protecting, and transporting concrete test specimens under field conditions.

4.2 If the specimens are made and standard cured, as stipulated here, the resulting strength test data where the specimens are tested are able to be used for the following purposes:
   4.2.1 Acceptance testing for specified strength,
   4.2.2 Checking the adequacy of mixture proportions for strength.
   4.2.3 Quality control.

4.3 If the specimens are made and field cured, as stipulated herein, the resulting strength test data when the specimens are tested are able to be used for the following purposes:
   4.3.1 Determination of whether a structure is capable of being put in service.
   4.3.2 Comparison with test results of standard cured specimens or with test results from various in-place test methods,
   4.3.4 Adequacy of curing and protection of concrete in the structure, or,
   4.3.5 Form or shoring removal time requirements,

5. APPARATUS
5.1 Cylinder: Molds for casting concrete test specimens shall conform to the requirements of M 205, and shall come from an approved shipment as verified by the WSDOT Quality Systems Manual Verification Procedure No. 2.

5.2 Beam Molds — Refer to WSDOT Test Method T 808.

5.3 Tamping Rod — Two sizes are specified as indicated in Table 1. Each shall be a round, straight steel rod with at least the tamping end rounded to a hemispherical tip of the same diameter as the rod. Both ends may be rounded if preferred.

<table>
<thead>
<tr>
<th>Diameter of Cylinder, in (mm.)</th>
<th>Diameter, in (mm.)</th>
<th>Length of Rod, in (mm.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;6 (150)</td>
<td>⅜ (10)</td>
<td>12 (300)</td>
</tr>
<tr>
<td>6 (150)</td>
<td>⅝ (16)</td>
<td>20 (500)</td>
</tr>
</tbody>
</table>

Rod tolerances length 100 mm (±4 in.) and diameter 2 mm (± 1/16 in).

Tamping Rod Requirements

Table 1
5.4 Vibrators — Internal vibrators shall be used. The vibrator frequency shall be at least 7,000 vibrations per minute at 150 Hz while the vibrator is operating in the concrete. The diameter of a round vibrator shall be no more than one-fourth the diameter of the cylinder mold or one-fourth the width of the beam mold. Other shaped vibrators shall have a perimeter equivalent to the circumference of an appropriate round vibrator. The combined length of the vibrator shaft and vibrating element shall exceed the depth of the section being vibrated by at least 3 in. (75 mm). The vibrator frequency shall be checked periodically.

Note 1: For information on size and frequency of various vibrators and a method to periodically check vibrator frequency, see ACI 309R.

5.5 Mallet — A mallet with a rubber or rawhide head weighing 1.25 ± 0.50 lb [0.57 ± 0.23 kg] shall be used.

5.6 Small Tools — Tools and items that may be required are shovels, pails, trowels, wood float, metal float, blunted trowels, straightedge, feeler gauge, scoops, and rules.

5.7 Sampling and Mixing Receptacle — The receptacle shall be a suitable heavy gage metal pan, wheelbarrow, or flat, clean non-absorbent mixing board of sufficient capacity to allow easy remixing of the entire sample with a shovel or trowel.

5.8 Cure Box- The cure box shall be capable of maintaining temperatures between 60°F and 80°F. The box shall also be capable of maintaining an environment that does not allow moisture loss from the concrete cylinders.

5.9 Temperature Measuring Device- The temperature measuring device shall be capable of recording the minimum and maximum temperature within a 24 hr period. The thermometer shall be capable of reading from 32°F to 150°F (0°C to 65°C) with an accuracy of 1.80°F (1°C).

6. TESTING REQUIREMENTS

Testing for determining the compressive strength at 28 days shall require a set of two specimens made from the same sample.

6.1 Compressive Strength Specimens — Compressive strength specimens shall be cylinders cast and allowed to set in an upright position. The length shall be twice the diameter. The cylinder diameter shall be at least three times the nominal maximum size of the coarse aggregate. The standard specimen shall be the 4 by 8-in. (100 by 200-mm) cylinder when the nominal maximum size of the coarse aggregate does not exceed 1 in. (25 mm). When the nominal maximum size of the coarse aggregate exceeds 1 in. (25 mm) the specimens shall be made with 6 by 12 in. (150 by 300 mm) cylinders. **Mixing of cylinder sizes for a particular concrete mix design is not permitted on a project.** When the nominal maximum size of the coarse aggregate exceeds 2 in (50 mm), the concrete sample shall be treated by wet sieving through a 2 in (50 mm) sieve as described in FOP for WAQTC TM 2. Contact the Materials Laboratory for directions.

Note 2: The nominal maximum size is the smallest sieve opening through which the entire amount of aggregate is REQUIRED to pass.

Note 3: When molds in SI units are required and not available, equivalent inch-pound unit size molds should be permitted.
6.2 Flexural Strength Specimens
Refer to WSDOT Test Method T 808

7. SAMPLING CONCRETE
7.1 The samples used to fabricate test specimens under this standard shall be obtained in accordance with FOP for WAQTC TM-2 unless an alternative procedure has been approved.
7.2 Record the identification of the sample with respect to the location of the concrete represented and the time of casting.
7.3 Cylinders shall be made using fresh concrete from the same sample as the slump, air content and temperature tests. Material from the slump, air content, and unit weight tests cannot be reused to construct cylinders.

8. MOLDING SPECIMENS
8.1 Place of Molding — Mold specimens on a level, rigid horizontal surface, free of vibration and other disturbances, at a place as near as practicable to the location where they are to be stored.
8.2 Casting the Concrete — Place the concrete in the mold using a scoop, blunted trowel, or shovel. Select each scoopful, trowelful, or shovelful of concrete from the mixing pan to ensure that it is representative of the batch. Remix the concrete in the mixing pan with a shovel or trowel to prevent segregation during the molding of specimens. Move the scoop, trowel, or shovel around the perimeter of the mold opening when adding concrete so the concrete is uniformly distributed within each layer with a minimum of segregation. Further distribute the concrete by use of the tamping rod prior to the start of consolidation. In placing the final layer, the operator shall attempt to add an amount of concrete that will exactly fill the mold after consolidation. Underfilled molds shall be adjusted with representative concrete during consolidation of the top layer. Overfilled molds shall have excess concrete removed.
8.2.1 Number of Layers — Make specimens in layers as indicated in Table 2 or 3.

<table>
<thead>
<tr>
<th>Specimen Type and Size</th>
<th>Number of Layers of Approximately Equal Depth</th>
<th>Number of Roddings per Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinders: Diameter, in. (mm)</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>4 (100)</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>6 (150)</td>
<td>3</td>
<td>25</td>
</tr>
</tbody>
</table>

Molding Requirements by Rodding

Table 2
### Specimen Type and Size

<table>
<thead>
<tr>
<th>Specimen Type and Size</th>
<th>Number of Layers</th>
<th>Number of Vibrator Insertions per Layer</th>
<th>Approximate Depth of Layer, mm (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinders: Diameter, in. (mm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 (1004)</td>
<td>2</td>
<td>1</td>
<td>one-half depth of specimen</td>
</tr>
<tr>
<td>6 (150)</td>
<td>2</td>
<td>2</td>
<td>one-half depth of specimen</td>
</tr>
</tbody>
</table>

#### Molding Requirements by Vibration

**Table 3**

8.2.2 Select the proper tamping rod from 5.4 and Table 1 or the proper vibrator from 5.5. If the method of consolidation is rodding, determine molding requirements from Table 2. If the method of consolidation is vibration, determine molding requirements from Table 3.

9.3 Consolidation:

9.3.1 Method of Consolidation — Preparation of satisfactory specimens require different methods of consolidation. The methods of consolidation are rodding and vibration. Base the selection of the method of consolidation on slump, unless the method is stated in the specifications under which the work is being performed. Rod or vibrate concretes with slumps greater than 1 in. (25 mm). Vibrate concretes with slumps less than or equal to 1 in. (25 mm). Concretes of such low water content that they cannot be properly consolidated by the method herein, or requiring other sizes and shapes of specimens to represent the product or structure, are not covered by this method. Specimens for such concretes shall be made in accordance with the requirements of Method T 126 with regards to specimen size and shape and method of consolidation.

9.3.2 Rodding — Place the concrete in the mold, in the required number of layers of approximately equal volume. Rod each layer with the rounded end of the rod using the required number of roddings specified in Table 2. Rod the bottom layer throughout its depth. Distribute the strokes uniformly over the cross section of the mold. For each layer, allow the rod to penetrate through the layer being rodded and into the layer below approximately 25 mm (1 in.). After each layer is rodded, tap the outsides of the mold lightly 10 to 15 times with the open hand mallet, or rod, to close any holes left by rodding and to release any large air bubbles that may have been trapped.
9.3.3 Vibration — Maintain a uniform time period for duration of vibration for the particular kind of concrete, vibrator, and specimen mold involved. The duration of vibration required will depend upon the workability of the concrete and the effectiveness of the vibrator. Usually, sufficient vibration has been applied as soon as the surface of the concrete has become relatively smooth and large air bubbles cease to break through the top surface. Continue vibration only long enough to achieve proper consolidation of the concrete. (See Note 5.) Fill the molds and vibrate in the required number of approximately equal layers. Place all the concrete for each layer in the mold before starting vibration of that layer. Compacting the specimen, insert the vibrator slowly and do not allow it to rest on the bottom or sides of the mold. Slowly withdraw the vibrator so that no large air pockets are left in the specimen. When placing the final layer, avoid overfilling by more than ¼ in. (6 mm).

Note 5 — Generally, no more than 5 s of vibration should be required for each insertion to adequately consolidate concrete with a slump greater than 3 in. (75 mm). Longer times may be required for lower slump concrete, but the vibration time should rarely have to exceed 10 s per insertion.

9.3.3.1 Cylinders — The number of insertions of a vibrator per layer is given in Table 3. When more than one insertion per layer is required, distribute the insertion uniformly within each layer. Allow the vibration to penetrate through the layer being vibrated, and into the layer below, approximately 1 in. (25 mm). After each layer is vibrated, tap the outsides of the mold lightly 10 to 15 times with the open hand, mallet, or rod, to close any holes left by rodding and to release any large air bubbles that may have been trapped.

9.3.3.2 Beam — Refer to WSDOT Test Method T 808.

9.4 Finishing — After consolidation, strike off excess concrete from the surface. Perform all finishing with the minimum manipulation necessary to produce a flat even surface that is level with the rim or edge of the mold and that has no depressions or projections larger than ⅛ in. (3.2 mm). Place lid on cylinder.

10. CURING

10.1 Standard Curing—Standard curing is the curing method used when the specimens are made and cured for the purposes stated in 4.2.

10.1.1 Storage—If specimens cannot be molded at the place where they will receive initial curing, immediately after finishing, move the specimens to an initial curing place for storage. The supporting surface on which specimens are stored shall be level to within ¼ in. per ft (20 mm per m.). If cylinders in the single-use molds are moved, lift and support the cylinders from the bottom of the molds with a large trowel or similar device. If the top surface is marred during movement to place of initial storage, immediately refinish.
10.1.2 Initial Curing—Immediately after molding and finishing, the specimens shall be stored in a cure box for a period 24 ± 8 hours, unless Contractor provides initial curing information for final set.

For concrete with a specified strength less than 6000 psi the cure temperature shall be between 60°F and 80°F and for concrete with specified strengths of 6000 psi and higher the cure temperature shall be between 68°F and 78°F.

A minimum/maximum thermometer shall be mounted on the cure box such that the thermometer reads the internal temperature of the box but is visible from the outside. Keep a record of the minimum and maximum temperatures at intervals of 24 hours during the initial curing time.

Do not exceed the capacity of the cure box. When concrete is placed at more than one location simultaneously, each location must have its own cure box.

Once concrete cylinders are placed in the cure box, the cure box shall not be moved until the cylinders are ready to be transported to the final cure location (See 10.1.3).

10.1.3 Transportation of specimens to final cure location- Prior to transporting, cure and protect specimens as required in Section 9. Specimens shall not be transported until at least 8 h after final set. (See Note 8.) During transporting, protect the specimen with suitable cushioning material to prevent damage from jarring and transport in an upright position. During cold weather, protect the specimens from freezing with suitable insulation material. Prevent moisture loss during transportation by use of tight-fitting plastic caps on plastic molds. Transportation time shall not exceed 4 h.

Note 8: If a specimen does not attain final set within 32 hours, it is to remain in place until final set is reached. The time of final set shall be provided by the concrete producer. After final set is reached, it can then be transported.

10.1.4 Final Curing:

10.1.4.1 Cylinders—Upon completion of initial curing and within 30 minutes after removing the molds, cure specimens with free water maintained on their surfaces at all times at a temperature of 73 ± 3°F (23 ± 2°C) using water storage tanks or moist rooms complying with the requirements of Specification M 201, except when capping with sulfur mortar capping compound and immediately before testing. When capping with sulfur mortar capping compounds, the ends of the cylinder shall be dry enough to preclude the formation of steam or foam pockets under or in cap larger than ¼ in (6 mm.) as described in T 231. For a period not to exceed 3 h immediately prior to test, standard curing temperature is not required provided free moisture is maintained on the cylinders and ambient temperature is between 68 to 80°F (20 and 30°C).

10.1.4.2 Beams—Refer to WSDOT Test Method T 808.
10.2 Field Curing—Field curing is the curing method used for the specimens made for the purposes stated in 4.3.

10.2.1 Cylinders — Store cylinders in or on the structure as near to the point of deposit of the concrete represented as possible. Protect all surfaces of the cylinders from the elements in as near as possible the same way as the formed work. Provide the cylinders with the same temperature and moisture environment as the structural work. Test the specimens in the moisture condition resulting from the specified curing treatment. To meet these conditions, specimens made for the purpose of determining when a structure is capable of being put in service shall be removed from the molds at the time of removal of form work.

10.2.2 Beams — Refer to WSDOT Test Method T 808.

11. REPORT

11.1 Report the following information to the laboratory that will test the specimens:

11.1.1 Identification number;

11.1.2 Location of concrete represented by the samples;

11.1.3 Date, time, and name of individual molding specimens;

11.1.4 Slump, air content, and concrete temperature, test results and results of any other tests on the fresh concrete and any deviations from referenced standard test methods, and

11.1.5 Record all information required using the Materials Automatic Tracking System (MATS) electronic Concrete Transmittal or for those not having access to MATS use WSDOT Form 350-009 Concrete Cylinder Transmittal
Performance Exam Checklist

Making and Curing Concrete Test Specimens in the Field
FOP for AASHTO T 23

Participant Name ___________________________ Exam Date __________

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Molds placed on a level, rigid, horizontal surface free of vibration?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Making of specimens begun within 15 minutes of sampling?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Concrete placed in the mold, moving a scoop or trowel around the perimeter of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the mold to evenly distribute the concrete as discharged?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Mold filled in correct number of layers, attempting to exactly fill the mold on</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the last layer?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Each layer rodded throughout its depth 25 times with hemispherical end of rod,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>uniformly distributing strokes?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Bottom layer rodded throughout its depth?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Middle and top layers rodded, each throughout their depths, and penetrate into</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the underlying layer?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Sides of the mold tapped 10-15 times after rodding each layer?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Strike off excess concrete, and finished the surface with a minimum of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>manipulation?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Specimens covered with non-absorbent, nonreactive cap or plate?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

First attempt: Pass ☐ Fail ☐ Second attempt: Pass ☐ Fail ☐

Signature of Examiner

This checklist is derived, in part, from copyrighted material printed in ACI CP-1, published by the American Concrete Institute.
Comments:
Sieve Analysis of Fine and Coarse Aggregates

Significance

Sieve analyses are performed on aggregates used in roadway bases and in portland cement and asphalt cement concretes. Sieve analyses reveal the size makeup of aggregate particles – from the largest to the smallest. A gradation curve or chart showing how evenly or unevenly the sizes are distributed between largest and smallest is created in this test. How an aggregate is graded has a major impact on the strength of the base or on the properties and performance of concrete. In portland cement concrete (PCC), for example, gradation influences shrinkage and shrinkage cracking, pumpability, finishability, permeability, and other characteristics.

Scope

This procedure covers sieve analysis in accordance with AASHTO T 27 and materials finer than No. 200 (75 µm) in accordance with AASHTO T 11. The procedure combines the two test methods.

Sieve analyses determines the gradation or distribution of aggregate particles within a given sample in order to determine compliance with design and production standards.

Accurate determination of material smaller than No. 200 (75 µm) cannot be made with AASHTO T 27 alone. If quantifying this material is required, it is recommended that AASHTO T 27 be used in conjunction with AASHTO T 11. Following AASHTO T 11, the sample is washed through a No. 200 (75 µm) sieve. The amount of material passing this sieve is determined by comparing dry sample masses before and after the washing process.

This procedure covers sieve analysis in accordance with AASHTO T 27 and materials finer than No. 200 (75 µm) in accordance with AASHTO T 11. The procedure includes two method choices, A, and B.

Apparatus

• Balance or scale: Capacity sufficient for the masses shown in Table 2, accurate to 0.1 percent of the sample mass or better and conform to the requirements of AASHTO M 231.
• Sieves – Meeting the requirements of AASHTO M 92.
• Mechanical sieve shaker – Meeting the requirements of AASHTO T 27.
• Suitable drying equipment (see FOP for AASHTO T 255)
• Containers and utensils: A pan or vessel of a size sufficient to contain the sample covered with water and to permit vigorous agitation without loss of any part of the sample or water
• Optional Mechanical washing device

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1 This FOP is based on WAQTC FOP for AASHTO T 27/T 11 and has been modified per WSDOT standards. To View the redline modifications, contact WSDOT Quality Systems Manager (360) 709-5497.
Sample Sieving
In all procedures it is required to shake the sample over nested sieves. Sieves are selected to furnish information required by specification. The sieves are nested in order of decreasing size from the top to the bottom and the sample, or a portion of the sample, is placed on the top sieve. The sample may also be sieved in increments.

Sieves are shaken in a mechanical shaker for the minimum time determined to provide complete separation for the sieve shaker being used.

Time Evaluation
WSDOT has deleted this section.

Overload Determination
Additional sieves may be necessary to provide other information, such as fineness modulus, or to keep from overloading sieves. The sample may also be sieved in increments.

Additional sieves may be necessary to provide other information, such as fineness modulus, or to keep from overloading sieves. The sample may also be sieved in increments. For sieves with openings smaller than No. 4 (4.75 mm), the mass retained on any sieve shall not exceed 4 g/in² (7 kg/m²) of sieving surface. For sieves with openings No. 4 (4.75 mm) and larger, the mass, in grams shall not exceed the product of 2.5 x (sieve opening in mm) x (effective sieving area). See Table 1.

<table>
<thead>
<tr>
<th>Sieve Size US inches (mm)</th>
<th>8 φ (203)</th>
<th>12 φ (305)</th>
<th>12 x 12 (305 x 305)</th>
<th>14 x 14 (350 x 350)</th>
<th>16 x 24 (372 x 580)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sieving Area m²</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0285</td>
<td>0.0670</td>
<td>0.0929</td>
<td>0.1225</td>
<td>0.2158</td>
</tr>
<tr>
<td>3½ (90)</td>
<td>*</td>
<td>15.1</td>
<td>20.9</td>
<td>27.6</td>
<td>48.5</td>
</tr>
<tr>
<td>3 (75)</td>
<td>*</td>
<td>12.6</td>
<td>17.4</td>
<td>23.0</td>
<td>40.5</td>
</tr>
<tr>
<td>2½ (63)</td>
<td>*</td>
<td>10.6</td>
<td>14.6</td>
<td>19.3</td>
<td>34.0</td>
</tr>
<tr>
<td>2 (50)</td>
<td>3.6</td>
<td>8.4</td>
<td>11.6</td>
<td>15.3</td>
<td>27.0</td>
</tr>
<tr>
<td>1½ (37.5)</td>
<td>2.7</td>
<td>6.3</td>
<td>8.7</td>
<td>11.5</td>
<td>20.2</td>
</tr>
<tr>
<td>1 (25.0)</td>
<td>1.8</td>
<td>4.2</td>
<td>5.8</td>
<td>7.7</td>
<td>13.5</td>
</tr>
<tr>
<td>¾ (19.0)</td>
<td>1.4</td>
<td>3.2</td>
<td>4.4</td>
<td>5.8</td>
<td>10.2</td>
</tr>
<tr>
<td>¾ (16.0)</td>
<td>1.1</td>
<td>2.7</td>
<td>3.7</td>
<td>4.9</td>
<td>8.6</td>
</tr>
<tr>
<td>½ (12.5)</td>
<td>0.89</td>
<td>2.1</td>
<td>2.9</td>
<td>3.8</td>
<td>6.7</td>
</tr>
<tr>
<td>½ (9.5)</td>
<td>0.67</td>
<td>1.6</td>
<td>2.2</td>
<td>2.9</td>
<td>5.1</td>
</tr>
<tr>
<td>¼ (6.3)</td>
<td>0.44</td>
<td>1.1</td>
<td>1.5</td>
<td>1.9</td>
<td>3.4</td>
</tr>
<tr>
<td>No. 4 (4.75)</td>
<td>0.33</td>
<td>0.80</td>
<td>1.1</td>
<td>1.5</td>
<td>2.6</td>
</tr>
<tr>
<td>Less than (No. 4)</td>
<td>0.20</td>
<td>0.47</td>
<td>0.65</td>
<td>1.2</td>
<td>1.3</td>
</tr>
</tbody>
</table>

**Note:** Sample sizes above are in kilograms to convert: to grams multiple by 1,000. To convert to pounds multiple by 2.2.
Sample Preparation

Obtain samples in accordance with the FOP for AASHTO T 2 and reduce to the size shown in Table 2 in accordance with the FOP for AASHTO T 248.

If the gradation sample is obtained from FOP for AASHTO T-308, the Ignition Furnace, proceed to Procedure Method A, Step 2.

<table>
<thead>
<tr>
<th>Nominal Maximum</th>
<th>Minimum Dry Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size* in.</td>
<td>(mm)</td>
</tr>
<tr>
<td>US No. 4</td>
<td>(4.75)</td>
</tr>
<tr>
<td>¼</td>
<td>(6.3)</td>
</tr>
<tr>
<td>⅜</td>
<td>(9.5)</td>
</tr>
<tr>
<td>½</td>
<td>(12.5)</td>
</tr>
<tr>
<td>⅝</td>
<td>(16.0)</td>
</tr>
<tr>
<td>¾</td>
<td>(19.0)</td>
</tr>
<tr>
<td>1</td>
<td>(25.0)</td>
</tr>
<tr>
<td>1¼</td>
<td>(31.5)</td>
</tr>
<tr>
<td>1½</td>
<td>(37.5)</td>
</tr>
<tr>
<td>2</td>
<td>(50)</td>
</tr>
<tr>
<td>2½</td>
<td>(63)</td>
</tr>
<tr>
<td>3</td>
<td>(75)</td>
</tr>
<tr>
<td>3¼</td>
<td>(90)</td>
</tr>
</tbody>
</table>

Sample Sizes for Aggregate Gradation Test  
* For aggregate, the nominal maximum size, (NMS) is the largest standard sieve opening listed in the applicable specification, upon which any material is permitted to be retained. For concrete aggregate, NMS is the smallest standard sieve opening through which the entire amount of aggregate is permitted to pass.

Note: For an aggregate specification having a generally unrestrictive gradation (i.e. wide range of permissible upper sizes), where the source consistently fully passes a screen substantially smaller than the maximum specified size, the nominal maximum size, for the purpose of defining sampling and test specimen size requirements may be adjusted to the screen, found by experience to retain no more than 5% of the materials.

WSDOT Note 1: These sample sizes are standard for aggregate testing but, due to equipment restraints, samples may need to be partitioned into several “subsamples.” See Method A.

Overview

Method A - This method is the preferred method of sieve analysis for HMA aggregate.
  - Determine dry mass of original sample
  - Wash through a No. 200 (75 µm) sieve
  - Determine dry mass of washed sample
  - Sieve material
Method B

- Determine dry mass of original sample
- Wash through a No. 200 (75 µm) sieve
- Determine dry mass of washed sample
- Sieve coarse material
- Determine mass of fine material
- Reduce fine portion
- Determine mass of reduced portion
- Sieve fine portion

Procedure Method A

1. Dry the sample in accordance with the FOP for AASHTO T 255, and record to the nearest 0.1 percent of total mass or better.

2. When the specification requires that the amount of material finer than No. 200 (75 µm) be determined, do Step 3 through Step 9 – otherwise, skip to Step 10.

   **WSDOT Note 2:** If the applicable specification requires that the amount passing the No. 200 (75 µm) sieve be determined on a portion of the sample passing a sieve smaller than the nominal maximum size of the aggregate, separate the sample on the designated sieve and determine the mass of the material passing that sieve to 0.1 percent of the mass of this portion of the test sample. Use the mass as the original dry mass of the test sample.

3. Nest a sieve, such as a No. 10 (2 mm), above the No. 200 (75 µm) sieve.

4. Place the test sample in a container and add sufficient water to cover it.

   **WSDOT Note 3:** A detergent, dispensing agent, or other wetting solution may be added to the water to assure a thorough separation of the material finer than the No. 200 (75 µm) sieve from the coarser particles. There should be enough wetting agent to produce a small amount of suds when the sample is agitated. Excessive suds may overflow the sieves and carry material away with them.

5. Agitate vigorously to ensure complete separation of the material finer than No. 200 (75 µm) from coarser particles and bring the fine material into suspension above the coarser material. When using a mechanical washing device, exercise caution to not degrade the sample.

6. Immediately pour the wash water containing the suspended and dissolved solids over the nested sieves, being careful not to pour out the coarser particles.

7. Add a second change of water to the sample remaining in the container, agitate, and repeat Step 6. Repeat the operation until the wash water is reasonably clear.

8. Return all material retained on the nested sieves to the container by flushing into the washed sample.

   **WSDOT Note 4:** A suction device may be used to extract excess water from the washed sample container. Caution will be used to avoid removing any material greater than the No. 200.
9. Dry the washed aggregate in accordance with the FOP for AASHTO T 255, and then cool prior to sieving. Record the dry mass.

10. Select sieves to furnish information required by the specifications. Nest the sieves in order of decreasing size from top to bottom and place the sample, or a portion of the sample, on the top sieve.

11. Place sieves in mechanical shaker and shake for a minimum of 10 minutes, or the minimum time determined to provide complete separation if this time is greater than 10 minutes for the sieve shaker being used.

12. Determine the individual or cumulative mass retained on each sieve and the pan to the nearest 0.1 percent or 0.1 g.

**WSDOT Note 5:** Use coarse wire brushes to clean the No. 40 (425 µm) and larger sieves, and soft bristle brushes for smaller sieves.

### Calculations

The total mass of material after sieving should be verified with the mass before sieving. If performing T 11 with T 27 this would be the dry mass after wash. If performing just T 27 this would be the original dry mass. When the masses before and after sieving differ by more than 0.3 percent do not use the results for acceptance purposes. When performing the gradation from HMA using T 308, the masses before and after sieving shall not differ by more than 0.2%.

Calculate the total percentages passing, individual or cumulative percentages retained, or percentages in various size fractions to the nearest 0.1 percent by dividing the masses for Method A, or adjusted masses for Methods B and C, on the individual sieves by the total mass of the initial dry sample. If the same test sample was first tested by T 11, use the total dry sample mass prior to washing in T 11 as the basis for calculating all percentages. Report percent passing as indicated in the “Report” section at the end of this FOP.

#### Percent Retained:

Where:

- **IPR** = Individual Percent Retained
- **CPR** = Cumulative Percent Retained
- **M** = Total Dry Sample mass before washing
- **IMR** = Individual Mass Retained OR Adjusted Individual mass from Methods B or C
- **CMR** = Cumulative Mass Retained OR Adjusted Individual mass From Methods B or C

\[
IPR = \frac{IMR}{M} \times 100 \quad OR \quad CPR = \frac{CMR}{M} \times 100
\]

OR

#### Percent Passing (Calculated):

Where:

- **PP** = Percent Passing
- **PPP** = Previous Percent Passing
- **PP** = PPP-IPR \quad OR \quad PP = 100-CPR
Calculate cumulative percent retained on and passing each sieve on the basis of the dry mass of total sample, before washing. This will include any material finer than No. 200 (75 µm) that was washed out.

Divide the cumulative masses, or the corrected masses, on the individual sieves by the total mass of the initial dry sample (prior to washing) to determine the percent retained on and passing each sieve. Calculate the percent retained on and passing each sieve. Report percent passing as indicated in the “Report” section at the end of this FOP.

Example

Dry mass of total sample, before washing: 3214.0 g

Dry mass of sample, after washing out the No. 200 (75 µm) minus: 3085.1 g

For the ½ sieve:

Cumulative Mass retained on ½” sieve = 161.0 g

Cumulative % retained = $\frac{161.0}{3214.0} \times 100 = 5.0\%$ retained

% passing = 100 - 5.0 = 95% passing ½” sieve

<table>
<thead>
<tr>
<th>Sieve Size in. (mm)</th>
<th>Cumulative Mass Retained g</th>
<th>Cumulative Percent Retained</th>
<th>Reported Percent Passing*</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾ (19.0)</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>½ (12.5)</td>
<td>161.0</td>
<td>5.0</td>
<td>95</td>
</tr>
<tr>
<td>⅜ (9.5)</td>
<td>642.0</td>
<td>20.0</td>
<td>80</td>
</tr>
<tr>
<td>No. 4 (4.75)</td>
<td>1118.3</td>
<td>34.8</td>
<td>65</td>
</tr>
<tr>
<td>**No. 6 (3.35)</td>
<td>1515.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 10 (2.0)</td>
<td>1914.7</td>
<td>59.6</td>
<td>40</td>
</tr>
<tr>
<td>No. 40 (0.425)</td>
<td>2631.6</td>
<td>81.9</td>
<td>18</td>
</tr>
<tr>
<td>No. 80 (0.210)</td>
<td>2862.7</td>
<td>89.1</td>
<td>11</td>
</tr>
<tr>
<td>No. 200 (0.075)</td>
<td>3051.1</td>
<td>94.9</td>
<td>5.1</td>
</tr>
<tr>
<td>Pan</td>
<td>3086.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Report No. 200 (75 µm) sieve to 0.1 percent. Report all others to 1 percent.

** Intermediate sieve used to prevent overloading the U. S. No. 10 sieve.

Test Validation: 3086.4 – 3085.1/3085.1 x 100 = 0.04 % which is within the 0.3 percent requirement and the results can be used for acceptance purposes.
Procedure Method B

1. Perform steps 1 thru 9 from the “Procedure Method A” then continue as follows:

2. Select sieves to furnish information required by the specifications. Nest the sieves in order of decreasing size from top to bottom through the No. 4 (4.75 mm) with a pan at the bottom to retain the minus No. 4 (4.75 mm). (See Table 1.)

3. Place sieves in mechanical shaker and shake for a minimum of 10 minutes, or the minimum time determined to provide complete separation if this time is greater than 10 minutes for the sieve shaker being used.

4. Determine the individual or cumulative mass retained on each sieve and the pan to the nearest 0.1 percent or 0.1 g. Ensure that all material trapped in the openings of the sieve are cleaned out and included in the mass retained. (See Note 5.)

5. Determine the mass retained on each sieve to the nearest 0.1 percent of the total mass or better.

6. Determine the mass of the material in the pan [minus No. 4 (4.75 mm)].

7. Reduce the minus No. 4 (4.75 mm) using a mechanical splitter in accordance with the FOP for AASHTO T 248 to produce a sample with a mass of 500 g minimum. Determine and record the mass of the minus No. 4 (4.75 mm) split.

8. Select sieves to furnish information required by the specifications. Nest the sieves in order of decreasing size from top to bottom through the No. 200 (75 μm) with a pan at the bottom to retain the minus No. 200 (75 μm).

9. Place sieves in mechanical shaker and shake for a minimum of 10 minutes, or the minimum time determined to provide complete separation if this time is greater than 10 minutes for the sieve shaker being used.

10. Determine the individual or cumulative mass retained on each sieve and the pan to the nearest 0.1 percent or 0.1 g. Ensure that all material trapped in the openings of the sieve are cleaned out and included in the mass retained. (See Note 5.)

Calculations

Compute the “Adjusted Cumulative Mass Retained” of the size increment of the original sample as follows when determining “Cumulative Mass Retained”: Divide the cumulative masses, or the corrected masses, on the individual sieves by the total mass of the initial dry sample (prior to washing) to determine the percent retained on and passing each sieve. Calculate the percent retained on and passing each sieve. Report percent passing as indicated in the “Report” section at the end of this FOP.
When material passing the No. 4 (4.75 mm) sieve is split and only a portion of that is tested, the proportionate share of the amount passing the No. 200 (75 µm) sieve must be added to the sample mass to obtain a corrected test mass. This corrected test mass is used to calculate the gradation of the material passing the No. 4 (4.75 mm) sieve.

\[ C = \left( \frac{M_1}{M_2} \times B \right) + D \]

where:

- \( C \) = Total cumulative mass retained of the size increment based on a total sample
- \( M_1 \) = mass of fraction finer than No. 4 (4.75 mm) sieve in total sample
- \( M_2 \) = mass of reduced portion of material finer than No. 4 (4.75 mm) sieve actually sieved
- \( B \) = cumulative mass of the size increment in the reduced portion sieved.
- \( D \) = cumulative mass of plus No. 4 (4.75 mm) portion of sample.

Example:

Dry mass of total sample, before washing: 3214.0 g

Dry mass of sample, after washing out the No. 200 (75 µm) minus: 3085.1 g

<table>
<thead>
<tr>
<th>Sieve Size in. (mm)</th>
<th>Cumulative Mass Retained g</th>
<th>Cumulative Percent Retained</th>
<th>Reported Percent Passing*</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾ (19.0)</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>½ (12.5)</td>
<td>161.0</td>
<td>5.0</td>
<td>95</td>
</tr>
<tr>
<td>⅜ (9.50)</td>
<td>642.0</td>
<td>20.0</td>
<td>80</td>
</tr>
<tr>
<td>No. 4 (4.75)</td>
<td>1118.3</td>
<td>34.8</td>
<td>65</td>
</tr>
</tbody>
</table>

Gradation on Coarse Screens

Pan = 1968.0

Test Validation : 1118.3 + 1968.0 – 3085.1/3085.1 x 100 = 0.04% which is within the 0.3 percent requirement and the results can be used for acceptance purposes.

The actual mass of material passing the No. 4 (4.75 mm) sieve and retained in the pan is 1968.0 g. This is \( M_1 \).

The pan (1968.0 grams) was reduced in accordance with the FOP for AASHTO T 248, so that at least 500 g are available. In this case, the mass determined was 512.8 g. This is \( M_2 \).
Gradation on Fine Screens

Test Validation: 512.8 - 512.8/512.8 = 0.0% which is within the 0.3 percent requirement and the results can be used for acceptance purposes.

For the No. 10 sieve:

\[
M_1 = 1968.0g \\
M_2 = 512.8g \\
B = 207.5g \\
D = 1118.3g \\
C = \left( \frac{M_1}{M_2} \times B \right) + D = \left( \frac{1968.0g}{512.8g} \times 207.5g \right) + 1118.3g = 1914.7g
\]

\%

% retained \( \frac{1914.7g}{3214.0g} = 59.6\% \)
% passing = 100-59.6=40.4% reported as 40%

Final Gradation on All Screens

<table>
<thead>
<tr>
<th>Sieve Size in. (mm)</th>
<th>Cumulative Mass Retained (g)</th>
<th>Adjusted Cumulative Mass Retained (g)</th>
<th>Cum. Percent Retained</th>
<th>Reported Percent Passing*</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾ (19.0)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>½ (12.5)</td>
<td>161.1</td>
<td>161.1</td>
<td>5.0</td>
<td>95</td>
</tr>
<tr>
<td>¾ (9.5)</td>
<td>642.5</td>
<td>642.5</td>
<td>20.0</td>
<td>80</td>
</tr>
<tr>
<td>No. 4 (4.75)</td>
<td>1118.3</td>
<td>1118.3</td>
<td>34.8</td>
<td>65</td>
</tr>
<tr>
<td>No. 10 (2.0)</td>
<td>207.5 x 3.838 + 1118.3</td>
<td>1914.7</td>
<td>59.6</td>
<td>40</td>
</tr>
<tr>
<td>No. 40 (0.425)</td>
<td>394.3 x 3.838 + 1118.3</td>
<td>2631.6</td>
<td>81.6</td>
<td>18</td>
</tr>
<tr>
<td>No. 80 (0.210)</td>
<td>454.5 x 3.838 + 1118.3</td>
<td>2862.7</td>
<td>89.1</td>
<td>11</td>
</tr>
<tr>
<td>No. 200 (0.075)</td>
<td>503.6 x 3.838 + 1118.3</td>
<td>3051.1</td>
<td>94.9</td>
<td>5.1</td>
</tr>
<tr>
<td>Pan</td>
<td>512.8 x 3.838 + 1118.3</td>
<td>3086.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Report No. 200 (75 µm) sieve to 0.1 percent. Report all others to 1 percent.
Alternative Method B

As an alternate method to account for the fact that only a portion of the minus No. 4 (4.75 mm) material was sieved, multiply the fine screen “Percent Passing” values by the percent passing the No. 4 (4.75 mm) sieve obtained in the coarse screen procedure, 65 percent in this case.

The mass retained in the pan must be corrected to include the proper percent of No. 200 (.075 mm) minus material washed out.

Divide the cumulative masses, or the corrected masses, on the individual sieves by the corrected pan mass of the initial dry sample (prior to washing) to determine the percent retained on and passing each sieve. Calculate the percent retained on and passing each sieve. Report percent passing as indicated in the “Report” section at the end of this FOP.

Dry mass of total sample, before washing: 3214.0 g
Dry mass of sample, after washing out the No. 200 (75 µm) minus: 3085.1 g
Amount of No. 200 (75 µm) minus washed out: 3214.0 g – 3085.1 g = 128.9 g

Gradation on Coarse Screens

<table>
<thead>
<tr>
<th>Sieve Size in. (mm)</th>
<th>Cumulative Mass Retained g</th>
<th>Cumulative Percent Retained</th>
<th>Reported Percent Passing*</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾ (19.0)</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>½ (12.5)</td>
<td>161.0</td>
<td>5.0</td>
<td>95</td>
</tr>
<tr>
<td>⅜ (9.50)</td>
<td>642.0</td>
<td>20.0</td>
<td>80</td>
</tr>
<tr>
<td>No. 4 (4.75)</td>
<td>1118.3</td>
<td>34.8</td>
<td>65</td>
</tr>
</tbody>
</table>

Pan = 1968.0
Test Validation: \[
\frac{1118.3 + 1968.0 - 3085.1}{3085.1 \times 100} = 0.04%\]

which is within the 0.3 percent requirement and the results can be used for acceptance purposes.

The actual mass of material passing the No. 4 (4.75 mm) sieve and retained in the pan is 1968.0 g. This is \(M_3\).

The pan (1968.0 grams) was reduced in accordance with the FOP for AASHTO T 248, so that at least 500 g are available. In this case, the mass determined was 512.8 g. This is \(M_4\).

Corrected pan mass = \(M_4 + \frac{(M_4)(C_1)}{M_3}\)

Where:

\(M_4\) = mass retained in the pan from the split of the No. 4 (4.75 mm) minus.

\(M_3\) = mass of the No. 4 (4.75 mm) minus of entire sample, not including No. 200 (.075 mm) minus washed out.

\(C_1\) = mass of No. 200 (.075 mm) minus washed out.
### Sieve Analysis of Fine and Coarse Aggregates

#### T 27/T 11

**WSDOT Materials Manual M 46-01.03**

*January 2009*

<table>
<thead>
<tr>
<th>Sieve Size in. (mm)</th>
<th>Cumulative Mass Retained (g)</th>
<th>Cumulative Percent Retained</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 4 (4.75)</td>
<td>0</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>No. 10 (2.00)</td>
<td>207.5</td>
<td>38.0</td>
<td>62.0</td>
</tr>
<tr>
<td>No. 40 (0.425)</td>
<td>394.3</td>
<td>72.2</td>
<td>27.8</td>
</tr>
<tr>
<td>No. 80 (0.210)</td>
<td>454.5</td>
<td>83.2</td>
<td>16.8</td>
</tr>
<tr>
<td>No. 200 (0.075)</td>
<td>503.6</td>
<td>92.2</td>
<td>7.8</td>
</tr>
<tr>
<td>Pan</td>
<td>512.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The corrected pan mass is the mass used to calculate the percent retained for the fine grading.

**Example:**

- \( M_4 = 512.8 \text{g} \)
- \( M_3 = 1968.0 \text{g} \)
- \( C_1 = 128.9 \text{g} \)
- Corrected pan mass = \( \frac{(512.8 \text{g})(128.9 \text{g})}{1968.0 \text{g}} = 546.4 \text{g} \)

For the No. 10 sieve:

- Mass of No. 10 sieve = 207.5g
- Corrected Pan Mass = 546.4g
- Cumulative % retained = \( \frac{207.5 \text{g}}{546.4 \text{g}} = 38.0\% \)
- % passing = 100-38.0 = 62.0%

Adjusted % passing No. 10 = % passing No. 10 x % No. 4 = 62.0 x 0.65 = 40%

<table>
<thead>
<tr>
<th>Sieve Size in. (mm)</th>
<th>Adjustment</th>
<th>Reported Percent Passing*</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾ (19.0)</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>½ (12.5)</td>
<td></td>
<td>95</td>
</tr>
<tr>
<td>¼ (9.5)</td>
<td></td>
<td>80</td>
</tr>
<tr>
<td>No. 4 (4.75)</td>
<td>100 x .65</td>
<td>65</td>
</tr>
<tr>
<td>No. 10 (2.00)</td>
<td>62.0 x .65</td>
<td>40</td>
</tr>
<tr>
<td>No. 40 (0.425)</td>
<td>27.8 x .65</td>
<td>18</td>
</tr>
<tr>
<td>No. 80 (0.210)</td>
<td>16.8 x .65</td>
<td>11</td>
</tr>
<tr>
<td>No. 200 (0.075)</td>
<td>7.8 x .65</td>
<td>5.1</td>
</tr>
</tbody>
</table>

* Report No. 200 (75 µm) sieve to 0.1 percent. Report all others to 1 percent

**Final Gradation on All Screens**
SAMPLE CALCULATION FOR FINENESS MODULUS

Fineness Modulus (FM) is used in determining the degree of uniformity of aggregate gradation in PCC mix designs. It is an empirical number relating to the fineness of the aggregate. The higher the FM, the coarser the aggregate. Values of 2.40 to 3.00 are common for FA in PCC.

The FM is the sum of the percentages retained on specified sieves 150 mm (6”), 75 mm (3”), 37.5 mm (1½”), 19.0 mm (¾”), 9.5 mm (⅜), No. 4 (4.75 mm), 2.36 mm (No. 8), 1.18 mm (No. 16), 0.60 mm (No. 30), 0.30 mm (No. 50), and 0.15 mm (No. 100) divided by 100 gives the FM.

The following example is for WSDOT Class 2 Sand:

<table>
<thead>
<tr>
<th>WSDOT Class 2 Sand</th>
<th>Sieve</th>
<th>Size</th>
<th>% Passing</th>
<th>% Retained</th>
<th>% Retained on Specified Sieves</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 in.</td>
<td>150 mm</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>3 in.</td>
<td>75 mm</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2½ in.</td>
<td>62.5 mm</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2 in.</td>
<td>50 mm</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1½ in.</td>
<td>37.5 mm</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1 in.</td>
<td>25 mm</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>¾ in.</td>
<td>19 mm</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>½ in.</td>
<td>12.5 mm</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>⅜ in.</td>
<td>9.5 mm</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>No. 4</td>
<td>4.75 mm</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>No. 8</td>
<td>2.36 mm</td>
<td>87</td>
<td>13</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>No. 16</td>
<td>1.18 mm</td>
<td>69</td>
<td>31</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>No. 30</td>
<td>0.60 mm</td>
<td>44</td>
<td>56</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>No. 50</td>
<td>0.30 mm</td>
<td>18</td>
<td>82</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>No. 100</td>
<td>0.15 mm</td>
<td>4</td>
<td>96</td>
<td>96</td>
<td></td>
</tr>
</tbody>
</table>

\[ \text{FM} = \frac{278}{100} = 2.78 \]

REPORT

Results shall be reported on standard forms approved for use by the agency. Depending on the agency, this may include:

- Cumulative mass retained on each sieve
- Cumulative percent retained on each sieve
- Percent passing and retained on each sieve shall be reported to the nearest 1 percent except for the percent passing the U.S. No. 200 (75 µm) sieve, which shall be reported to the nearest 0.1 percent
- FM to the nearest 0.01 percent for WSDOT Class 2 Sand

Report results using WSDOT Form 422-020, or other report approved by the State Materials Engineer.
**Performance Exam Checklist**

**WAQTC FOP FOR AASHTO T 27/T 11**

**SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES**

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>has the current calibration/verification tags present?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Minimum sample mass meets requirement of Table 1 or from FOP for AASHTO T308?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Test sample dried to a constant mass by FOP for AASHTO T 255?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Test sample cooled and mass determined to nearest 0.1 percent of mass?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Sample placed in container and covered with water?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(If specification requires that the amount of material finer than the No. 200 sieve is to be determined.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Dispersing Agent used for HMA?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Contents of the container vigorously agitated?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Complete separation of coarse and fine particles achieved?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Wash water poured through nested sieves such as No. 10 and No. 200?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Operation continued until wash water is reasonably clear?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Material retained on sieves returned to washed sample?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Washed aggregate dried to a constant mass by FOP for AASHTO T 255?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Washed aggregate cooled and mass determined to nearest 0.1 percent of mass?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Sample placed in nest of sieves specified? (Additional sieves may be used to prevent overloading as allowed in FOP.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Material sieved in verified mechanical shaker for minimum of 10 minutes or for the minimum verified time whichever is longer?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Mass of residue on each sieve determined to 0.1 percent of mass?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Total mass of material after sieving agrees with mass before sieving to within 0.3 percent, or 0.2 percent for HMA (per FOP for AASHTO T308)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Percentages calculated to the nearest 0.1 percent and reported to the nearest whole number, except No. 200 - reported to the nearest 0.1 percent?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Percentage calculations based on original dry sample mass?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Calculations performed properly? If material passing No. 4 sieve is split and only a portion is tested, calculation as noted in FOP performed properly?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

First attempt: Pass ☐   Fail ☐
Second attempt: Pass ☐   Fail ☐

Signature of Examiner ____________________________________________
Comments:
Sampling Bituminous Materials

Significance
The quality of bituminous materials has a tremendous impact on a roadway project. The grade of binder selected is based on a number of factors, including local temperature extremes and characteristics of expected traffic. Using a grade of binder material other than that specified will have serious impacts on roadway performance and durability.

Scope
The procedure covers obtaining samples of liquid bituminous materials in accordance with AASHTO T 40. Sampling of solid and semi-solid bituminous materials (included in AASHTO T 40) is not covered here.

Agencies may be more specific on exactly who samples, where to sample, and what type of sampling device to use.

WSDOT personnel need to observe the contractor’s personnel sampling to assure that proper sampling procedures are followed.

If proper sampling procedures are not followed it shall be noted on the sample transmittal “Proper sampling procedures not followed.” See WSDOT Standard Specification 1-06.

Procedure
1. Coordinate sampling with contractor or supplier.
2. Use appropriate safety equipment and precautions.
3. Allow a minimum of 1 gal (4 L) to flow before obtaining samples.
4. Obtain samples of:
   • Asphalt binder from Hot Mix Asphalt (HMA) Plant from the line between the storage tank and the mixing plant or the storage tank while the plant is in operation, or from the delivery truck.
   • Cutback and Emulsified asphalt from distributor spray bar or application device; or from the delivery truck before it is pumped into the distributor. Sample emulsified asphalt at delivery or prior to dilution.
Containers

Sample containers must be new, and the inside may not be washed or rinsed. The outside may be wiped with a clean, dry cloth.

All samples shall be put in 1 qt (1 L) containers and properly identified on the outside of the container with contract number, date sampled, data sheet number, brand and grade of material, and sample number. Include lot and sublot numbers when appropriate.

Note: The filled sample container shall not be submerged in solvent, nor shall it be wiped with a solvent saturated cloth. If cleaning is necessary, use a clean dry cloth.

- Emulsified asphalt: Use wide-mouth plastic jars with screw caps. Place tape around the seam of the cap, to keep the cap from loosening and spilling the contents. Protect the samples from freezing since water is a part of the emulsion.
- Asphalt binder & Cutbacks: Use metal cans.

Standard sample labels (WSDOT Form 350-016) shall be completely filled out and attached to each sample container.
### Performance Exam Checklist

**Sampling Bituminous Materials**  
**WAQTC FOP for AASHTO T 40**

<table>
<thead>
<tr>
<th>Participant Name</th>
<th>Exam Date</th>
</tr>
</thead>
</table>

**Procedure Element**

1. The tester has a copy of the current procedure on hand?  
   - Yes □  No □

2. Appropriate containers used?  
   - a. Wide-mouth plastic containers (emulsified).  
     - Yes □  No □
   - b. Metal cans (all other bituminous liquids).  
     - Yes □  No □

3. Containers not washed or rinsed on inside?  
   - Yes □  No □

4. Minimum of 1 gallon allowed to flow before sample taken?  
   - Yes □  No □

5. Material obtained at correct location?  
   - a. Line between storage tank and mixing plant or the storage tank (HMA plants).  
     - Yes □  No □
   - b. Spray bar or application device, if not diluted (distributors).  
     - Yes □  No □
   - c. From delivery vehicle or prior to dilution, if diluted (distributors).  
     - Yes □  No □

Sample taken by:  
- Contractor □  WSDOT □

First attempt:  
- Pass □  Fail □  
Second attempt:  
- Pass □  Fail □

Signature of Examiner  
____________________________

Comments:
WSDOT FOP for AASHTO TP 61\textsuperscript{1}

Determining the Percentage of Fracture in Coarse Aggregate

1. **SCOPE**

1.1. This test method covers the determination of the percentage, by mass, of a coarse aggregate sample that consists of fractured particles meeting specified requirements.

1.2. This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1.3. The text of the standard reference notes provide explanatory material. These notes (excluding those in tables and figures) shall not be considered as requirements of the standard.

Method 1 will be used by WSDOT for determining the fracture of aggregate as required by the Standard Specifications.

2. **REFERENCED DOCUMENTS**

2.1. *AASHTO Standards:*

- M 92, Wire-Cloth Sieves for Testing Purposes
- M 231, Weighing Devices Used in the Testing of Materials
- T 2, Sampling of Aggregates
- T 11, Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
- T 27, Sieve Analysis of Fine and Coarse Aggregates
- T 248, Reducing Samples of Aggregate to Testing Size
- T 255, Total Evaporable Moisture Content of Aggregate by Drying

3. **SUMMARY OF TEST METHOD**

3.1. A sample of aggregate is separated using the designated size of screen conforming to the specification controlling the determination of coarse and fine aggregate. The coarse aggregate particles are visually evaluated to determine their conformance to the defined fracture. The percentage of conforming particles, by mass, is determined for comparison to standard specifications.

4. **APPARATUS**

4.1. *Balance* — shall have sufficient capacity, be readable to 0.1 percent of the sample mass, or better, and conform to the requirements of M 231 for general-purpose balance required for the principle sample mass being tested.

4.2. *Sieves*—Meeting the requirements of M 92.

4.3. *Splitter*—Meeting the requirements of T 248.

\textsuperscript{1} This FOP is based on AASHTO TP 61-02 and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
5. TERMINOLOGY

5.1. fractured face—an angular, rough, or broken surface of an aggregate particle created by crushing, or by other means. A face is considered a “fractured face” whenever one-half or more of the projected area, when viewed normal to that face, is fractured with sharp and well-defined edges: this excludes small nicks.

5.2. fractured particle—a particle of aggregate having at least the minimum number of fractured faces specified.

6. SAMPLING

Sample the aggregate in accordance with FOP for AASHTO T 2 and reduce the sample in accordance with FOP for AASHTO T 248, to the sample sizes shown in Table 1 of FOP for AASHTO T 27/11.

7. SAMPLE PREPARATION

7.1. Where the specifications list only a total fracture percentage, the sample shall be prepared in accordance with Method 1.

7.2. Method 1—Combined Fracture Determination

7.2.1. Dry the sample sufficiently to obtain a clean separation of fine and coarse material in the sieving operation. Sieve the sample in accordance with FOP for AASHTO T 27/11 over the No. 4 (4.75-mm) sieve.

Note 1: Where necessary, wash the sample over the sieve or sieves designated for the determination of fractured particles to remove any remaining fine material, and dry to a constant mass in accordance with FOP for AASHTO T 255.

7.2.2. Reduce the sample using a splitter in accordance with FOP for AASHTO T 248 to the appropriate size for test.

<table>
<thead>
<tr>
<th>Nominal Maximum Particle Size</th>
<th>Minimum Sample Mass Retained No. 4 (4.75-mm) Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>1½ in (37.5 mm)</td>
<td>6 lb (2500 g)</td>
</tr>
<tr>
<td>1 in (25 mm)</td>
<td>3.5 lb (1500 g)</td>
</tr>
<tr>
<td>¾ in (19.0 mm)</td>
<td>2.5 lb (1000 g)</td>
</tr>
<tr>
<td>½ in (16.0 mm)</td>
<td>2.0 lb (800 g)</td>
</tr>
<tr>
<td>¼ in (12.5 mm)</td>
<td>1.5 lb (700 g)</td>
</tr>
<tr>
<td>¼ in (9.5 mm)</td>
<td>0.9 lb (400 g)</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>0.4 lb (200 g)</td>
</tr>
</tbody>
</table>

* For aggregate, the nominal maximum size, (NMS) is the largest standard sieve opening listed in the applicable specification, upon which any material is permitted to be retained. For concrete aggregate, NMS is the smallest standard sieve opening through which the entire amount of aggregate is permitted to pass.

Note: For an aggregate specification having a generally unrestrictive gradation (i.e. wide range of permissible upper sizes), where the source consistently fully passes a screen substantially smaller than the maximum specified size, the nominal maximum size, for the purpose of defining sampling and test specimen size requirements may be adjusted to the screen, found by experience to retain no more than 5% of the materials.

Sample Size (Method 1, Combined Sieve Fracture)
7.3 Method 2—Individual Sieve Fracture Determination WSDOT has deleted this section

8. PROCEDURE

8.1. Spread the sample on a clean flat surface large enough to permit careful inspection of each particle. To verify that a particle meets the fracture criteria, hold the aggregate particle so that the face is viewed directly. (See Section 5.1.)

8.2. To aid in making the fracture determination separate the sample into three categories:
   (1) fractured particles meeting the above criteria, (2) particles not meeting specification criteria, and (3) questionable or borderline particles.

8.3. Determine the mass of particles in the fractured category, the mass of questionable particles, and the mass of the unfractured particles.

9. CALCULATION

9.1. Report the following information:

   9.1.1. Calculate the mass percentage of fracture faces to the nearest 1 percent as follows:

   \[ P = \left( \frac{F + Q/2}{F + Q + N} \right) \times 100 \]

   where:
   
   \( P \) = percent of fracture,
   \( F \) = mass of fractured particles,
   \( Q \) = mass of questionable or borderline particles, and
   \( N \) = mass of unfractured particles.

10. REPORT

    Results shall be reported on standard forms approved for use by the agency. Report fracture to the nearest 1 percent.

    Report the results using WSDOT Form 350-161 EF, 422-020X, or other report approved by the State Materials Engineer.

11. PRECISION AND BIAS

   11.1. Precision—The research required to determine the precision of this standard has not been performed.

   11.2. Bias—The research required to determine the bias of this standard has not been performed.
Performance Exam Checklist  
*Determining the Percentage of Fracture In Coarse Aggregate*  
*WSDOT FOP for AASHTO TP 61*

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Sample reduced to correct size, if needed?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Sample dried and cooled, if necessary?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Sample properly sieved through specified sieve(s)?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. Particles separated into fractured, unfractured, and questionable categories?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. Dry mass of each category determined to nearest 0.1 g?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8. Calculation performed correctly?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

First attempt: Pass ☐ Fail ☐  
Second attempt: Pass ☐ Fail ☐

Signature of Examiner  
______________________________

Comments:
WSDOT FOP for AASHTO T 99\(^1\)

Moisture-Density Relations of Soils Using a 5.5-lb (2.5-kg) Rammer and a 12-in. (305-mm) Drop

1. SCOPE

1.1 These methods of test are intended for determining the relation between the moisture content and density of soils compacted in a mold of a given size with a 5.5-lb (2.5-kg) rammer dropped from a height of 12 in. (305 mm). Four alternate procedures are provided as follows:

**Method A**
A 4-in. (101.60-mm) mold: Soil material passing a No. 4 (4.75-mm) sieve Sections 3 and 4.

**Method B**
A 6-in. (152.40-mm) mold: Soil material passing a No. 4 (4.75-mm) sieve Sections 5 and 6.

**Method C**
A 4-in. (101.60-mm) mold: Soil material passing a ¾-in. (19.0-mm) sieve Sections 7 and 8.

**Method D**
A 6-in. (152.40-mm) mold: Soil material passing a ¾-in. (19.0-mm) sieve Sections 9 and 10.

The preferred method of WSDOT is to use Method A.

WSDOT recommends that the bulk specific gravity of coarse aggregate be determined.

Native soils within the contract limits to be used for embankment construction and/or backfill material do not require the sampling by a qualified tester. For material that requires gradation testing such as but not limited to manufactured aggregates and Gravel Borrow, a qualified testers shall be required for sampling.

1.2 The method to be used should be indicated in the specifications for the material being tested. If no method is specified, the provisions of Method A shall govern.

1.3 This test method applies to soils mixtures that have 30% or less retained on the No. 4 (4.75 mm) sieve, when Method A or B is used and 30% or less retained on the ¾-in. (19.0-mm) sieve, when Method C or D is used. The material retained on these sieves shall be defined as oversized particles (coarse particles).

1.4 If the test specimen contains oversize particles, and the test specimen is used for field density compaction control, corrections must be made according to T 224 SOP 615 to compare the total field density with the compacted specimen density. The person or agency specifying this method shall specify a minimum percentage below which correction for oversize need not be applied. If no minimum percentage is specified, correction shall be applied to samples with more than 5\% by weight of oversize particles.

\(^1\) This FOP is based on AASHTO T 99 99-01 and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
1.5. If the specified oversized maximum tolerances are exceeded, other methods of compaction control must be used.

*Note 1:* One method for the design and control of the compaction of such soils is to use a test fill to determine the required degree of compaction and a method to obtain that compaction. Then use a method specification to control the compaction by specifying the type and size of compaction equipment, the lift thickness and the number of passes.

1.6. The following applies to all specified limits in this standard: For the purposes of determining conformance with these specifications, an observed value or a calculated value shall be rounded off “to the nearest unit” in the last right-hand place of figures used in expressing the limiting value, in accordance with R 11.

1.7. The values stated in SI units are to be regarded as the standard.

2. Referenced Documents

2.1. *AASHTO Standards:*
- M 92, Wire-Cloth Sieves for Testing Purposes
- M 231, Weighing Devices Used in the Testing of Materials
- R 11, Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values
- T 19/T 19M, Bulk Density (“Unit Weight”) and Voids in Aggregate
- T 224, Correction for Coarse Particles in the Soil Compaction Test
- T 255, Total Evaporable Moisture Content of Aggregate by Drying
- T 265, Laboratory Determination of Moisture Content of Soils

2.2. *ASTM Standard:*
- D 2168, Calibration of Laboratory Mechanical-Rammer Soil Compactors

3. APPARATUS

3.1 Molds — The molds shall be solid-wall, metal cylinders manufactured with dimensions and capacities shown in Sections 3.1.1 and 3.1.2 below. They shall have a detachable collar assembly approximately 2.375 in. (60 mm) in height, to permit preparation of compacted specimens of soil-water mixtures of the desired height and volume. The mold and collar assembly shall be so constructed that it can be fastened firmly to a detachable base plate made of the same material (Note 2). The base plate shall be plane to 0.005 in. as shown in Figures 1 and 2.

*Note 2:* Alternate types of molds with capacities as stipulated herein may be used, provided the test results are correlated with those of the solid-wall mold on several soil types and the same moisture-density results are obtained. Records of such correlation shall be maintained and readily available for inspection, when alternate types of molds are used.

3.1.1 A 4-in. (101.6-mm) mold having a capacity of $\frac{1}{30}$ (0.0333) ± 0.0003 cu. ft. (0.000943 ± 0.000008 m$^3$) with an internal diameter of 4.000 ± 0.016 in. (101.60 ± 0.41 mm) and a height of 4.584 ± 0.005 in. (116.43 ± 0.13 mm) (Figure 1).
Moisture-Density Relations of Soils Using a 5.5-lb (2.5-kg) Rammer and a 12-in. (305-mm) Drop

Figure 1

(A) WING NUT (4)
(B) STUD (2)
(C) HANGER (4)
(D) WELD (Top and bottom of each hanger)
(E) COLLAR (1)
(F) MOLD (1)
(G) BASE PLATE (1)

NOTE:
ALL DIMENSIONS SHOWN IN MILLIMETERS UNLESS OTHERWISE NOTED.

<table>
<thead>
<tr>
<th>Dimensional Equivalents</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>3.18 ± 0.64</td>
</tr>
<tr>
<td>3.81</td>
</tr>
<tr>
<td>6.35 ± 1.27</td>
</tr>
<tr>
<td>7.62</td>
</tr>
<tr>
<td>9.53 ± 0.64</td>
</tr>
<tr>
<td>12.70 ± 2.54</td>
</tr>
<tr>
<td>17.78 ± 1.27</td>
</tr>
<tr>
<td>20.32</td>
</tr>
<tr>
<td>38.10 ± 2.54</td>
</tr>
</tbody>
</table>

0.000943 ± 0.000008 m³ | 1/30 ± 0.0003 ft³

Cylindrical Mold and Base Plate (101.6-mm mold)

Figure 1
T 99 Moisture-Density Relations of Soils Using a 5.5-lb (2.5-kg) Rammer and a 12-in. (305-mm) Drop

(A) WING NUT (4)
(B) STUD (2)
(C) HANGER (4)
(D) WELD (Top and bottom of each hanger)
(E) COLLAR (1)
(F) MOLD (1)
(G) BASE PLATE (1)

NOTE:
ALL DIMENSIONS SHOWN IN MILLIMETERS UNLESS OTHERWISE NOTED.

<table>
<thead>
<tr>
<th>Dimensional Equivalents</th>
<th>mm</th>
<th>in.</th>
<th>mm</th>
<th>in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.18 ± 0.64</td>
<td>0.125 ± 0.025</td>
<td>50.80 ± 0.64</td>
<td>2.000 ± 0.025</td>
<td></td>
</tr>
<tr>
<td>3.81</td>
<td>0.150</td>
<td>60.33 ± 1.27</td>
<td>2.375 ± 0.050</td>
<td></td>
</tr>
<tr>
<td>6.35 ± 1.27</td>
<td>0.250 ± 0.050</td>
<td>116.43 ± 0.13</td>
<td>4.584 ± 0.005</td>
<td></td>
</tr>
<tr>
<td>7.62</td>
<td>0.300</td>
<td>152.40 ± 0.66</td>
<td>6.000 ± 0.026</td>
<td></td>
</tr>
<tr>
<td>9.53 ± 0.64</td>
<td>0.375 ± 0.025</td>
<td>158.75 ± 1.27</td>
<td>6.250 ± 0.050</td>
<td></td>
</tr>
<tr>
<td>12.70 ± 2.54</td>
<td>0.500 ± 0.100</td>
<td>165.10 ± 2.54</td>
<td>6.500 ± 0.100</td>
<td></td>
</tr>
<tr>
<td>17.78 ± 1.27</td>
<td>0.700 ± 0.050</td>
<td>172.72 ± 2.54</td>
<td>6.800 ± 0.100</td>
<td></td>
</tr>
<tr>
<td>20.32</td>
<td>0.800</td>
<td>203.20 ± 2.54</td>
<td>8.000 ± 0.100</td>
<td></td>
</tr>
<tr>
<td>38.10 ± 2.54</td>
<td>1.500 ± 0.100</td>
<td>215.90 ± 2.54</td>
<td>8.500 ± 0.100</td>
<td></td>
</tr>
</tbody>
</table>

0.002123 ± 0.000021 m³ 1/13.33 ± 0.00075 ft³

Cylindrical Mold and Base Plate (152.4-mm mold)

Figure 2
3.1.2 A 6-in. (152.4-mm) mold having a capacity of 1/13.33 (0.07500) ± 0.00075 cu. ft. (0.002124 ± 0.000021 m³) with an internal diameter of 6.000 ± 0.026 in. (152.40 ± 0.66 mm) and a height of 4.584 ± 0.005 in. (116.43 ± 0.13 mm) (Figure 2).

3.1.3 Molds Out of Tolerance Due to Use — A mold that fails to meet manufacturing tolerances after continued service may remain in use provided those tolerances are not exceeded by more than 50 percent; and the volume of the mold, calibrated in accordance with Section 8 (Calibration of Measure) of T 19/T 19M, for Unit Mass of Aggregate, is used in the calculations.

3.2 Rammer

3.2.1 Manually Operated — Metal rammer with a mass of 5.5 ± 0.02 lb (2.495 ± 0.009 kg), and having a flat circular face of 2.000-in. (50.80-mm) diameter with a manufacturing tolerance of 0.01 in. (± 0.25 mm). The in-service diameter of the flat circular face shall be not less than 1.985 in. (50.42 mm). The rammer shall be equipped with a suitable guide-sleeve to control the height of drop to a free fall of 12.00 ± 0.06 in. (305 ± 2 mm) above the elevation of the soil. The guide-sleeve shall have at least 4 vent holes, no smaller than ⅜-in. (9.5-mm) diameter spaced approximately 90 degrees (1.57 rad) apart and approximately ¾ in. (19 mm) from each end; and shall provide sufficient clearance so the free fall of the rammer shaft and head is unrestricted.

3.2.2 Mechanically Operated — A metal rammer which is equipped with a device to control the height of drop to a free fall of 12.00 ± 0.06 in. (305 ± 2 mm) above the elevation of the soil and uniformly distributes such drops to the soil surface (Note 3). The rammer shall have a mass of 5.5 ± 0.02 lb (2.495 ± 0.009 kg), and have a flat circular face of 2.000-in. (50.80 mm) diameter with a manufactured tolerance of 0.01 in. (± 0.25 mm). The in-service diameter of the flat circular face shall be not less than 1.985 in. (50.42 mm). The mechanical rammer shall be calibrated by ASTM D 2168.

Note 3: It may be impractical to adjust the mechanical apparatus so the free fall is 12 in. (305 mm) each time the rammer is dropped, as with the manually operated rammer. To make the adjustment of free fall, the portion of loose soil to receive the initial blow should be slightly compressed with the rammer to establish the point of impact from which the 12 in. (305 mm) drop is determined. Subsequent blows on the layer of soil being compacted may all be applied by dropping the rammer from a height of 12 in. (305 mm) above the initial-setting elevation; or, when the mechanical apparatus is designed with a height adjustment for each blow, all subsequent blows should have a rammer free fall of 12 in. (305 mm) measured from the elevation of the soil as compacted by the previous blow. A more detailed calibration procedure for laboratory mechanical-rammer soil compactors can be found in ASTM D 2168.
3.2.3 Rammer Face — The circular face rammer shall be used but a sector face may be used as an alternative provided the report shall indicate type of face used other than the 2-in. (50.8-mm) circular face and it shall have an area equal to that of the circular face rammer.

3.3 Sample Extruder (for Solid-Walled Molds Only) — A jack, lever, frame, or other device adopted for the purpose of extruding compacted specimens from the mold.

3.4 Balances and Scales — A balance or scale conforming to the requirements of AASHTO M 231, Class G 20. Also, a balance conforming to the requirements of AASHTO M 231, Class G 2.

**Note 4:** The capacity of the metric balance or scale should be approximately 11.5 kg when used to weigh the 6-in. (152.4-mm) mold and compacted, moist soil; however, when the 4-in. (101.60-mm) mold is used, a balance or scale of lesser capacity than the 11.5 kg may be used, if the sensitivity and readability is 5 g.

3.5 Drying Oven — A thermostatically controlled drying oven capable of maintaining a temperature of 230 ± 9°F (110 ± 5°C) for drying moisture samples.

3.6 Straightedge — A hardened-steel straightedge at least 10 in. (250 mm) in length. It shall have one beveled edge, and at least one longitudinal surface (used for final trimming) shall be plane within 0.01 in. per 10 in. (0.250 mm per 250 mm) (0.1 percent) of length within the portion used for trimming the soil (Note 5).

**Note 5:** The beveled edge may be used for final trimming if the edge is true within a tolerance of 0.01 in. per 10 in. (0.250 mm per 250 mm) (0.1 percent) of length; however, with continued use, the cutting edge may become excessively worn and not suitable for trimming the soil to the level of the mold. The straightedge should not be so flexible that trimming the soil with the cutting edge will cause a concave soil surface.

3.7 Sieves — 2-in. (50-mm), ¾-in. (19.0-mm), and No. 4 (4.75-mm) sieves conforming to the requirements of M 92.

3.8 Mixing Tools — Miscellaneous tools such as mixing pan, spoon, trowel, spatula, etc., or a suitable mechanical device for thoroughly mixing the sample of soil with increments of water.

3.9 Containers — Suitable containers made of material resistant to corrosion and not subject to change in mass or disintegration on repeated heating and cooling. Containers shall have close-fitting lids to prevent loss of moisture from samples before initial mass determination and to prevent absorption of moisture from the atmosphere following drying and before final mass determination. One container is needed for each moisture content determination.
METHOD A

4. SAMPLE

4.1 If the soil sample is damp when received from the field, dry it until it becomes friable under a trowel. Drying may be in air or by use of a drying apparatus which is maintained at a temperature not exceeding 140°F (60°C). Then thoroughly break up the aggregations in such a manner as to avoid reducing the natural size of individual particles.

4.2 Sieve an adequate quantity of the representative pulverized soil over the No. 4 (4.75-mm) sieve. Discard the coarse material, if any, retained on the No. 4 (4.75-mm) sieve.

4.3 Select a representative sample, with a mass of approximately 7 lb (3 kg) or more, of the soil prepared as described in Sections 4.1 and 4.2.

Note 6: When developing a compaction curve for free draining soils, such as uniform sands and gravels, where seepage occurs at the bottom of the mold and base plate, taking a representative moisture content sample from the mixing bowl may be preferred in order to determine the amount of moisture available for compaction.

5. PROCEDURE

5.1 Thoroughly mix the selected representative sample with sufficient water to dampen it to approximately four percentage points below optimum moisture content.

5.2 Form a specimen by compacting the prepared soil in the 4-in. (101.60-mm) mold (with collar attached) in three approximately equal layers to give a total compacted depth of about 5 in. (125 mm). Prior to compaction, place the loose soil into the mold and spread into a layer of uniform thickness. Lightly tamp the soil prior to compaction until it is not in a loose or fluffy state, using either the manual compaction rammer or similar device having a face diameter of approximately 2 in. (50 mm). Following compaction of each of the first two layers, any soil adjacent to the mold walls that has not been compacted or extends above the compacted surface shall be trimmed using a knife or other suitable device, and be evenly distributed on top of the layer. Compact each layer by 25 uniformly distributed blows from the rammer dropping free from a height of 12 in. (305 mm) above the elevation of the soil when a sleeve-type rammer is used, or from 12 in. (305 mm) above the approximate elevation of compacted soil when a stationary mounted type of rammer is used. During compaction, the mold shall rest firmly on a dense, uniform, rigid, and stable foundation or base. This base shall remain stationary during the compaction process (Note 7).

Note 7: Each of the following has been found to be a satisfactory base on which to rest the mold during compaction of the soil: A block of concrete, with a mass not less than 200 lb (90 kg), supported by a relatively stable foundation; a sound concrete floor; and for field application, such surfaces as are found in concrete box culverts, bridges, and pavements.
5.2.1 Following compaction, remove the extension collar, carefully trim the compacted soil even with the top of the mold by means of the straightedge, and determine the mass of the mold and moist soil in kilograms to the nearest 5 grams, or determine the mass in pounds to the nearest 0.01 pounds. For molds conforming to tolerances given in Section 3.1.1 and masses recorded in kilograms, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 1060, and record the result as the wet density, \( W_1 \), in kilograms per cubic meter, of compacted soil. For molds conforming to tolerances given in Section 3.1.1 and masses recorded in pounds, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 30, and record the result as the wet density, \( W_1 \), in pounds per cubic foot, of compacted soil. For used molds out of tolerance by not more than 50 percent (Section 3.1.3), use the factor for the mold as determined in accordance with Calibration of Measure in AASHTO T 19/T 19M.

5.3 Remove the material from the mold and slice vertically through the center. Take a representative sample of the material from one of the cut faces, the minimum mass of the sample shall be in accordance with the Table 1, weigh immediately and dry in accordance with T 255 or T 265, to determine the moisture content, and record the results.

<table>
<thead>
<tr>
<th>Maximum Particle Size</th>
<th>Minimum Mass of Sample, g</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 40 (0.425-mm) sieve</td>
<td>10</td>
</tr>
<tr>
<td>No. 4 (4.75-mm) sieve</td>
<td>100</td>
</tr>
<tr>
<td>½ in. (12.5-mm)</td>
<td>300</td>
</tr>
<tr>
<td>1 in. (25.0-mm)</td>
<td>500</td>
</tr>
<tr>
<td>2 in. (50-mm)</td>
<td>1000</td>
</tr>
</tbody>
</table>

Table 1

5.4 Thoroughly break up the remaining portion of the molded specimen until it will pass a No. 4 (4.75-mm) sieve as judged by eye, and add to the remaining portion of the sample being tested. Add water in sufficient amount to increase the moisture content of the soil one to two percentage points (water content increments should not exceed 2.5 percent except when heavy clay soils or organic soils exhibiting flat elongated curves are encountered, the water content increments may be increased to a maximum of 4 percent), and repeat the above procedure for each increment of water added. Continue this series of determinations until there is either a decrease or no change in the wet unit mass, \( W_1 \), per cubic foot (cubic meter) of the compacted soil (Note 8).

**Note 8:** This procedure has been found satisfactory in most cases. However, in instances where the soil material is fragile in character and will reduce significantly in grain size due to repeated compaction, and in cases where the soil is a heavy-textured clayey material into which it is difficult to incorporate water, a separate and new sample shall be used in each compaction test. In these cases, separate samples shall be thorougly mixed with amounts of water sufficient to cause the moisture contents of the samples to vary by approximately two percentage points. The moisture points selected shall bracket the optimum moisture content, thus providing
samples which, when compacted, will increase in mass to the maximum density and then decrease in mass. The samples of soil-water mixtures shall be placed in covered containers and allowed to stand for not less than 12 hours before making the moisture-density test.

5.4.1 In instances where the soil material is fragile in character and will be reduced significantly in grain size by repeated compaction, a separate and new sample shall be used in each compaction test.

METHOD B

6. SAMPLE

6.1 Select the representative sample in accordance with Section 3.3, except that it shall have a mass of approximately 16 lb (7 kg).

7. PROCEDURE

7.1 Follow the same procedure as described for Method A in Section 4, except for the following: Form a specimen by compacting the prepared soil in the 6-in. (152.4-mm) mold (with collar attached) in three approximately equal layers to give a total compacted depth of about 5 in. (125 mm), each layer being compacted by 56 uniformly distributed blows from the rammer. For molds conforming to tolerances given in Section 2.1.2, and masses recorded in kilograms, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 471, and record the result as the wet density, \( W_1 \), in kilograms per cubic meter, of compacted soil. For molds conforming to tolerances given in Section 2.1.2, and masses recorded in pounds, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 13.3, and record the result as the wet density, \( W_1 \), in pounds per cubic foot, of compacted soil. For used molds out of tolerance by not more than 50 percent (Section 3.1.3), use the factor for the mold as determined in accordance with Calibration of Measure in 19/T 19M.

METHOD C

8. SAMPLE

8.1 If the soil sample is damp when received from the field, dry it until it becomes friable under a trowel. Drying may be in air or by use of a drying apparatus which is maintained at a temperature not exceeding 140°F (60°C). Then thoroughly break up the aggregations in such a manner as to avoid reducing the natural size of individual particles.

8.2 Sieve an adequate quantity of the representative pulverized soil over the 19.0-mm sieve. Discard the coarse material, if any, retained on the 7/4 in. (19.0-mm) sieve (Note 9).

Note 9: If it is advisable to maintain the same percentage of coarse material (passing a 2 in. (50-mm) sieve and retained on a No. 4 (4.75-mm) sieve) in the moisture-density sample as in the original field sample, the material retained on the 7/4 in. (19.0-mm) sieve shall be replaced as follows: Sieve an adequate quantity of the representative pulverized soil over the 2 in. - 7/4 in. (50- and 19.0-mm) sieves.
Determine the mass of the material passing the 2 in. (50-mm) sieve and retained on the ¾ in. (19.0-mm) sieve and replace it with an equal mass of material passing the ¾ in. (19.0-mm) sieve and retained on the No. 4 (4.75-mm) sieve. Take the material for replacement from the remaining portion of the sample.

Select a representative sample, having a mass of approximately 11 lb (5 kg) or more, of the soil prepared as described in Sections 8.1 and 8.2.

9. PROCEDURE

9.1 Thoroughly mix the selected representative sample with sufficient water to dampen it to approximately 4 percentage points below optimum moisture content.

9.2 Form a specimen by compacting the prepared soil in the 4-in. (101.60-mm) mold (with collar attached) in three approximately equal layers to give a total compacted depth of about 5 in. (125 mm). Prior to compaction, place the loose soil into the mold and spread into a layer of uniform thickness. Lightly tamp the soil prior to compaction until it is not in a loose or fluffy state, using either the manual compaction rammer or similar device having a face diameter of approximately 2 in. (50 mm). Following compaction of each of the first two layers, any soil adjacent to the mold walls that has not been compacted or extends above the compacted surface shall be trimmed using a knife or other suitable device, and be evenly distributed on top of the layer. Compact each layer by 25 uniformly distributed blows from the rammer dropping free from a height of 12 in. (305 mm) above the elevation of the soil when a sleeve-type rammer is used, or from 12 in. (305 mm) above the approximate elevation of each finely compacted layer when a stationary mounted type rammer is used. During compaction, the mold shall rest firmly on a dense, uniform, rigid and stable foundation (Note 7).

9.2.1 Following compaction, remove the extension collar, carefully trim the compacted soil even with the top of the mold by means of the straightedge. Holes developed in the surface by removal of coarse material shall be patched with smaller sized material. Determine the mass of the mold and moist soil in kilograms to the nearest 5 grams, or determine the mass in pounds to the nearest 0.01 pounds. For molds conforming to tolerances given in Section 3.1.1 and masses recorded in kilograms, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 1060, and record the result as the wet density, \( W_1 \), in kilograms per cubic meter, of compacted soil. For molds conforming to tolerances given in Section 3.1.1 and masses recorded in pounds, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 30, and record the result as the wet density, \( W_1 \), in pounds per cubic foot, of compacted soil. For used molds out of tolerance by not more than 50 percent (3.1.3), use the factor for the mold as determined in accordance with Section 8 (Calibration of Measure), AASHTO T 19/T 19M.
9.3 Remove the material from the mold and slice vertically through the center. Take a representative sample of the material from one of the cut faces, determine the mass immediately and dry in accordance with T 255 or T 265, to determine the moisture content, and record the results.

9.4 Thoroughly break up the remainder of the material until it will pass a ¾ in. (19.0-mm) sieve and 90 percent of the soil aggregations will pass a No. 4 (4.75-mm) sieve as judged by eye, and add to the remaining portion of the sample being tested. Add water in sufficient amounts to increase the moisture content of the soil sample by one or two percentage points, and repeat the above procedure for each increment of water added. Continue this series of determinations until there is either a decrease or no change in the wet mass, W₁, per cubic foot (cubic meter) of compacted soil (Note 8).

METHOD D

10. SAMPLE

10.1 Select the representative sample in accordance with Section 8.3 except that it shall have a mass of approximately 25 lb (11 kg).

11. PROCEDURE

11.1 Follow the same procedure as described for Method C in Section 9, except for the following: Form a specimen by compacting the prepared soil in the 6-in. (152.4-mm) mold (with collar attached) in three approximately equal layers to give a total compacted depth of about 5 in. (125 mm), each layer being compacted by 56 uniformly distributed blows from the rammer. For molds conforming to tolerances given in Section 3.1.2, and masses recorded in kilograms, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 471, and record the result as the wet density, W₁, in kilograms per cubic meter, of compacted soil. For molds conforming to tolerances given in Section 3.1.2, and masses recorded in pounds, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 13.33, and record the result as the wet density, W₁, in pounds per cubic foot, of the compacted soil. For used molds out of tolerance by not more than 50 percent (Section 3.1.3), use the factor for the mold as determined in accordance with Section 9 (Calibration of Measure), T 19/T 19M.

CALCULATIONS AND REPORT

12. CALCULATIONS

12.1 Calculate the moisture content and the dry unit mass of the soil as compacted for each trial, as follows:

\[ w = \frac{A - B}{B - C} \times 100 \]

and

\[ W = \frac{W_{1}}{w + 100} \times 100 \]
where:
\[ w = \text{percentage of moisture in the specimen, based on oven dry mass of soil}; \]
\[ A = \text{mass of container and wet soil}; \]
\[ B = \text{mass of container and dry soil}; \]
\[ C = \text{mass of container}; \]
\[ W = \text{dry mass, in kilograms per cubic meter of compacted soil, or pounds per cubic foot of compacted soil}; \]
\[ W_1 = \text{wet mass, in kilograms per cubic meter of compacted soil, or pounds per cubic foot of compacted soil}. \]

13. MOISTURE-DENSITY RELATIONSHIP

13.1 The calculations in Section 12.1 shall be made to determine the moisture content and corresponding oven-dry unit mass (density) in kilograms per cubic meter or pounds per cubic foot of the compacted samples. The oven-dry densities (unit mass) of the soil shall be plotted as ordinates and the corresponding moisture content as abscissas.

13.2 Optimum Moisture Content — When the densities and corresponding moisture contents for the soil have been determined and plotted as indicated in Section 13.1, it will be found that by connecting the plotted points with a smooth line, a curve is produced. The moisture content corresponding to the peak of the curve shall be termed the “optimum moisture content” of the soil under the above compaction.

13.3 Maximum Density — The oven-dry density in pounds per cubic foot (kilograms per cubic meter) of the soil at optimum moisture content shall be termed “maximum density” under the above compaction.

14. REPORT

14.1 The report shall include the following:

14.1.1 The method used (Method A, B, C, or D).

14.1.2 The optimum moisture content, as a percentage, to the nearest whole number.

14.1.3 The maximum density in pounds per cubic foot to the nearest whole number (kilograms per cubic meter to the nearest 10 kg/m³).

14.1.4 In Methods C and D indicate if the material retained on the ¾ in. (19.0-mm) sieve was removed or replaced.

14.1.5 Type of face if other than 2 in. (50.8 mm) circular.

15. PRECISION STATEMENT

See AASHTO T-99 for Precision.
Tester Qualification Practical Exam Checklist

Moisture-Density Relations of Soils Using a 5.5-lb (2.5-kg) Rammer and a 12-in. (305-mm) Drop
FOP for AASHTO T 99

Participant Name ___________________________  Exam Date ____________

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>has the current calibration/verification tags present?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample Preparation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. If damp, sample dried in air or drying apparatus, not exceeding 140°F (60°C)?</td>
<td></td>
</tr>
<tr>
<td>2. Sample pulverized and adequate amount sieved over the No. 4 (4.75 mm) sieve?</td>
<td></td>
</tr>
<tr>
<td>3. Material retained on the sieve discarded?</td>
<td></td>
</tr>
<tr>
<td>4. Sample passing the sieve has appropriate mass?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Procedure</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sample mixed with water to approximately 4 percent below expected optimum</td>
<td></td>
</tr>
<tr>
<td>moisture content?</td>
<td></td>
</tr>
<tr>
<td>2. Layer of soil placed in mold with collar attached?</td>
<td></td>
</tr>
<tr>
<td>3. Mold placed on rigid and stable foundation?</td>
<td></td>
</tr>
<tr>
<td>4. Lightly tamp soil in mold?</td>
<td></td>
</tr>
<tr>
<td>5. Soil compacted with 25 blows?</td>
<td></td>
</tr>
<tr>
<td>6. Scrape sides of mold and evenly distributed on top of the layer?</td>
<td></td>
</tr>
<tr>
<td>7. Soil placed and compacted in three equal layers?</td>
<td></td>
</tr>
<tr>
<td>8. No more than ½ inch of soil above the top of the bottom portion of the</td>
<td></td>
</tr>
<tr>
<td>mold?</td>
<td></td>
</tr>
<tr>
<td>9. Collar removed and soil trimmed to top of mold with straightedge?</td>
<td></td>
</tr>
<tr>
<td>10. Mass of mold and contents determined to appropriate precision?</td>
<td></td>
</tr>
<tr>
<td>11. Wet mass of specimen multiplied by appropriate factor to obtain wet</td>
<td></td>
</tr>
<tr>
<td>density (.03333 lbs/ft³)?</td>
<td></td>
</tr>
<tr>
<td>12. Soil removed from mold using sample extruder?</td>
<td></td>
</tr>
<tr>
<td>13. Soil sliced vertically through center?</td>
<td></td>
</tr>
<tr>
<td>14. Moisture sample removed from one cut face and moist mass determined</td>
<td></td>
</tr>
<tr>
<td>immediately?</td>
<td></td>
</tr>
</tbody>
</table>
Tester Qualification Practical Exam Checklist (continued)

Procedure
15. Moisture sample mass of at least 100 g? □ □
16. Sample dried and water content determined according to AASHTO T 255 or T 265? □ □
17. Remainder of material from mold broken up to about passing sieve size and added to remainder of original test sample? □ □
18. Water added to increase moisture content in approximately 2 percent increments? □ □
19. Steps 2 through 15 repeated for each increment of water added? □ □
20. If soil is plastic (clay types):
   a. Sample mixed with water varying moisture content by approximately 2 percent, bracketing the optimum moisture content? □ □
   b. Samples placed in covered containers and allowed to stand for at least 12 hours □ □
21. Process continued until wet density either decreases or stabilizes? □ □
22. Water content and dry density calculated for each sample? □ □
23. Dry density plotted on vertical axis, moisture content plotted on horizontal axis, and points connected with a smooth curve? □ □
24. Water content at peak of curve recorded as optimum water content and recorded to nearest 1 percent? □ □
25. Dry density at optimum water content reported as maximum density, to nearest 1 lb/ft³ (10 kg/m³)? □ □
26. All calculations performed correctly? □ □

First attempt: Pass □ Fail □ Second attempt: Pass □ Fail □

Signature of Examiner __________________________

Comments:
WSDOT FOP for AASHTO T 119¹

Standard Test Method for Slump of Hydraulic-Cement Concrete

1. SCOPE
   1.1 This test method covers determination of slump of concrete, both in the laboratory and in the field.
   1.2 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.
   1.3 The text of the standard reference notes and footnotes provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.
   1.4 This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. (Warning—Fresh Hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.)

2. REFERENCED DOCUMENTS
   2.1 AASHTO Standards:
       T 141 Sampling Freshly Mixed Concrete
   2.2 ASTM Standards:
       C 172 Practice for Sampling Freshly Mixed Concrete

3. SUMMARY OF TEST METHOD
   3.1 A sample of freshly mixed concrete is placed and compacted by rodding in a mold shaped as the frustum of a cone. The mold is raised, and the concrete allowed to subside. The distance between the original and displaced position of the center of the top surface of the concrete is measured and reported as the slump of the concrete.

¹ This FOP is based on AASHTO T 119-07.
4. SIGNIFICANCE AND USE

4.1 This test method is intended to provide the user with a procedure to determine slump of plastic hydraulic-cement concretes.

*Note 1:* This test method was originally developed to provide a technique to monitor the consistency of unhardened concrete. Under laboratory conditions, with strict control of all concrete materials, the slump is generally found to increase proportionally with the water content of a given concrete mixture, and thus to be inversely related to concrete strength. Under field conditions, however, such a strength relationship is not clearly and consistently shown. Care should therefore be taken in relating slump results obtained under field conditions to strength.

4.2 This test method is considered applicable to plastic concrete having coarse aggregate up to 1½ in. (37.5 mm) in size. If the coarse aggregate is larger than 1½ in. (37.5 mm) in size contact the State Materials Laboratory. The test method is applicable when it is performed on the fraction of concrete passing a 1½-in. (37.5-mm) sieve, with the larger aggregate being removed per FOP for WAQTC TM 2. Contact the Materials Laboratory for directions in accordance with the section titled “Additional Procedure for Large Maximum Size Aggregate Concrete” in Practice T 141.

4.3 This test method is not considered applicable to non-plastic and non-cohesive concrete.

*Note 2:* Concretes having slumps less than 0.5 in. (15 mm.) may not be adequately plastic and concretes having slumps greater than about 9 in. (230 mm) may not be adequately cohesive for this test to have significance. Caution should be exercised in interpreting such results.

5. APPARATUS

5.1 Mold — The test specimen shall be formed in a mold made of metal not readily attacked by the cement paste. The metal shall not be thinner than 0.060 in. (1.5 mm) and if formed by the spinning process, there shall be no point on the mold at which the thickness is less than 0.045 in. (1.15 mm). The mold shall be in the form of the lateral surface of the frustum of a cone with the base 8 in. (200 mm) in diameter, the top 4 in. (100 mm) in diameter, and the height 12 in. (300 mm). Individual diameters and heights shall be within ± ⅛ in. (3.2 mm) of the prescribed dimensions. The base and the top shall be open and parallel to each other and at right angles to the axis of the cone. The mold shall be provided with foot pieces and handles similar to those shown in Figure 1. The mold shall be constructed without a seam. The interior of the mold shall be relatively smooth and free from projections. The mold shall be free from projections. A mold which clamps to a nonabsorbent base plate is acceptable instead of the one illustrated provided the clamping arrangement is such that it can be fully released without movement of the mold and the base is large enough to contain all of the slumped concrete in an acceptable test.

5.1.1 Check and record conformance to the mold’s specified dimensions when it is purchased or first placed in service and at least annually thereafter.

5.1.2 Mold with alternative materials.
5.1.2.1 Molds other than metal are permitted if the following requirements are met: The mold shall meet the shape, height, and internal dimensional requirements of Section 5.1. The mold shall be sufficiently rigid to maintain the specified dimensions and tolerances during use, resistant to impact forces, and shall be nonabsorbent. The mold shall be demonstrated to provide test results comparable to those obtained when using a metal mold meeting the requirements of Section 5.1. Comparability shall be demonstrated on behalf of the manufacturer by an independent testing laboratory. Test for comparability shall consist of not less than 10 consecutive pairs of comparisons performed at each of three different slumps ranging from 50 to 200 mm [2 to 8 in.]. No individual test results shall vary by more than 15 mm [0.50 in.] from that obtained using the metal mold. The average test results of each slump range obtained using the mold constructed of alternative material shall not vary by more than 6 mm [0.25 in.] from the average of test results obtained using the metal mold. Manufacturer comparability test data shall be available to users and laboratory inspection authorities (see Note 4). If any changes in material or method of manufacture are made, tests for comparability shall be repeated.

Note 3: The phrase “consecutive pairs of comparisons” does not mean without interruption or all in one day. At a schedule selected by the testing entity, the pairs of tests leading to 10 consecutive pairs may be accomplished in small groups. The word consecutive prevents ignoring pairs of tests which may not meet criteria.

Note 4: Because the slump of concrete decreases with time and higher temperatures, it will be advantageous for the comparability tests to be performed by alternating the use of metal cones and alternative material cones, to utilize several technicians, and to minimize the time between test procedures.

5.1.2.2 If the condition of any individual mold is suspected of being out of tolerance from the as manufactured condition, a single comparative test shall be performed. If the test results differ by more than 0.50 in. (15 mm) from that obtained using the metal mold, the mold shall be removed from service.

5.2 Tamping Rod — The tamping rod shall be a round, straight steel rod ⅝ in. (16 mm) in diameter and approximately 24 in. (600 mm) in length, having the tamping end or both ends rounded to a hemispherical tip, the diameter of which is ⅝ in. (16 mm).

5.3 Measuring Device—A ruler, metal roll-up measuring tape, or similar rigid or semi-rigid length measuring instrument marked in increments of 5 mm [¼ in.] or smaller. The instrument length shall be at least 300 mm [12 in.].

5.4 Torpedo level

5.5 Base — Flat, nonabsorbent, rigid surface.
Mold for Slump Test

*Figure 1*
6. **SAMPLE**

6.1 The sample of concrete from which test specimens are made shall be representative of the entire batch. It shall be obtained in accordance with FOP for WAQTC TM 2. With concrete using 1½ in. (37.5 mm), or larger aggregate, the aggregate larger than 1½ in. (37.5 mm) must be removed per FOP for WAQTC TM 2. Contact the Materials Laboratory for directions.

7. **PROCEDURE**

7.1 Dampen the mold and place it on a flat, level, moist, nonabsorbent (rigid) surface such as a pre-moistened concrete floor or a base plate. It shall be held firmly in place during filling and perimeter cleaning by the operator standing on the two foot pieces, or by clamping arrangements to a base plate as described in 5.1. From the sample of concrete obtained in accordance with Section 6, immediately fill the mold in three layers, each approximately one-third the volume of the mold.

*Note 5:* One third of the volume of the slump mold fills it to a depth of 2⅝ in. (67 mm); two thirds of the volume fills it to a depth of 6⅛ in. (155 mm).

7.2 Rod each layer with 25 strokes of the tamping rod. Uniformly distribute the strokes over the cross section of each layer. For the bottom layer this will necessitate inclining the rod slightly and making approximately half of the strokes near the perimeter, and then progressing with vertical strokes spirally toward the center. Rod the bottom layer throughout its depth. Rod the second layer and the top layer each throughout its depth, so that the strokes just penetrate into the underlying layer.

7.3 In filling and rodding the top layer, heap the concrete above the mold before rodding is started. If the rodding operation results in subsidence of the concrete below the top edge of the mold, add additional concrete to keep an excess of concrete above the top of the mold at all times. After the top layer has been rodded, strike off the surface of the concrete by means of a screeding and rolling motion of the tamping rod. Continue to hold the mold down firmly and remove concrete from the area surrounding the base of the mold to preclude interface with the movement of slumping concrete.

Remove the mold immediately from the concrete by raising it carefully in a vertical direction. Raise the mold a distance of approximately 12 in. (300 mm) in 5 ± 2 seconds by a steady upward lift with no lateral or torsional motion. Complete the entire test from the start of the filling through removal of the mold without interruption and complete it within an elapsed time of 2½ min.

7.4 Immediately measure the slump by determining the vertical difference between the top of the mold and the displaced original center of the top surface of the specimen. If a decided falling away or shearing off of concrete from one side or portion of the mass occurs (Note 6), disregard the test and make a new test on another portion of the sample.

*Note 6:* If two consecutive tests on a sample of concrete show a falling away or shearing off of a portion of the concrete from the mass of the specimen, the concrete probably lacks necessary plasticity and cohesiveness for the slump test to be applicable. Report material cannot be slumped due to shearing or falling away.
8. REPORT

8.1 Report the slump in terms of inches (millimeters) to the nearest ¼ in. (5 mm) of subsidence of the specimen during the test. as follows:

Slump = 12 inches of height after subsidence
Slump = 300 mm of height after subsidence

Report results on concrete delivery ticket (i.e., Certificate of Compliance).

The name of the tester who performed the field acceptance test is required on concrete delivery tickets containing test results.

9. PRECISION AND BIAS

9.1 Precision:

See AASHTO T 119 for Precision and bias
Performance Exam Checklist

Slump of Hydraulic Cement Concrete
FOP for AASHTO T 119

Participant Name ___________________________ Exam Date ________________

Procedure Element Yes No
1. The tester has a copy of the current procedure on hand? □ □
2. All equipment is functioning according to the test procedure, and if required, □ □
   has the current calibration/verification tags present?
3. Cone and floor or base plate dampened? □ □
4. Cone held firmly against the base by standing on the two foot pieces? □ □
   Cone not allowed to move in any way during filling?
5. Representative samples scooped into the cone? □ □
6. Cone filled in three approximately equal layers by volume? □ □
7. Each layer rodded throughout its depth 25 times with hemispherical end of rod, □ □
   uniformly distributing strokes?
8. Middle and top layers rodded to just penetrate into the underlying layer? □ □
9. When rodding the top layer, excess concrete kept above the mold at all times? □ □
10. Concrete struck off level with top of cone using tamping rod? □ □
11. Excess concrete removed from around the base? □ □
12. Cone lifted upward approximately 12 in. (300 mm) in one smooth motion, □ □
    without twisting the cone, in 5 ± 2 seconds?
13. Slump measured to the nearest ¼ in. (5 mm) from the top of the cone to the □ □
    displaced original center of the top surface of the specimen?
14. Test performed from start to finish within 2½ minutes? □ □

First attempt: Pass □ Fail □ Second attempt: Pass □ Fail □

Signature of Examiner ____________________________

Comments: ____________________________
WSDOT Test Method T 123
Method of Test for Bark Mulch

1. SCOPE
   a. This method covers a procedure for determining the sieve analysis and material finer than \( \frac{1}{4} \) in. No. 4 sieve using a loose volume bucket.

2. EQUIPMENT
   a. A mechanical sieve shaker.
   b. Sieves — Sieves conforming to the requirements of AASHTO M-92. Breaker sieves may be used.
   c. Volume Bucket — A container calibrated in 1 gal. increments from 1 to 5 gal. A 5-gal. bucket may be used when calibrated as follows:
      On a level surface calibrate the container by gradually filling it with water in 1 gal. increments. Mark the inner wall of the container after the addition of each gallon

3. PROCEDURE
   a. Air dry (140°F max.) the sample for 15 hours, ± 4 hours.
   b. Reduce the sample to testing size per the FOP for AASHTO T 248.
   c. Place the sample in the volume bucket and record the volume as the total volume.
   d. Shake the sample over the \( \frac{1}{4} \) in. and No. 4 sieves. Using breaker sieves inserted between the two specified sieves so the No. 4 sieve will not be overloaded. Use caution to avoid over sieving as the wood material breaks down.
   e. The material retained on the \( \frac{1}{4} \) in. sieve is measured in the volume bucket and recorded.
   f. The material on the breaker sieves is added to the material retained on the No. 4 sieve and the volume measured in the volume bucket and recorded.
   g. The percent passing is calculated as follows:

\[
100 - \left( \frac{\text{Volume on sieve} \times 100}{\text{Total Volume}} \right) = \% \text{ passing}
\]
## Performance Exam Checklist

### Method of Test for Bark Mulch

**WSDOT T 123**

<table>
<thead>
<tr>
<th>Procedure Element</th>
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<th>No</th>
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<tr>
<td>2. All equipment is functioning according to the test procedure, and if required,</td>
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<td>☐</td>
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<td>has the current calibration/verification tags present?</td>
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</tr>
<tr>
<td>3. Bark mulch sample dried for 15 ± 4 hrs @ 140°F?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Five (5) gallon bucket calibrated in 1 gal. increments?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Sample quartered or split and placed in calibrated bucket?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. Volume of sample in bucket recorded as total volume?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. Sample screened in the shaker through 1½ in. screen, breaker screens and No. 4</td>
<td>☐</td>
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<tr>
<td>screen?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8. Do not over shake to prevent degrading of sample?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>9. Remove 1½ in. screen and damp material in calibrated bucket and record volume</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>as volume on 1½ in. screen?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>10. Place all breaker screen material down to No. 4 screen in bucket and record</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>volume as volume on No. 4 screen?</td>
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<td>☐</td>
</tr>
<tr>
<td>11. All calculations performed correctly?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>12. Report results?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

First attempt: Pass ☐ Fail ☐  Second attempt: Pass ☐ Fail ☐

Signature of Examiner: ____________________________________

Comments:

Participant Name: ___________________________  Exam Date: ____________
WSDOT FOP for WAQTC/AASHTO T 152

AIR CONTENT OF FRESHLY MIXED CONCRETE BY THE PRESSURE METHOD

Significance

Concrete is not a solid, but rather a solid with void spaces. The voids may contain gas such as air, or liquid, such as water. All concrete contains air voids, and the amount can be increased by the addition of an air entraining agent to the mix. When such an agent is used, the size of the voids drastically decreases and the number of voids greatly increases, providing a much greater dispersal of voids.

Air entrainment is necessary in concrete that will be saturated and exposed to cycles of freezing and thawing, and to deicing chemicals. The microscopic entrained air voids provide a site for relief of internal pressure that develops as water freezes and thaws inside the concrete. Without the proper entrained-air content, normal concrete that is saturated and is exposed to cycles of freezing and thawing can fail prematurely by scaling, spalling, or cracking.

Care must be taken, however, not to have too much entrained air. As the air content increases, there will be a corresponding reduction in the strength and other desirable properties of the concrete. Typically, this strength reduction will be on the order of 3 to 5 percent for each 1 percent of air content. A concrete mix design proportioned for 5 percent air, for example, will be approximately 15 to 25 percent lower in strength if the air content were to double.

Scope

This procedure covers determination of the air content in freshly mixed portland cement concrete containing dense aggregates in accordance with AASHTO T 152 (Type B meter). It is not for use with lightweight or highly porous aggregates. This procedure includes calibration of the "Type B" air meter gauge, and two methods for calibrating the gauge are presented. Concrete containing aggregate that would be retained on the 1½ in (37.5 mm) sieve must be wet sieved. Sieve a sufficient amount of the sample over the 1½ in (37.5 mm) sieve in accordance with the FOP for WAQTC TM 2.

Apparatus

• Air meter: Type B, as described in AASHTO T 152
• Balance or scale: Accurate to 0.3 percent of the test load at any point within the range of use (for Method 1 calibration only)
• Verified external or internal calibration vessel of known volume (usually 5% ± of the volume of the meter base).
• Tamping rod: ⅝ in. (16 mm) diameter and approximately 24 in. (600 mm) long, having a hemispherical tip. (Hemispherical means half a sphere; the tip is rounded like half of a ball.)
• Vibrator: 7000 vibrations per minute, 0.75 to 1.50 in. (19 to 38 mm) in diameter, at least 3 in. (75 mm) longer than the section being vibrated for use with low slump concrete
• Scoop
• Container for water: rubber syringe (may also be a squeeze bottle)

1 This FOP is based on AASHTO T 152-05 and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
• Strike-off bar: Approximately 12 in. x 3/4 in. x 1/8 in. (300 mm x 22 mm x 3 mm).
• Strike-off Plate: A flat rectangular metal plate at least ¼ in. (6 mm) thick or a glass or acrylic plate at least ½ in. (12 mm) thick, with a length and width at least 2 in. (50 mm) greater than the diameter of the measure with which it is to be used. The edges of the plate shall be straight and smooth within tolerance of 1/16 in. (1.5 mm).

Note 1: Use either the strike-off bar or strike-off plate; both are not required. Unit weight requires the use of a strike off plate.

• Mallet: With a rubber or rawhide head having a mass of 1.25 ±0.5 lb (0.57 ± 0.23 kg)

Calibration of Air Meter Gauge

Note 2: There are two methods for calibrating the air meter, mass or volume.

1. Screw the short piece of straight tubing into the threaded petcock hole on the underside of the cover. Determine the mass of the dry, empty air meter base and cover assembly (Mass Method only).

2. Fill the base nearly full with water.

3. Clamp the cover on the base with the tube extending down into the water. Mark the petcock with the tube attached for future reference.

4. Add water through the petcock having the pipe extension below until all air is forced out the other petcock. Rock the meter slightly until all air is expelled through the petcock.

5. Wipe off the air meter base and cover assembly, and determine the mass of the filled unit (Mass Method only).

6. Pump up the air pressure to a little beyond the predetermined initial pressure indicated on the gauge. Wait a few seconds for the compressed air to cool, and then stabilize the gauge hand at the proper initial pressure by pumping up or relieving pressure, as needed.

7. Close both petcocks and immediately open the main air valve exhausting air into the base. Wait a few seconds until the meter needle stabilizes. The gauge should now read 0 percent. If two or more tests show a consistent variation from 0 percent in the result, change the initial pressure line to compensate for the variation, and use the newly established initial pressure line for subsequent tests.

8. Determine which petcock has the straight tube attached to it. Attach the curved tube to external portion of the same petcock.

9. Pump air into the air chamber. Open the petcock with the curved tube attached to it. Open the main air valve for short periods of time until 5 percent of water by mass or volume has been removed from the air meter. Remember to open both petcocks to release the pressure in the base and drain the water in the curved tube back into the base. To determine the mass of the water to be removed, subtract the mass found in Step 1 from the mass found in Step 5. Multiply this value by 0.05. This is the mass of the water that must be removed. To remove 5 percent by volume, remove water until the external calibrating vessel is level full.
**Note 3:** Many air meters are supplied with a calibration vessel(s) of known volume that are used for this purpose. Calibration vessels must be protected from damage that would change their volume.

If an external or internal calibration vessel is used, confirm what percentage volume it represents for the air meter being used. Vessels commonly represent 5 percent volume, but they are for specific size meters. This should be confirmed by mass.

10. Remove the curved tube. Pump up the air pressure to a little beyond the predetermined initial pressure indicated on the gauge. Wait a few seconds for the compressed air to cool, and then stabilize the gauge hand at the proper initial pressure by pumping up or relieving pressure, as needed.

11. Close both petcocks and immediately open the main air valve exhausting air into the base. Wait a few seconds until the meter needle is stabilized. The gauge should now read 5.0 ± 0.2 percent. If the gauge is outside that range, the meter needs adjustment. (Consult the Region Materials Lab) The adjustment could involve adjusting the starting point so that the gauge reads 5.0 ± 0.2 percent when this calibration is run, or could involve moving the gauge needle to read 5.0 percent. Any adjustment should comply with the manufacturer’s recommendations.

**Note 4:** Calibration shall be performed per agency standards, prior to field use, and weekly during construction use. Record the date of the calibration, the calibration results, and the name of the technician performing the calibration in the log book kept with each air meter.

**WSDOT Note:** Air meter calibration standard for WSDOT:

*Region Laboratory* - Required to calibrate air meter yearly

*Project Office* - Required to calibrate air meter as follows:

1. First Time Use Calibration: Calibrate air meter prior to first time use in the field each construction season or when the air meter has not been used for more than a month during the construction season.

2. Construction Use Calibration: After “First Time Use Calibration,” calibrate the air meter once a week when used during construction.

12. When the gauge hand reads correctly at 5.0 percent, additional water may be withdrawn in the same manner to check the results at other values such as 10 percent or 15 percent.

**Note 5:** Remove the extension tubing from threaded petcock hole in the underside of the cover before starting the test procedure.

An internal calibration vessel of known volume, usually 5% of the volume of the bucket, may be employed as a quick method to verify the calibration of the air meter during construction use. To employ this vessel proceed as follows:

13. Fill the base nearly full with water and place the internal calibration vessel into the base. Place the cover back on the base and gently add water through the petcock until all the air has been expelled. Do not disturb the meter to such an extent as to knock the calibration vessel from an upright position. Do not install either of the threaded tubes into the petcock when using the calibration vessels.
14. Pump up the air pressure to a little beyond the predetermined initial pressure indicated in the calibration record log book. Wait a few seconds for the compressed air to cool and then stabilize the gauge hand at the proper initial pressure by pumping up or relieving pressure, as needed.

15. Close both petcocks and immediately open the main air valve exhausting air into the base. Wait a few seconds and gently tap the back of the gauge until the meter needle stabilizes. The gauge should now read 5.0 ± 0.2 percent or ± 0.2 percent of the volume indicated in the calibration vessel. If the gauge is outside of that range follow step 1 through step 12 of the calibration procedure to re-calibrate the air meter. If further adjustment is required consult the Region Materials Lab.

16. If necessary, additional vessels may be placed into the base to verify the calibration of the air meter at 10% volume and 15% volume or the sum of the volumes indicated on the individual calibration vessels.

17. Record the date that the calibration of the air meter was verified in the calibration log book.

18. Gently release the air pressure in the base by opening one of the petcocks then remove and drain any water from within the calibration vessel and store it in a safe location. The air meter is now ready for use.

Procedure Selection

There are two methods of consolidating the concrete – rodding and vibration. If the slump is greater than 3 in. (75 mm), consolidation is by rodding. When the slump is 1 to 3 in. (25 to 75 mm), internal vibration or rodding can be used to consolidate the sample, but the method used must be that required by the agency in order to obtain consistent, comparable results. For slumps less than 1 in. (25 mm), consolidate the sample by internal vibration.

PROCEDURE – RODDING

1. Obtain the sample in accordance with the FOP for WAQTC TM 2. If any aggregate larger than 1½ in. (37.5 mm) is present, the larger aggregate must be removed. Sieve a sufficient amount of the sample over the 1½ in. (37.5 mm) sieve in accordance with the Wet Sieving portion of the FOP for WAQTC TM 2. Contact the Materials Laboratory for directions.

Note 7: Testing shall begin within five minutes of obtaining the sample.

2. Dampen the inside of the air meter base and place on a firm, level surface.

3. Fill the base approximately ⅓ full with concrete.

4. Consolidate the layer with 25 strokes of the tamping rod, using the rounded end. Distribute the strokes evenly over the entire cross section of the concrete. Rod throughout its depth without hitting the bottom too hard.

5. Tap the sides of the base smartly 10 to 15 times with the mallet to close voids and release trapped air.

6. Add the second layer, filling the base about ⅔ full.

7. Consolidate this layer with 25 strokes of the tamping rod, penetrating about 1 in (25 mm) into the bottom layer.
8. Tap the sides of the base 10 to 15 times with the mallet.
9. Add the final layer, slightly overfilling the base.
10. Consolidate this layer with 25 strokes of the tamping rod, penetrating about 1 in. (25 mm) into the second layer.
11. Tap the sides of the base smartly 10 to 15 times with the mallet.

*Note 8:* The base should be slightly over full, about ⅛ in. (3 mm) above the rim. If there is a great excess of concrete, remove a portion with the trowel or scoop. If the base is under full, add a small quantity. This adjustment may be done only after consolidating the final layer and before striking off the surface of the concrete.

12. Strike off the surface of the concrete and finish it smoothly with a sawing action of the strike-off bar or plate, using great care to leave the base just full. The surface should be smooth and free of voids, as much as possible.
13. Clean the top flange of the base to ensure a proper seal.
14. Moisten the inside of the cover and check to see that both petcocks are open and the main air valve is closed.
15. Clamp the cover on the base.
16. Inject water into one petcock until water emerges from the second petcock. (Note: Water is injected into only one petcock during the entire procedure)
17. Rock the air meter gently until no air bubbles appear to be coming out of the second petcock. The petcock expelling water should be higher than the petcock where water is being injected. Return the air meter to a level position and verify that water is present in both petcocks.
18. Close the air bleeder valve and pump air into the air chamber until the needle goes past the initial pressure line. Allow a few seconds for the compressed air to cool.
19. Tap the gauge gently with one hand while slowly opening the air bleeder valve until the needle rests on the initial pressure line. Close the air bleeder valve.
20. Close both petcocks.
21. Open the main air chamber valve.
22. Tap the sides of the base smartly with the mallet.
23. With the main air chamber valve open, lightly tap the gauge to settle the needle, and then read the air content to the nearest 0.1 percent, while the air chamber valve is open.
24. Release or close the main air chamber valve.
25. Open both petcocks to release pressure, remove the concrete, and thoroughly clean the cover and base with clean water.
26. Open the main air valve to relieve the pressure in the air chamber.
Procedure - Internal Vibration

1. Obtain the sample in accordance with the FOP for WAQTC TM 2. If any aggregate larger than 1½ in (37.5 mm) is present, the larger aggregate must be removed. Sieve a sufficient amount of the sample over the 1½ in (37.5 mm) sieve in accordance with the Wet Sieving portion of the FOP for WAQTC TM 2. Contact the Materials Laboratory for directions.

2. Dampen the inside of the air meter bowl and place on a firm level surface.

3. Fill the base approximately half full.

4. Insert the vibrator at three different points. Do not let the vibrator touch the bottom or sides of the base.

   Note 9: Remove the vibrator slowly, so that no air pockets are left in the material.

   Note 10: Continue vibration only long enough to achieve proper consolidation of the concrete. Over vibration may cause segregation and loss of appreciable quantities of intentionally entrained air.

5. Fill the base a bit over full.

6. Insert the vibrator as in Step 3. Do not let the vibrator touch the sides of the base, and penetrate the first layer approximately 1 in. (25 mm).

7. Return to Step 12 of the rodding procedure and continue.

Report

Results shall be reported on standard forms approved for use by the agency. Record the percent of air to the nearest 0.1 percent.

Report results on concrete delivery ticket, (i.e. Certificate of Compliance).

The name of the tester who performed the field acceptance test is required on concrete delivery tickets containing test results.
## Performance Exam Checklist

**WSDOT FOP for WAQTC/AASHTO T 152**

**AIR CONTENT OF FRESHLY MIXED CONCRETE BY THE PRESSURE METHOD**

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required,</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>has the current calibration/verification tags present?</td>
<td>☐</td>
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<tr>
<td>3. Container filled in three equal layers, slightly overfilling the last layer?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Each layer rodded throughout its depth 25 times with hemispherical end of rod,</td>
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<td>☐</td>
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<tr>
<td>uniformly distributing strokes?</td>
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<td>5. Bottom layer rodded throughout its depth, without forcibly striking the bottom</td>
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<tr>
<td>of the container?</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>6. Middle and top layers rodded, each throughout their depths and penetrating</td>
<td>☐</td>
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<tr>
<td>1 in. (25 mm) into the underlying layer?</td>
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<tr>
<td>7. Sides of the container tapped 10 to 15 times with the mallet after rodding</td>
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<td>each layer?</td>
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<tr>
<td>8. Concrete struck off level with top of container using the bar and rim</td>
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<td>cleaned off?</td>
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### Using a Type B Meter

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<tr>
<th>Procedure Element</th>
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<th>No</th>
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<tbody>
<tr>
<td>9. Both petcocks open?</td>
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<tr>
<td>10. Air valve closed between air chamber and the bowl?</td>
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<tr>
<td>11. Inside of cover cleaned and moistened before clamping to base?</td>
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<tr>
<td>12. Water injected through petcock until it flows out the other petcock?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>13. Water injection into the petcock continued while <strong>tipping</strong> the meter to insure all air is expelled?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>14. Air pumped up to initial pressure line?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>15. A few seconds allowed for the compressed air to stabilize?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>16. Gauge adjusted to the initial pressure?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>17. Both petcocks closed?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>18. Air valve opened between chamber and bowl?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>19. Sides of bowl tapped with the mallet?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
### Using a Type B Meter

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>20. With air valve open, Air percentage read after lightly tapping the gauge to stabilize the hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>21. Air valve closed and then petcocks opened to release pressure before removing the cover?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>22. Air content recorded to 0.1 percent?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>23. All calculations performed correctly?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

First attempt: Pass ☐ Fail ☐  
Second attempt: Pass ☐ Fail ☐

Signature of Examiner ________________________________

This checklist is derived, in part, from copyrighted material printed in ACI CP-1, published by the American Concrete Institute.

Comments:
WSDOT FOP for AASHTO T 166¹

Bulk Specific Gravity of Compacted Hot Mix Asphalt Using Saturated Surface-Dry Specimens

1. SCOPE

1.1 This method of test covers the determination of bulk specific gravity of specimens of compacted hot mix asphalt.

1.2 Definition:

1.3 Bulk specific gravity (of solids)—the ratio of the weight mass in air of a unit volume of a permeable material (including both permeable and impermeable voids normal to the material) at a stated temperature to the weight in air of equal density of an equal volume of gas-free distilled water at a stated temperature. The form of the expression shall be:

Bulk specific gravity $x/y \, ^\circ C$

where:

$x$ = temperature of the material, and

$y$ = temperature of the water

1.4 This method should not be used with samples that contain open or interconnecting voids and/or absorb more than 2 percent of water by volume, as determined in Sections 6.2 or 9.2 herein.

1.5 The bulk specific gravity of the compacted hot mix asphalt may be used in calculating the unit mass of the mixture.

1.6 The values stated in English SI units are to be regarded as the standard.

Note: Method A shall be used for laboratory compacted specimens, and field specimens compacted using gyratory compactor. Method C shall be used for asphalt pavement cores.

2. REFERENCED DOCUMENTS

2.1 AASHTO Standards:

• M 231, Weighing Devices Used in the Testing of Materials

• T 275, Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens

¹ This Test Method is based on AASHTO T 166-07.
3. TEST SPECIMENS

3.1 Test specimens may be either laboratory-molded HMA asphalt mixtures or from HMA pavements. The mixtures may be surface, wearing, leveling or base course materials, or the length of the sides of sawed specimens, or the longest specimen from core drill, diamond or carborundum saw specimens. Specimens shall be taken from pavements with core drill, diamond or carborundum saw, or by other suitable means.

3.2 Size of Specimens — It is recommended that: (1) the diameter of cylindrically molded or cored specimens, or the length of the sides of sawed specimens, be at least equal to four times the maximum size of the aggregate; and (2) the thickness of specimens be at least one-and-one-half times the maximum size of the aggregate.

3.3 Specimens shall be taken from pavements with core drill, diamond or carborundum saw, or by other suitable means.

3.4 Care shall be taken to avoid distortion, bending, or cracking of specimens during and after the removal from pavement or mold. Specimens shall be stored in a safe, cool place.

3.5 Specimens shall be free from foreign materials such as seal coat, tack coat, foundation material, soil, paper, or foil.

3.6 If desired, specimens may be separated from other pavement layers by sawing or other suitable means. Care should be exercised to ensure sawing does not damage the specimens.

4. APPARATUS

4.1 Weighing Device — The weighing device shall have sufficient capacity, be readable to 0.1 percent of the sample specimen mass, or better, and conform to the requirements of AASHTO M 231. The weighing device shall be equipped with suitable suspension apparatus and holder to permit weighing the specimen while suspended from the center of scale pan of the weighing device.

4.2 Suspension Apparatus — The wire suspending the container shall be the smallest practical size to minimize any possible effects of a variable immersed length. The suspension apparatus shall be constructed to enable the container to be immersed to a depth sufficient to cover it and the test sample specimen during weighing. Care should be exercised to ensure no trapped air bubbles exist under the specimen.

4.3 Water Bath — for immersing the specimen in water while suspended under the weighing device, equipped with an overflow outlet for maintaining a constant water level.

5. PROCEDURE

5.1 Dry the specimen to a constant mass (Note 1). Cool the specimen to room temperature for a minimum of 15 hours and a maximum of 24 hours at 77 ± 0°F (25 ± 5°C) per SOP 731 and record the dry mass as A. Immerse each specimen in water at 77 ± 1.8°F (25 ± 1°C) for 4 ± 1 minute and record the immersed mass as C. Remove the specimen from the water, damp dry the specimen by blotting with a damp towel as quickly as possible (blotting not to exceed 5s), and determine the surface-dry mass as, B. Any water that seeps from the specimen during the weighing operation is considered part of the saturated specimen (Note 1). Each specimen shall be immersed and weighed individually.
**Note 1:** Constant mass shall be defined as the mass at which further drying at 125 ± 5°F (52 ± 3°C) does not alter the mass by more than 0.1 ± 0.05 percent. A specimen saturated with water shall initially be dried overnight at 125 ± 5°F (52 ± 3°C) and then weighed at 2-hour drying intervals. Recently molded laboratory specimens which have not been exposed to moisture do not require drying.

**Note 2:** If desired, the sequence of testing operations may be changed to expedite the test results. For example, first the immersed mass (C) can be taken, then the surface-dry mass (B), and finally the dry mass (A).

**Note 3:** Terry cloth has been found to work well for an absorbent cloth. Damp is considered to be when no water can be wrung from towel.

6. **CALCULATION**

6.1 Calculate the bulk specific gravity of the specimens as follows (round and report the value to the nearest three decimal places):

\[
\text{Bulk Sp. Gr.} = \frac{A}{B - C}
\]

where:
- \(A\) = mass in grams of sample specimen in air,
- \(B\) = mass in grams of surface-dry specimen in air,
- \(C\) = mass in grams of sample specimen in water.

6.2 Calculate the percent water absorbed by the specimen (on volume basis) as follows:

\[
\text{Percent Water Absorbed by Volume} = \left(\frac{B - A}{B - C}\right) \times 100
\]

6.3 If the percent water absorbed by the specimen in Section 5.1 exceeds 2 percent, use T 275 (Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens) to determine the bulk specific gravity.

**METHOD B**

WSDOT does not use Method B and has removed this section from the procedure.

**METHOD C (RAPID TEST)**

10. **PROCEDURE**

10.1 This procedure can be used for testing specimens which are not required to be saved and which contain substantial amount of moisture. Specimens obtained by coring or sawing can be tested the same day by this method.

10.2 The testing procedure shall be the same as given in Sections 5 except for the sequence of operations. The dry mass (A) of the specimen is determined last as follows.

**Note 4:** A microwave oven can be used to speed up the process by initially heating the sample so that it can be broken into small pieces prior to placing it into the drying oven.
10.3 Place the specimen in a large flat bottom drying pan of known mass. Place the pan and specimen in a 230 ± 9°F (110 ± 5°C) 325 ± 25º F (164 ± 14°C) oven. Leave the specimen in the oven until it can be easily separated to the point where the particles of the fine aggregate-asphalt portion are not larger than ¼ in. (6.4 mm). Place the separated specimen in the 230°F (110°C) 325º F (164ºC) oven and dry to a constant mass. The test sample shall be initially dried for a minimum of 90 minutes, and its mass determined. Then, at 30 minute intervals until constant mass is achieved. Constant mass shall be defined as the mass at which further drying at 230 ± 9°F (110 ± 5°C) 325 ± 25º F (164 ± 14°C) does not alter the mass by more than 0.1 ± 0.05 percent when weighed at 2 hour intervals.

Note: If samples are placed in the oven overnight for a minimum of 6 hours at 230°F, then the 2 hour 90 minute weighting is not necessary.

10.4 Cool the pan and specimen to room temperature at 77 ± 9°F (25 ± 5°C). Determine the mass of the pan and specimen, subtract the mass of the pan and record the dry mass, A.

11. CALCULATIONS

11.1 Calculate the bulk specific gravity in Sections 6.1 and 8.1.

12. REPORT

12.1 The report shall include the following:

12.1.1 The method used (A, B, or C).

12.1.2 Bulk Specific Gravity reported to the nearest thousandth. (0.001)

12.1.3 Absorption reported to the nearest hundredth. (0.01)

13. PRECISION

13.1 Duplicate specific gravity results by the same operator should not be considered suspect unless they differ more than 0.02.
Performance Exam Checklist

WSDOT FOP for AASHTO T 166
Bulk Specific Gravity of Compacted Hot Mix Asphalt Using Saturated Surface Dry Specimens

Participant Name ______________________ Exam Date ____________

Procedure Element

1. The tester has a copy of the current procedure on hand?  
   Yes ☐  No ☐

2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present?  
   Yes ☐  No ☐

Method A (For use with laboratory compacted specimens.)

1. Compacted specimen cooled to room temperature (refer to WSDOT SOP 731, Procedure #5g), 77 ± 9 F, and record the dry mass.  
   Yes ☐  No ☐  I

2. Immerse each specimen in water at 77 ± 1.8°F for 3 to 5 minutes and record the immersed mass to the nearest 0.1 gram?  
   Yes ☐  No ☐

3. Remove sample from water, surface dry with damp towel and weigh the specimen in air at 77 ± 9 F to the nearest 0.1 gram?  
   Yes ☐  No ☐

4. Calculate the bulk specific gravity of the specimens by following the calculation in AASHTO T 166 (Section 5.1)?  
   Yes ☐  No ☐

Method C (For use with pavement cores and chunks.)

1. Immerse specimen in water at 77 ± 1.8°F for 3 to 5 minutes and record the immersed weight to the nearest 0.1 gram?  
   Yes ☐  No ☐  I

2. Remove sample from water, surface dry by blotting with damp towel and immediately weigh specimen in air at 77 ± 9 F to the nearest 0.1 gram?  
   Yes ☐  No ☐

3. Place specimen in container (noting the empty container weight), then into an oven set at 325 ± 25°F until sample can be broken into small pieces?  
   Yes ☐  No ☐

4. Return container to oven until it has reached a constant weight?  
   Yes ☐  No ☐

5. Remove container and sample from oven and allow to cool to room temperature, 77 ± 9 F?  
   Yes ☐  No ☐

6. Weigh pan with sample and record to nearest 0.1 gram, deducting known weight of pan to arrive at oven-dried sample weight?  
   Yes ☐  No ☐

7. Calculate the bulk specific gravity of the specimen by following the calculation in AASHTO T166 (Section 5.1)?  
   Yes ☐  No ☐

First attempt:  Pass ☐  Fail ☐  Second attempt:  Pass ☐  Fail ☐

Signature of Examiner ____________________________
Comments:
SAMPLING OF HOT MIX ASPHALT PAVING MIXTURES
FOP FOR WAQTC T 168

Significance
Testing bituminous paving mixtures in the field begins with obtaining and preparing the sample to be tested. Standardized procedures for obtaining a representative sample have been established. Producing strong, durable, reliable pavement in roadways requires careful sampling and accurate testing.

Technicians must be patient and follow these procedures. If one considers that the specifications require quality tests to be made on only a small portion of the total material placed, the need for a truly representative sample is apparent. For this reason, every precaution must be taken to obtain a sample that is truly representative of the entire batch and then to protect that sample from contamination and physical damage.

Scope
This procedure covers the sampling of bituminous paving mixtures from HMA plants, haul units, and roadways in accordance with AASHTO T 168. Sampling is as important as testing, and every precaution must be taken to obtain a truly representative sample.

Apparatus
- Shovel
- Sample containers: such as cardboard boxes, metal cans, stainless steel bowls, or other agency-approved containers
- Mechanical Sampling Device

Sample Size
Sample size depends on the test methods specified by the agency for acceptance. WSDOT requires a minimum of four times the amount required for testing. This should be approximately 125 lbs.

Sampling
- General
  1. The material shall be inspected to determine variations. The supplier/contractor shall provide one of the following:
     a. A mechanical sampling device attached to the HMA plant.
     b. Platforms or devices to enable sampling from the hauling vehicle without entering the hauling vehicle for sampling HMA.

1 This FOP is based on WAQTC T 168 and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360)709-5412.
2. Place dense graded mixture samples in cardboard boxes or stainless steel bowls or other agency approved containers. Place open graded mixture samples in stainless steel bowls. Do not put open graded mixture samples in boxes until they have cooled to the point that bituminous material will not migrate from the aggregate.

*Note 2:* Care shall be taken to prevent contamination of bituminous mixes by dust or other foreign matter, and to avoid segregation of aggregate and bituminous materials.

- **Attached Sampling Devices**
  Some agencies require mechanical sampling devices for hot mix asphalt (HMA) and cold feed aggregate on some projects. These are normally permanently attached devices that allow a sample container to pass perpendicularly through the entire stream of material or divert the entire stream of material into the container. Operation may be hydraulic, pneumatic, or manual and allows the sample container to pass through the stream twice, once in each direction, without overfilling. Special caution is necessary with manually operated systems since a consistent speed is difficult to maintain and non-representative samples may result. Check agency requirements for the specifics of required sampling systems.

- **Sampling from Truck Transports Haul Units**
  1. Obtain samples in four approximately equal increments from haul units.
  2. Obtain each increment from approximately 12 in. (300 mm) below the surface, in each of the four quadrants of the load.
  3. Combine the increments to form a sample of the required size.

- **Sampling from Roadway Prior to Compaction (Plate Method)**
  WSDOT has deleted this section.

3. **Temperature of Mix**
   Using a verified thermometric device, check and record temperature immediately upon obtaining sample.

**Identification and Shipping**
1. Identify sample containers as required by the agency.
2. Ship samples in containers that will prevent loss, contamination, or damage.
3. Refer to the sample identification requirements in FOP for WSDOT Test Method 712.
Performance Exam Checklist

**WSDOT FOP FOR WAQTC/AASHTO T 168**
**SAMPLING OF HOT MIX ASPHALT PAVING MIXTURES**

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Containers of correct type and ample size available?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Samples from truck transports taken from four quadrants at approximately</td>
<td></td>
<td></td>
</tr>
<tr>
<td>depth 12 inches?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Temperature of mix checked?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Sample size meets agency requirements?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Sample identified as required?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

First attempt: Pass □ Fail □  
Second attempt: Pass □ Fail □

Signature of Examiner  ________________________________

Comments:
Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test

1. SCOPE

1.1 This test is intended to serve as a rapid field test to show the relative proportions of fine dust or claylike material in soils or graded aggregates.

1.2 The following applies to all specified limits in this standard: For the purpose of determining conformance with these specifications, an observed value or a calculated value shall be rounded off “to the nearest unit” in the last right-hand place of figures used in expressing the limiting value, in accordance with R 11, Recommended Practice for Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values.

1.3 The values stated in English units are to be regarded as the standard.

1.4 Refer to R 16 for regulatory information for chemicals.

2. APPARATUS

2.1 A graduated plastic cylinder, rubber stopper, irrigator tube, weighted foot assembly, and siphon assembly, all conforming to their respective specifications and dimensions shown in Figure 1. Fit the siphon assembly to a 1 gal (4-L) bottle of working calcium chloride solution (see Section 2.8) placed on a shelf 36 ± 1 in. (915 ± 25 mm) above the work surface. In lieu of the specified 1 gal (4-L) bottle, a glass or plastic vat having a larger capacity may be used provided the liquid level of the working solution is maintained between 36 and 46 inches (915 and 1170 mm) above the work surface. (See Figure 2.)

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1 This FOP is based on AASHTO T 176-08 and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
FIGURE 1 Sand Equivalent Apparatus
ASSEMBLY C

Note: all dimensions are shown in mm unless otherwise indicated.

FIGURE 1 Sand Equivalent Apparatus (continued)
### LIST OF MATERIAL

<table>
<thead>
<tr>
<th>Assembly</th>
<th>No. Reg.</th>
<th>Description</th>
<th>Stock size</th>
<th>Material</th>
<th>Heat Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>SIPHON ASSEMBLY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Siphon Tube</td>
<td>6.4 dia. X 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Siphon Hose</td>
<td>4.6 I.D. X 1220</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Blow Hose</td>
<td>4.8 I.D. X 50.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Blow Tube</td>
<td>6.4 dia X 50.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Two-Hole Stopper</td>
<td>No. 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Irrigator Tube</td>
<td>6.4 O.D. 0.89 Wall X 500 Stainless Steel tube, Type 316</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Clamp</td>
<td>Pinchcock, Day, BKH No. 21730 or Equiv.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>GRADUATE ASSEMBLY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Tube</td>
<td>38.1 Od. X 430</td>
<td>Trans. Acrylic Plastic</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Base</td>
<td>12.7 X 102 X 102</td>
<td>Trans. Acrylic Plastic</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>WEIGHTED FOOT ASSEMBLY</td>
<td></td>
<td></td>
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<tr>
<td>10</td>
<td></td>
<td>Sand Reading Indicator</td>
<td>6.4 dia. X 14.9</td>
<td>Nylon 101 type 66 Annealed</td>
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<tr>
<td>11</td>
<td></td>
<td>Rod</td>
<td>6.4 dia. X 438.2</td>
<td>Brass</td>
<td></td>
</tr>
<tr>
<td>12</td>
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<td>Weight</td>
<td>50.8 dia. X 52.78</td>
<td>C.R. SH.</td>
<td></td>
</tr>
<tr>
<td>13</td>
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<td>Roll Pin</td>
<td>0.16 dia. X 12.7</td>
<td>Steel</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>Foot</td>
<td>0.16 dia. X 13.7</td>
<td>Brass</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>Solid Stopper</td>
<td>No. 7</td>
<td>Rubber</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. “C” Mounted Foot Assembly to weigh 1000 ± 5 g.
2. Graduations of graduate to be 2.54 mm apart and every tenth mark to be numerically designated as shown. Every fifth line should be approximately 9.5 mm long. All other lines should be approximately 5.5 mm long. Depth to be 0.4 mm. Width to be 0.8 mm across the top.
3. Accuracy of scale to be ± 0.25 mm. Error at any point on scale to be ± 0.75 mm of true distance to zero.
4. Glass or stainless steel may be substituted as a material type for the copper siphon and blow tubing.

### Sand Equivalent Apparatus (continued)

*Figure 1*

**Note 1:** An older model of weighted foot assembly has a guide cap that fits over the upper end of the graduated cylinder and centers the rod in the cylinder, and the foot of the assembly has a conical upper surface and three centering screws to center it loosely in the cylinder. The older model does not have the same reading indicator affixed to the rod (Figure 1), but a slot in the centering screws of the weighted foot is used to indicate the sand reading. Apparatus with the sand reading indicator (Figure 1) is preferred for testing clayey materials.

2.2 A tinned measure, having a capacity of 3 oz (85 ± 5 mL), approximately 2.25 in. (57 mm) in diameter.

2.3 A wide-mouth funnel approximately 4 in. (100 mm) in diameter at the mouth.
2.4 A clock or watch reading in minutes and seconds.

2.5 A mechanical shaker having a throw of 8.00 ± 0.04 in. (203.2 ± 1.0 mm) and operating at 175 ± 2 cycles per minute (2.92 ± 0.03 Hz) (Note 2). Prior to use, fasten the mechanical sand equivalent shaker securely to a firm and level mount.

Note 2: The mechanical shaker shall be used when performing referee sand equivalent determinations.

2.6 A manually operated shaker capable of producing an oscillating motion at the rate of 100 complete cycles in 45 ± 5 seconds, with a hand-assisted half stroke length of 5.0 ± 0.2 in. (127 ± 5 mm). The shaker shall be fastened securely to a firm and level mount by bolts or clamps.

2.7 Stock Solution – Shall meet the requirements of AASHTO T 176.

2.8 Working calcium chloride solution: Prepare the working calcium chloride by diluting one measuring tin full 3 oz. (85 ± 5 mL), or from a graduated cylinder of the stock calcium chloride solution to 1 gal (3.8 L) with water (finished product will equal 1 gallon). Use distilled or demineralized water for the normal preparation of the working solution. Record the date made on the gallon bottle. Working solutions more than 30 days old shall be discarded.

2.9 A straightedge or spatula, suitable for striking off the excess soil from the tin measure.

2.10 A thermostatically controlled drying oven, or other suitable sources of heat may be used, such as an electric or gas hot plate, electric heat lamp, or a ventilated microwave oven.

2.11 Quartering or splitting cloth, approximately 2 ft square, nonabsorbent material such as plastic or oil cloth.

2.12 Optional Handle for Irrigation Tube — A 25-mm diameter wooden dowel to aid in pushing the irrigation tube into firm materials. See Figure 1, Assembly B.

3. TEMPERATURE CONTROL

3.1 The temperature of the working solution should be maintained at 67-77°F (22 ± 3°C) during the performance of this test. If field conditions preclude the maintenance of the temperature range, frequent reference samples should be submitted to a laboratory where proper temperature control is possible. It is also possible to establish temperature correction curves for each material being tested where proper temperature control is not possible. However, no general correction curve should be utilized for several materials even within a narrow range of sand equivalent values. Samples which meet the minimums and equivalent requirement at a working solution temperature below the recommended range need not be subject to reference testing.
4. **SAMPLING**

4.1 Obtain a sample of the material to be tested in accordance with WSDOT FOP for AASHTO T 2.

4.2 Reduce the sample according to T 248.

4.3 Sieve the sample over a 4.75-mm (No. 4) sieve. All aggregations of fine-grained soil material shall be pulverized to pass the 4.75-mm (No. 4) sieve, and all fines shall be cleaned from the particles retained on the 4.75-mm (No. 4) sieve and included with the material passing the 4.75-mm (No. 4) sieve.

4.4 Split or quarter the material passing the No. 4 (4.75-mm) to yield approximately 1,000 g to 1500 g of material. Use extreme care to obtain a truly representative portion of the original sample (Note 3).

Sieve the aggregate past the No. 4 sieve with a mechanical shaker per FOP for WAQTC/AASHTO T27/11 at SSD or drier. Use caution to avoid overloading the No. 4 sieve, additional sieving may be necessary.

**Note 3:** Experiments show that as the amount of material being reduced by splitting or quartering is decreased, the accuracy of providing representative portions is decreased. It is imperative that the sample be split or quartered carefully. When it appears necessary, dampen the material before splitting or quartering, to avoid segregation or loss of fines.

5. **SAMPLE PREPARATION**

5.1 Prepare two test samples by the following method:

5.1.1 The sample must be in the proper moisture condition to achieve reliable results. This condition is determined by tightly squeezing a small portion of the thoroughly mixed sample in the palm of the hand. If the cast that is formed permits careful handling without breaking, the correct moisture range has been obtained. If the material is too dry, the cast will crumble and it will be necessary to add water and remix and retest until the material forms a cast. If the material shows any free water it is too wet to test and must be drained and air-dried, mixing it frequently to insure uniformity. This overly wet material will form a good cast when checked initially, so the drying process should continue until a squeeze check on the drying material gives a cast which is more fragile and delicate to handle than the original.

Place the sample on the splitting cloth and mix by alternately lifting each corner of the cloth and pulling it over the sample toward the diagonally opposite corner, causing the material to be rolled. When the material appears homogeneous, finish the mixing with the sample in a pile near the center of the cloth.
5.1.2 Fill the 3 oz (85 mL) tin measure by pushing it through the base of the pile while exerting pressure with the hand against the pile on the side opposite the measure. As the tin is moved though the pile, hold enough pressure with the hand to cause the material to fill the tin to overflowing. Press firmly with the palm of the hand, compacting the material and allowing the maximum amount to be placed in the tin. Strike off the tin measure level full with a spatula or straightedge. For the second determination, remix the sample and fill the tin again.

Dry the test sample to constant mass in accordance with FOP for AASHTO T 255, and cool to room temperature before testing. It is acceptable to place the test sample in a larger container to aid drying.

6. PROCEDURE

6.1 Start the siphon by forcing air into the top of the solution bottle through the bent copper, glass, or stainless steel blow tube while the pinch clamp is open. The apparatus is now ready for use.

6.2 Siphon 4.0 ± 0.1 in. (101.6 ± 2.5 mm) of working calcium chloride solution into the plastic cylinder. Pour the prepared test sample into the plastic cylinder using the funnel to avoid spillage (See Figure 3). Tap the bottom of the cylinder sharply on the heel of the hand several times to release air bubbles and to promote thorough wetting of the sample.

6.3 Allow the wetted sample to stand undisturbed for 10 ± 1 minute. At the end of the 10-minute soaking period, stopper the cylinder, then loosen the material from the bottom by partially inverting the cylinder and shaking it simultaneously.

6.4 After loosening the material from the bottom of the cylinder, shake the cylinder and contents by any one of the following methods:

6.4.1 Mechanical Shaker Method — Place the stoppered cylinder in the mechanical sand equivalent shaker, set the timer, and allow the machine to shake the cylinder and contents for 45 ± 1 second.
6.4.2 Manual Shaker Method — Secure the stoppered cylinder in the three spring clamps on the carriage of the hand-operated sand equivalent shaker and reset the stroke counter to zero. Stand directly in front of the shaker and force the pointer to the stroke limit marker painted on the backboard by applying an abrupt horizontal thrust to the upper portion of the right hand spring steel strap. Then remove the hand from the strap and allow the spring action of the straps to move the carriage and cylinder in the opposite direction without assistance or hindrance. Apply enough force to the right hand spring steel strap during the thrust portion of each stroke to move the pointer to the stroke limit marker by pushing against the strap with the ends of the fingers to maintain a smooth oscillating motion. The center of the stroke limit marker is positioned to provide the proper stroke length and its width provides the maximum allowable limits of variation. Proper shaking action is accomplished only when the tip of the pointer reverses direction within the marker limits. Proper shaking action can best be maintained by using only the forearm and wrist action to propel the shaker. Continue the shaking action for 100 strokes.

![Manually-operated shaker]

Figure 4

6.5 Following the shaking operation, set the cylinder upright on the work table and remove the stopper.

6.6 Irrigation Procedure — Insert the irrigator tube in the cylinder and rinse material from the cylinder walls as the irrigator is lowered. Force the irrigator through the material to the bottom of the cylinder by applying a gentle stabbing and twisting action while the working solution flows from the irrigator tip. This flushes the fine material into suspension above the coarser sand particles, (See Figure 5.) Continue to apply the stabbing and twisting action while flushing the fines upward until the cylinder is filled to the 15 in. (381 mm) mark. Then raise the irrigator slowly without shutting off the flow so that the liquid level is maintained at about 15 in. (381 mm) while the irrigator is being withdrawn. Regulate the flow just before the irrigator is entirely withdrawn and adjust the final level to 15 in. (381 mm). Final level as judged by the bottom of the meniscus shall be between the top two gradations on the tube but shall not be above the 15 in. (381 mm) level.
Note 4: For certain soils, particularly on crushed materials, the stabbing action may not be possible. For these materials, the irrigation technique is as follows: Continue to apply a twisting action as the irrigation tube is slowly withdrawn. As the tube is withdrawn, it is essential that as many fines as possible flushed upward until the cylinder is filled to the 15 in (381 mm) mark.

6.7 Allow the cylinder and contents to stand undisturbed for 20 minutes ± 15 seconds. Start the timing immediately after withdrawing the irrigator tube.

6.8 At the end of the 20 minute sedimentation period, read and record the level of the top of the clay suspension. This is referred to as the “clay reading.” If no clear line of demarcation has formed at the end of the specified 20 minute sedimentation period, allow the sample to stand undisturbed until a clear reading can be obtained, then immediately read and record the level of the top of the clay suspension and the total sedimentation time. If the total sedimentation time exceeds 30 minutes, it will be rejected.

6.9 After the clay reading has been taken, the “sand reading” shall be obtained by one of the following methods:

[Images: Irrigation and Clay reading]

6.9.1 When using the weighted foot assembly having the sand indicator on the rod of the assembly, place the assembly over the cylinder and gently lower the assembly toward the sand. Do not allow the indicator to hit the mouth of the cylinder as the assembly is being lowered. As the weighted foot comes to rest on the sand, tip the assembly toward the graduations on the cylinder until the indicator touches the inside of the cylinder. Subtract 10 in. (254 mm) from the level indicated by the extreme top edge of the indicator and record this value as the “sand reading.” (See Figure 6.)

6.9.2 If an older model weighted foot assembly having centering screws is used, keep one of the centering screws in contact with the cylinder wall near the graduations so that it can be seen at all times while the assembly is being lowered. When the weighted foot has come to rest on the sand, read the level of the centering screw and record this value as the “sand reading.”

6.10 If clay or sand readings fall between 0.1 in. (2.5 mm) graduations, record the level of the higher graduation as the reading. For example, a clay reading of 7.95 would be recorded as 8.0, and a sand reading of 3.22 would be recorded as 3.3.
7. CALCULATIONS

7.1 Calculate the sand equivalent (SE) to the nearest 0.1 using the following formula:

\[ SE = \frac{\text{Sand Reading} \times 100}{\text{Clay Reading}} \]

7.2 If the calculated sand equivalent is not a whole number, report it as the next higher whole number, as in the following example:

\[ SE = \frac{3.3}{8} \times 100 = 41.25 \]

which is reported as 42.

7.3 Average the whole number values determined as described above. If the average of these values is not a whole number, raise it to the next higher whole number, as in the following example:

Calculated SE values: 41.2, 40.9

After raising each to the next higher whole number, they become: 42, 41.

The average of these values is then determined:

\[ \frac{42 + 41}{2} = 41.5 \]

Which is reported as 42

If the two results from the same SE sample vary by more than 8 points, the test shall be invalid and a new test completed.

7.3.1 Since the average value is not a whole number, it is raised to the next higher whole number and the reported averages and equivalent value is reported as 42.

Report the results using WSDOT Form 350-161 EF, 422-020X, or other report approved by the State Materials Engineer.

8. PRECAUTIONS

See AASHTO T 176 for Precision

9. OPERATOR QUALIFICATIONS

WSDOT has deleted this section see Section 9-5.5 of the Construction Manual.
Performance Exam Checklist

Plastic Fines in Graded Aggregates and Soils by the Use of the Sand Equivalent Test
FOP for AASHTO T 176

Participant Name ___________________________ Exam Date __________

Procedure Element

Preparation

1. The tester has a copy of the current procedure on hand? □ □
2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present? □ □
3. Sample passed through No. 4 (4.75 mm) sieve? □ □
4. Material in clods broken up and re-screened? □ □
5. No fines lost? □ □
6. Temperature of working solution 72 ± 5°F (22 ± 3°C)? □ □
7. Working calcium chloride solution 36 ± 1 in. (915 mm ± 25 mm) above the work surface? □ □
8. 4 ± 0.1 in (101.6 ± 2.5 mm) working calcium chloride solution siphoned into cylinder? □ □
9. Working solution dated? □ □

Sample Preparation

1. If necessary, sample sprayed with water to prevent loss of fines? □ □
2. Material checked for moisture condition by tightly squeezing small portion in palm of hand and forming a cast? □ □
3. Sample at proper water content?
   a. If too dry, (cast crumbles easily), water added and re-mixed? □ □
   b. If too wet (shows free water), sample drained, air dried and mixed frequently? □ □
4. Sample placed on splitting cloth and mixed by alternately lifting each corner of the cloth and pulling it over the sample toward diagonally opposite corner, causing material to be rolled? □ □
5. Is material thoroughly mixed? □ □
6. When material appears to be homogeneous, mixing finished with sample in a pile near center of cloth? □ □
7. Fill the 85 mL tin by pushing through base of pile with other hand on opposite side of pile? □ □
8. Material fills tin to overflowing? □ □
9. Material compacted into tin with palm of hand? □ □
10. Tin struck off level full with spatula or straightedge? □ □
Procedure Element

Sample Preparation (continued)

Yes  No

11. Test sample dried to a constant mass?  

12. Sample cooled to room temperature  

- Procedure

1. Prepared sample funneled into cylinder with no loss of fines?  

2. Bottom of cylinder tapped sharply on heel of hand several times to release air bubbles?  

3. Wetted sample allowed to stand undisturbed for 10 min. ± 1 min.?  

4. Cylinder stoppered and material loosened from bottom by shaking?  

5. Properly performed shaking method?  
   - Mechanical Shaker Method
   - Manual Shaker Method  

6. Following shaking, cylinder set vertical on work surface and stopper removed?  

7. Irrigator tube inserted in cylinder and material rinsed from cylinder walls as irrigator is lowered?  

8. Irrigator tube forced through material to bottom of cylinder by gently stabbing and twisting action?  

9. Stabbing and twisting motion applied until cylinder filled to 15 in. (381 mm) mark?  

10. Liquid raised and maintained at 15 in. (381 mm) mark while irrigator is being withdrawn?  

11. No clear solution at top of column?  

12. Contents let stand 20 minutes ± 15 seconds?  

13. Timing started immediately after withdrawal of irrigator?  

14. No vibration or disturbance of the sample?  

15. Readings taken at 20 minutes or up to 30 minutes, when a definite line appears?  

16. Weighted foot assembly lowered into cylinder without hitting mouth of cylinder?  

17. Calculations made to 0.1 and reported to the next higher whole number?  

18. SE is based on the average results of two samples?  

19. If the two SE values vary by more than 8 points additional tests run?  

20. All calculations performed correctly?  

First attempt: Pass [ ]  Fail [ ]  Second attempt:  Pass [ ]  Fail [ ]

Signature of Examiner

Comments:
1. SCOPE

1.1 This test method covers the determination of the theoretical maximum specific gravity and density of uncompacted hot-mix asphalt paving mixtures at 77°F (25°C).

1.2 The values stated in English units are to be regarded as the standard.

1.3 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. REFERENCED DOCUMENTS

2.1 AASHTO Standards:
- M 231, Weighing Devices Used in the Testing of Materials
- PP 57, Establishing Requirements for and Performing Equipment Standardizations
- Standardizations and Checks
- R 47, Reducing Samples of Hot Mix Asphalt to Testing Size
- T 168, Sampling Bituminous Paving Mixtures

2.2 ASTM Standards:
- D 4311, Practice for Determining Asphalt Volume Correction to a Base Temperature
- C 670, Preparing Precision and Bias Statements for Test Methods for Construction Materials

2.3 Other Standards:
- T 168 WAQTC FOP for AASHTO for Sampling Bituminous Paving Mixtures
- T 712 WSDOT Standard Method of Reducing Bituminous Paving Mixtures
- SOP 729 In Place Density of Bituminous Mixes Using the Nuclear Moisture-Density Gauge FOP for WAQTC TM 8
- SOP 730 Standard Operating Procedure for Correlation of Nuclear Gauge Determined Density with Asphalt Concrete Pavement Cores
- SOP 731 Method for Determining Volumetric Properties of Asphalt Concrete Pavement Class Superpave
- SOP 732 Standard Operating Procedure for Superpave Volumetric Design for Hot-Mix Asphalt (HMA)

1 This FOP is based on AASHTO T 209 (2008) and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360)709-5412.
3. TERMINOLOGY

3.1 Definitions:

3.1.1 Density, as determined by this test method—the mass of a cubic meter of the material at 77°F (25°C) in English units, or the mass of a cubic foot of the material at 77°F (25°C) in inch-pound units.

3.1.2 Residual pressure, as employed by this test method—the pressure in a vacuum vessel when vacuum is applied.

3.1.3 Specific gravity, as determined by this test method—the ratio of a given mass of material at 77°F (25°C) to the mass of an equal volume of water at the same temperature.

4. SUMMARY OF TEST METHOD

4.1 A weighed sample of HMA paving mixture in the loose condition is placed in a tared vacuum vessel. Sufficient water is added to completely submerge the sample. Vacuum is applied for 15 ± 2 min to gradually reduce the residual pressure in the vacuum vessel. At the end of the vacuum period, the vacuum is gradually released. The volume of the sample of paving mixture is obtained by (Section 9.5.2) filling the vacuum container level full of water and weighing in air. At the time of weighing the temperature is measured as well as the mass. From the mass and volume measurements, the specific gravity or density at 77°F (25°C) is calculated. If the temperature employed is different from 77°F (25°C), an appropriate correction is applied.

5. SIGNIFICANCE AND USE

5.1 The theoretical maximum specific gravities and densities of hot-mix asphalt paving mixtures are intrinsic properties whose values are influenced by the composition of the mixtures in terms of types and amounts of aggregates and asphalt binder materials.

5.1.1 These properties are used to calculate percent air voids in compacted HMA.

5.1.2 These properties provide target values for the compaction of HMA.

5.1.3 These properties are essential when calculating the amount of asphalt binder absorbed by the internal porosity of the individual aggregate particles in HMA.
6. APPARATUS

6.1 Follow the procedures for performing equipment standardizations, standardization, and checks found in PP 57.

6.2 Vacuum Container:

6.2.1 The vacuum containers described must be capable of withstanding the full vacuum applied, and each must be equipped with the fittings and other accessories required by the test procedure being employed. The opening in the container leading to the vacuum pump shall be covered by a piece of No. 200 (75-μm) mesh to minimize the loss of fine material.

6.2.2 The capacity of the vacuum container should be between 2000 and 10,000-mL and depends on the minimum sample size requirements given in Section 7.2. Avoid using a small sample in a large container.

6.2.3 Vacuum Bowl, either a metal or plastic bowl with a diameter of approximately 180 to 260 mm (7.1 to 10.2 in.) and a bowl height of at least 160 mm (6.3 in.) equipped with a transparent cover fitted with a rubber gasket and a connection for the vacuum line.

6.2.4 Vacuum Flask for Weighing in Air Only, a thick-walled volumetric glass flask and a rubber stopper with a connection for the vacuum line.

6.2.5 Pycnometer for Weighing in Air Only, a glass, metal or plastic pycnometer.

6.3 Balance, conforming to the requirements of AASHTO M 231, Class G 2. The balance shall be standardized at least every 12 months.

6.3.1 For the mass determination-in-water method (Section 9.5.1), the balance shall be equipped with a suitable apparatus and holder to permit determining the mass of the sample while suspended below the balance. The wire suspending the holder shall be the smallest practical size to minimize any possible effects of a variable immersed length.

6.4 Vacuum pump or water aspirator, capable of evacuating air from the vacuum container to a residual pressure of 30 mm Hg (4.0 kPa) or less.

6.4.1 When a vacuum pump is used, a suitable trap of one or more filter flasks, or equivalent, shall be installed between the vacuum vessel and vacuum source to reduce the amount of water vapor entering the vacuum pump.

6.5 Absolute pressure gauge or vacuum gauge, used for annual standardization and traceable to NIST (mandatory) to be connected directly to the vacuum vessel and to be capable of measuring residual pressure down to 30 mm Hg (4.0 kPa), or less (preferably to zero). It is to be connected at the end of the vacuum line using an appropriate tube and either a “T” connector on the top of the vessel or by using a separate opening (from the vacuum line) in the top of the vessel to attach the hose.

Note 2: A residual pressure of 30 mm Hg (4.0 kPa) absolute pressure is approximately equivalent to 730 mm Hg (97 kPa) reading on vacuum gauge at sea level.
6.6 Thermometric Device (Mass Determination in Air), liquid-in-glass thermometers or other suitable thermometric device, accurate to 1°F (0.5°C). The thermometric device shall be standardized at the test temperature at least every 12 months.

6.7 Water Bath, a water bath that can be maintained at a constant temperature between 73 and 82.9°F (22.8 and 28.3°C).

6.8 Bleeder Valve, attached to the vacuum train to facilitate adjustment of the vacuum being applied to the vacuum vessel.

6.9 Protective Gloves, used when handling glass equipment under vacuum.

6.10 Mallet, with a rubber or rawhide head.

7. SAMPLING

7.1 Obtain the sample in accordance with WAQTC FOP for AASHTO T 168 and WSDOT T 712.

7.2 The size of the sample shall conform to the requirements in Table 1. Samples larger than the capacity of the container may be tested a portion at a time.

<table>
<thead>
<tr>
<th>Class of Mix</th>
<th>Nominal Max. Agg. * Size</th>
<th>Superpave</th>
<th>Other</th>
<th>Minimum Mass of Specimen, lbs (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 4 (4.75)</td>
<td></td>
<td></td>
<td></td>
<td>1 (500)</td>
</tr>
<tr>
<td>⅜ (9.5)</td>
<td>⅜ In.</td>
<td>Class G &amp; D</td>
<td></td>
<td>2 (1000)</td>
</tr>
<tr>
<td>⅜ (12.5)</td>
<td>⅜ In.</td>
<td>Class A, B, &amp; ATB</td>
<td>3 (1500)</td>
<td></td>
</tr>
<tr>
<td>½ (19.0)</td>
<td>½ In.</td>
<td></td>
<td></td>
<td>4 (2000)</td>
</tr>
<tr>
<td>1 (25.0)</td>
<td>1 In.</td>
<td>Class E</td>
<td></td>
<td>5 (2500)</td>
</tr>
<tr>
<td>1 ½ (37.5)</td>
<td></td>
<td></td>
<td></td>
<td>8 (4000)</td>
</tr>
<tr>
<td>2 (50.0)</td>
<td></td>
<td></td>
<td></td>
<td>12 (6000)</td>
</tr>
</tbody>
</table>

* For aggregate, the nominal maximum size, (NMS) is the largest standard sieve opening listed in the applicable specification, upon which any material is permitted to be retained. For concrete aggregate, NMS is the smallest standard sieve opening through which the entire amount of aggregate is permitted to pass.

Note: For an aggregate specification having a generally unrestrictive gradation (i.e. wide range of permissible upper sizes), where the source consistently fully passes a screen substantially smaller than the maximum specified size, the nominal maximum size, for the purpose of defining sampling and test specimen size requirements may be adjusted to the screen, found by experience to retain no more than 5% of the materials.

8. STANDARDIZATION OF FLASKS, BOWLS, AND PYCNOMETERS

This section has been deleted by WSDOT and replaced with the following:

The volumetric flask or metal vacuum pycnometer will be standardized periodically in conformance with established verification procedures or per AASHTO T 209. Standardization shall be done at 77°F.
9. PROCEDURE

9.1 Separate the particles of the HMA sample by hand, taking care to avoid fracturing the aggregate, so that the particles of the fine aggregate portion are not larger than ¼ in (6.3 mm). If an HMA sample is not sufficiently soft to be separated manually, place it in a flat pan, and warm it in an oven until it can be separated as described.

9.2 WSDOT has deleted this section

9.3 Cool the sample to room temperature, and place it in a tared and standardized flask, bowl, or pycnometer. Weigh and designate the net mass of the sample as A. Add sufficient water at a temperature of approximately 25°C (77°F) to cover the sample completely.

9.4 Remove air trapped in the sample by applying gradually increased vacuum until the absolute pressure gauge or vacuum gauge reads 30 mm HG or less (3.7 ± 0.3 kPa or less). Maintain this residual pressure for 15 ± 2 min. Agitate the container and contents during the vacuum period either continuously by a mechanical device, or manually by vigorous shaking at intervals of about 2 minutes. Glass vessels should be shaken on a resilient surface such as a rubber or plastic mat, and not on a hard surface, so as to avoid excessive impact while under vacuum. To aid in releasing the trapped air from the metal vacuum pycnometer, tap the sides of the metal vacuum pycnometer 3 to 5 times with the mallet at approximately two minutes intervals. The release of entrapped air may be facilitated by the addition of a few drops of suitable wetting agent.

9.5 At the end of the vacuum period, release the vacuum within 10 to 15 seconds. Start the 9 to 11 minute time, as described in 9.5.2, immediately upon starting the release of vacuum. Proceed to 9.5.2.

9.5.1 WSDOT has deleted this section

9.5.2 Weighing in Air—Fill the flask with water and adjust the contents to a temperature of 77 ± 2°F (25 ± 1°C) in a constant temperature water bath. Determine the mass of the container (and contents), completely filled, 9 to 11 minutes after starting Section 9.5. Designate this mass as E. Accurate filling may be ensured by the use of a glass cover plate.

In lieu of a constant temperature water bath described in 9.5.2, determine the temperature of the water within the flask or metal vacuum pycnometer and determine the appropriate density correction factor “R” using Table 2.
10. **CALCULATION**

10.1 Calculate the theoretical maximum specific gravity of the sample at 77°F (25°C) as follows:

10.1.1 Weighing in Air:

Theoretical Maximum Specific Gravity = \[ \frac{A}{A + D - E} \]

where:

- \( A \) = mass of oven-dry sample in air, g;
- \( D \) = mass of container filled with water at 77°F (25°C), g; and
- \( E \) = mass of container filled with sample and water at 77°F (25°C), g.

10.1.1.1 If the test temperature differs significantly from 77°F (25°C), correct for thermal effects as follows:

WSDOT has removed the AASHTO calculation and replaced it with the following calculations:

1. Determination using temperature correction:

\[ \text{Theoretical Maximum Gravity} = \frac{A}{A + D - E} \times R \]

where:

- \( A \) = mass of oven-dry sample in air, g;
- \( D \) = mass of container filled with water at 77°F (25°C), g; and
- \( E \) = mass of container filled with sample and water at 77°F (25°C), g.
- \( R \) = Factor from Table 2 to correct density of water from the test temperature to 77°F (25°C).

*Note:* The flask standardization is done at 77 ± 0.4°F (25 ± 0.2°C).

2. Determination using weighted average:

\[ \text{Weighted Average Maximum Specific Gravity} = \frac{(\text{Sp. G}_1 \times A_1) + (\text{Sp. G}_2 \times A_2)}{(A_1 + A_2)} \]

where:

- \( \text{Sp.G}_1 \) = Specific gravity of first test segment
- \( \text{Sp.G}_2 \) = Specific gravity of second test segment
- \( A_1 \) and \( A_2 \) = Mass of dry sample in air of respective test segments

3. Calculate the rice density (calculate to one decimal place):

\[ \text{Rice density} = \text{Rice sp. gr.} \times 62.24 \text{ lb/ft}^3 (997 \text{ kg/m}^3) \]
### Density Correction Factor “R”

**Table 2**

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<tr>
<th>C°</th>
<th>F°</th>
<th>“R”</th>
</tr>
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<tbody>
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<td>73.0</td>
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</tr>
<tr>
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<td>23.3</td>
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<td>23.4</td>
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</tbody>
</table>

10.2 Theoretical maximum density at 77°F (25°C):

10.2.1 Calculate the corresponding theoretical maximum density at 77°F (25°C) as follows:

Theoretical maximum density at 77°F (25°C) = theoretical maximum specific gravity × 997.1 kg/m³ in SI units, or

Theoretical maximum density at 77°F (25°C) = theoretical maximum specific gravity × 62.245 lb/ft³ in inch-pound units.

where:

The specific gravity of water at 77°F (25°C) = 997.1 in SI units or = 62.245 in inch-pound units.
11. SUPPLEMENTAL PROCEDURE FOR MIXTURES CONTAINING POROUS AGGREGATE

WSDOT has removed this section.

12. REPORT

12.1 Report the following information:

12.1.1 Specific gravity and density of the mixture to the third decimal place
12.1.2 Type of mixture,
12.1.3 Size of sample,
12.1.4 Number of samples,
12.1.5 Type of container, and
12.1.6 Type of procedure.

13. PRECISION

See AASHTO T-209 for Precision.

APPENDIX

Nonmandatory Information

A1. THEORETICAL MAXIMUM SPECIFIC GRAVITY FOR A LOOSE-PAVING MIXTURE

WSDOT has removed this section.
Performance Exam Checklist

Theoretical Maximum Specific Gravity and Density of HOT MIX ASPHALT Paving Mixtures

FOP for AASHTO T 209

Participant Name ____________________________ Exam Date ____________

Procedure Element

1. The tester has a copy of the current procedure on hand?
   Yes ☐ No ☐

2. All equipment is functioning according to the test procedure, and if required, has the current standardization/verification tags present?
   Yes ☐ No ☐

3. Particles of sample separated?
   Yes ☐ No ☐

4. Care used not to fracture mineral fragments?
   Yes ☐ No ☐

5. After separation, fine HMA particles not larger than ¼ inch?
   Yes ☐ No ☐

6. Sample at room temperature?
   Yes ☐ No ☐

7. Mass of bowl or flask determined?
   Yes ☐ No ☐

8. Mass of sample and bowl or flask determined?
   Yes ☐ No ☐

9. Mass of sample determined?
   Yes ☐ No ☐

10. Water at approximately 77°F (25°C) added to cover sample?
    Yes ☐ No ☐

11. Entrapped air removed using partial vacuum for 15 ± 2 min?
    Yes ☐ No ☐

12. Container and contents agitated continuously by mechanical device or manually by vigorous shaking at intervals of about 2 minutes?
    Yes ☐ No ☐

13. For metal pycnometer, strike 3 to 5 times with a mallet?
    Yes ☐ No ☐

14. Release of entrapped air facilitated by addition of suitable wetting agent (optional)?
    Yes ☐ No ☐

15. Flask determination:
    a. Flask filled with water?
       Yes ☐ No ☐
       1. Flask then placed in constant temperature water bath (optional) or?
          Yes ☐ No ☐
       2. Temperature of water in flask determined upon completion of 15 c.?
          Yes ☐ No ☐
    b. Contents at 77 ± 2°F or density of water corrected using Table 2 in FOP?
       Yes ☐ No ☐
    c. Mass of filled flask determined 9 to 11 minutes after removal of entrapped air completed?
       Yes ☐ No ☐

16. All calculations performed correctly?
    Yes ☐ No ☐

First attempt: Pass ☐ Fail ☐ Second attempt: Pass ☐ Fail ☐

Signature of Examiner ____________________________

WSDOT Materials Manual M 46-01.03 Page 9 of 10
January 2009
Comments:
WSDOT FOP for AASHTO T 217

Determination of Moisture in Soils by Means of a Calcium Carbide Gas Pressure Moisture Tester

1. SCOPE

1.1 This method of test is intended to determine the moisture content of soils by means of a calcium carbide gas pressure moisture tester. The manufacturer’s instructions shall be followed for the proper use of the equipment.

1.2 The following applies to all specified limits in this standard: For the purposes of determining conformance with these specifications, an observed value or a calculated value shall be rounded off “to the nearest unit” in the last right-hand place of figures used in expressing the limiting value, in accordance with R 11, Recommended Practice for Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values.

**Note 1:** This method shall not be used on granular materials having particles large enough to affect the accuracy of the test in general any appreciable amount retained on a No. 4 (4.75 mm) sieve. The super 200 D tester is intended to be used to test aggregate.

1.3 The values stated in English units are to be regarded as the standard.

1.4 Refer to R 16 for regulatory information for chemicals.

2. REFERENCED DOCUMENT

2.1 *AASHTO Standards:*

   R 11, Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values

   T 265, Laboratory Determination of Moisture Content of Soils

3. APPARATUS

3.1 Calcium carbide pressure moisture test – a chamber with attached pressure gage for the water content of specimens having a mass of at least 20 g. (Figure 1).

   Those “Speed Moisture Testers” which use a 20 g sample may be used to test aggregates and soil-aggregate mixtures where the maximum particle size is ¾ in. (20 mm) or less.

3.2 Balance – shall conform to AASHTO M 231, Class G-2.

3.3 Two 1.25-in. (31.75-mm) steel balls

3.4 Cleaning brush and cloth.

3.5 Scoop for measuring calcium carbide reagent.

---

1 This FOP is based on AASHTO T 217-02
4. MATERIAL

4.1 Calcium carbide reagent.

*Note 2:* The calcium carbide must be finely pulverized and should be of a grade capable of producing acetylene gas in the amount of at least 2.25 ft$^3$/lb (0.14 m$^3$/kg) of carbide.

*Note 3:* The "shelf life" of the calcium carbide reagent is limited, so it should be used according to the manufacturer’s recommendations. When a can of calcium carbide is opened, it shall be dated. After 3 months of use, or if the can becomes contaminated, it shall be discarded.

5. PROCEDURE

5.1 When using the 20 g or 26 g tester, place three scoops (approximately 24 g) of calcium carbide in the body of the moisture tester (or per the manufacturers recommendations). When using the super 200 D tester to test aggregate, place six scoops (approximately 48 g) of calcium carbide in the body of the moisture tester.

*Note 4:* Care must be exercised to prevent the calcium carbide from coming into direct contact with water.

5.2 Weigh a sample of the exact mass specified by the manufacturer of the instrument in the balance provided, and place the sample in the cap of the tester. When using the 20-g or 26-g size tester, place two 1.25-in. (31.75-mm) steel balls in the body of the tester with the calcium carbide (or per the manufacturers recommendations).

*Note 5:* Manufacturer’s instructions shall be followed for the use of steel balls, particularly when testing sand.

*Note 6:* If the moisture content of the sample exceeds the limit of the pressure gage (12 percent moisture for aggregate tester to 20-percent moisture for soil tester), a one-half size sample must be used and the dial reading must be multiplied by 2. This proportional method is not directly applicable to the dry mass percent scale on the super 200 D tester.
5.3 With the pressure vessel in an approximately horizontal position, insert the cap in the pressure vessel and seal the unit by tightening the clamp, taking care that no carbide comes in contact with the soil until a complete seal is achieved.

5.4 Raise the moisture tester to a vertical position so that the soil in the cap will fall into the pressure vessel.

5.5 Shake the instrument vigorously so that all lumps will be broken up to permit the calcium carbide to react with all available free moisture. When steel balls are being used in the tester and when using the large tester to test aggregate, the instrument should be shaken with a rotating motion so the steel balls or aggregate will not damage the instrument or cause soil particles to become embedded in the orifice leading to the pressure diaphragm.

Note 7: Shaking should continue for at least 60 seconds with granular soils and for up to 180 seconds for other soils so as to permit complete reaction between the calcium carbide and the free moisture. Time should be permitted to allow dissipation of the heat generated by the chemical reaction.

5.6 When the needle stops moving, read the dial while holding the instrument in a horizontal position at eye level.

5.7 Record the sample mass and the dial reading.

5.8 With the cap of the instrument pointed away from the operator, and away from open flame or source of ignition, slowly release the gas pressure. Empty the pressure vessel and examine the material for lumps. If the sample is not completely pulverized, the test should be repeated using a new sample. Clean the cap thoroughly of all carbide and soil before running another test.

Note 8: When removing the cap, care should be taken to point the instrument away from the operator to avoid breathing the fumes, and away from any potential source of ignition for the acetylene gas.

5.9 The dial reading is the percent of moisture by wet mass and must be converted to dry mass. With the super 200 D tester the dial reading is the percent of moisture by dry mass, and no further calculation is required.

6. CALCULATION

6.1 The percentage of moisture by dry mass of the soil may be determined from a correction curve similar to Figure 2.

6.2 A correction curve similar to Figure 2 is normally supplied with each moisture tester. Each moisture tester, however, should be checked for the accuracy of its gage, and for the accuracy of its correction curve.

5.2.1 The accuracy of the moisture tester gage should be checked by using a calibration kit (available from the manufacturer), equipped with a standard gage. In case of discrepancy, the gage on the tester should be adjusted to conform with the standard gage.
5.2.2 The accuracy of the correction curve should be checked by comparing curve-corrected moisture contents to moisture contents of locally prepared soils determined using T 265. In case of discrepancy, develop a new correction curve based on moisture contents determined from T 265.

5.2.3 The range of the factory-supplied or laboratory-determined curves may be extended by additional testing.

*EXAMPLE*

*Conversion Curve for Moisture Tester Reading*

*Figure 2*

**Figure 2** — Correction Curve for Moisture Tester Reading (Example Only—Use curve provided by the manufacturer with the specific apparatus, or a correction curve calibrated or extended for local soils at known moisture contents determined in accordance with 6.2.)

**Note 9:** It may be more convenient for field use of the apparatus to prepare a table of moisture tester readings versus oven-dry moisture content for the moisture tester.

6.3 Determine the percentage of moisture to the nearest whole percent.
# Performance Exam Checklist

**Determination of Moisture in Soils by Means of Calcium Carbide Gas Pressure Moisture Tester**  
*FOP for AASHTO T 217*

Participant Name ___________________________      Exam Date __________

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preparation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required,</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>has the current calibration/verification tags present?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Shelf life of calcium carbide reagent checked?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Correct amount of reagent placed in body of tester?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Number and size of steel balls correct?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. Correct mass of moist soil placed in cap of tester?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. Cap clamped to body with tester in horizontal position?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8. Shaking done for proper time (60 seconds for granular soils, 180 seconds for</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>other soils)?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>9. Shaking done without steel balls hitting cap or bottom of tester?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>10. Reading taken with tester in horizontal position at eye level?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>11. Reading taken after gauge stops moving?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>12. Gauge reading recorded?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>13. Tester positioned with cap away from user and away from open flame or source</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>of ignition before gas slowly released?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>14. Moisture content on wet mass basis converted to dry mass basis?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

First attempt: Pass ☐  Fail ☐  Second attempt: Pass ☐  Fail ☐

Signature of Examiner ________________________________

Comments: 
WSDOT FOP for AASHTO T 248\(^1\)

**Reducing Samples of Aggregate to Testing Size**

1. **Scope**
   1.1 This method covers for the reduction of large samples of aggregate to the appropriate size for testing employing techniques that are intended to minimize variations in measured characteristics between the test samples so selected and the large sample.
   1.2 The values stated in English units are to be regarded as the standard.
   1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. **Referenced Documents**
   2.1 AASHTO Standards:
      T 2 Sampling of Aggregate
      T 84 Specific Gravity and Absorption of Coarse Aggregate
   2.2 ASTM Standards:
      C 125 Terminology Relating to Concrete and Concrete Aggregates

3. **Terminology**
   3.1 *Definitions* — The terms used in this practice are defined in ASTM C 125.

4. **Significance and Use**
   4.1 Specifications for aggregates require sampling portions of the material for testing. Other factors being equal, larger samples will tend to be more representative of the total supply. These methods provide for reducing the large sample obtained in the field or produced in the laboratory to a convenient size for conducting a number of tests to describe the material and measure its quality in a manner that the smaller test sample portion is most likely to be a representation of the larger sample, and thus of the total supply. The individual test methods provide for minimum amount of material to be tested.

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\(^1\) This FOP is based on AASHTO T 248-02.
4.2 Under certain circumstances, reduction in size of the large sample prior to testing is not recommended. Substantial differences between the selected test samples sometimes cannot be avoided, as for example, in the case of an aggregate having relatively few large size particles in the sample. The laws of chance dictate that these few particles may be unequally distributed among the reduced size test samples. Similarly, if the test sample is being examined for certain contaminants occurring as a few discrete fragments in only small percentages, caution should be used in interpreting results from the reduced size test sample. Chance inclusion or exclusion of only one or two particles in the selected test sample may importantly influence interpretation of the characteristics of the original sample. In these cases, the entire original sample should be tested.

4.3 Failure to carefully follow the procedures in this practice could result in providing a nonrepresentative sample to be used in subsequent testing.

5. SELECTION OF METHOD

5.1 Fine Aggregate — Samples of fine aggregate that are drier than the drier saturated-surface-dry condition or drier (Note 1) may be reduced using a mechanical splitter according to Method A. Samples having free moisture on the particle surfaces may be reduced in size by quartering according to Method B, or by treating as a miniature stockpile as described in Method C.

5.1.1 If the use of Method B or Method C is desired, and the sample does not have free moisture on the particle surfaces, the sample may be moistened to achieve this condition, thoroughly mixed, and then the sample reduction performed.

Note 1: The method of determining the saturated-surface-dry condition is described in Test Method T 84. As a quick approximation, if the fine aggregate will retain its shape when molded in the hand, it may be considered to be wetter than saturated-surface-dry.

5.1.2 If use of Method A is desired and the sample has free moisture on the particle surfaces, the entire sample may be dried to at least the saturated-surface-dry condition, using temperatures that do not exceed those specified for any of the tests contemplated, and then the sample reduction performed. Alternatively, if the moist sample is very large, a preliminary split may be made using a mechanical splitter having wide chute openings of 1½ in. (38 mm) or more to reduce the sample to not less than 5000 g. The portion so obtained is then dried, and reduction to test sample size is completed using Method A.

5.2 Coarse Aggregates and Mixtures of Coarse and Fine Aggregates — Reduce the sample using a mechanical splitter in accordance with Method A (preferred method) or by quartering in accordance with Method B. The miniature stockpile Method C is not permitted for coarse aggregates or mixtures of coarse and fine aggregates.
5.3 Untreated materials shall be prepared for testing using this procedure. Treated materials (i.e., Hot Mix Asphalt or Asphalt Treated Base) shall be prepared for testing using WSDOT Test Method No. T 12 for reduction of size of samples of Asphalt treated materials.

6. SAMPLING

6.1 The samples of aggregate obtained in the field shall be taken in accordance with T 2, or as required by individual test methods. When tests for sieve analysis only are contemplated, the size of field sample listed in T 2 is usually adequate. When additional tests are to be conducted, the user shall determine that the initial size of the field sample is adequate to accomplish all intended tests. Similar procedures shall be used for aggregate production in the laboratory.

Sample Dividers (Rifflies)

*Figure 1*
Method A — Mechanical Splitter

7. APPARATUS

7.1 Sample Splitter — Sample splitters shall have an even number of equal width chutes, but not less than a total of eight for coarse aggregate, or 12 for fine aggregate, which discharge alternately to each side of the splitter. For coarse aggregate and mixed aggregate, the minimum width of the individual chutes shall be approximately 50 percent larger than the largest particles in the sample to be split (Note 2). For dry fine aggregate in which the entire sample will pass the 3/8 in. (9.5 mm) sieve, the minimum width of the individual chutes shall be at least 50 percent larger than the largest particles in the sample and the maximum width shall be ¾ in. (19 mm). The splitter shall be equipped with two receptacles to hold the two-halves of the sample following splitting. It shall also be equipped with a hopper or straight edge pan which has a width equal to or slightly less than the overall width of the assembly of chutes, by which the sample may be fed at a controlled rate to the chutes. The splitter and accessory equipment shall be so designed that the sample will flow smoothly without restriction or loss of material (Figure 1).

Note 2: Mechanical splitters are commonly available in sizes adequate for coarse aggregate having the largest particle not over 1 ½ in. (37.5 mm).

8. PROCEDURE

8.1 Place the original sample in the hopper or pan and uniformly distribute it from edge to edge, so that when it is introduced into the chutes, approximately equal amounts will flow through each chute. The rate at which the sample is introduced shall be such as to allow free flowing through the chutes into the receptacles below. Reintroduce the portion of the sample in one of the receptacles into the splitter as many times as necessary to reduce the sample to the size specified for the intended test. The portion of the material collected in the other receptacle may be reserved for reduction in size for other tests.

Method B — Quartering

9. APPARATUS

9.1 Apparatus shall consist of a straightedge, scoop, shovel, or trowel; a broom or brush; and a canvas blanket approximately 6 by 8 ft. (2 by 2.5 m).
10. PROCEDURE

10.1 Use either the procedure described in 10.1.1 or 10.1.2 or a combination of both.

10.1.1 Place the original sample on a hard clean, level surface where there will be neither loss of material nor the accidental addition of foreign material. Mix the material thoroughly by turning the entire sample over three times. With the last turning, shovel the entire sample into a conical pile by depositing each shovelful on top of the preceding one. Carefully flatten the conical pile to a uniform thickness and diameter by pressing down the apex with a shovel so that each quarter sector of the resulting pile will contain the material originally in it. The diameter should be approximately four to eight times the thickness. Divide the flattened mass into four equal quarters with a shovel or trowel and remove two diagonally opposite quarters, including all fine material, and brush the cleared spaces clean. Successively mix and quarter the remaining material until the sample is reduced to the desired size (Figure 2).

10.1.2 As an alternative to the procedure in 10.1.1 when the floor surface is uneven, the field sample may be placed on a canvas blanket and mixed with a shovel as described in 10.1.1, or by alternatively lifting each corner of the canvas and pulling it over the sample toward the diagonally opposite corner causing the material to be rolled. Flatten the pile as described in 10.1.1. Divide the sample as described in 10.1.1 or if the surface beneath the blanket is uneven, insert a stick or pipe beneath the blanket and under the center of the pile, then lift both ends of the stick, dividing the sample into two equal parts. Remove the stick leaving a fold of the blanket between the divided portions. Insert the stick under the center of the pile at right angles to the first division and again lift both ends of the stick, dividing the sample into four equal parts. Remove two diagonally opposite quarters, being careful to clean the fines from the blanket. Successively mix and quarter the remaining material until the sample is reduced to the desired size (Figure 3).
Method C — Miniature Stockpile Sampling (Damp Fine Aggregate Only)

11. APPARATUS

11.1 Apparatus shall consist of a straight-edged scoop, shovel, or trowel for mixing the aggregate, and either a small sampling thief, small scoop, or spoon for sampling.

12. PROCEDURE

12.1 Place the original sample of damp fine aggregate on a hard clean, level surface where there will be neither loss of material nor the accidental addition of foreign material. Mix the material thoroughly by turning the entire sample over three times. With the last turning, shovel the entire sample into a conical pile by depositing each shovelful on top of the preceding one. If desired, the conical pile may be flattened to a uniform thickness and diameter by pressing the apex with a shovel so that each quarter sector of the resulting pile will contain the material originally in it. Obtain a sample for each test by selecting at least five increments of material at random locations from the miniature stockpile, using any of the sampling devices described in 11.1.
## Performance Exam Checklist

**Reducing Samples of Aggregates to Testing Size**

**FOP for AASHTO T 248**

<table>
<thead>
<tr>
<th>Participant Name</th>
<th>Exam Date</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Preparation</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td></td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

| Selection of Method | |
|---------------------|-----|-----|----|
| 1. Fine Aggregate | | ☐   | ☐   | |
| a. Saturated surface dry or drier: Method A (Splitter) used? | ☐   | ☐   | |
| b. Free moisture present: Method B (Quartering) used? | ☐   | ☐   | |
| 2. Coarse Aggregate and Mixtures of Fine and Coarse Aggregates | ☐   | ☐   | |
| a. Method A used (preferred)? | ☐   | ☐   | |
| b. Method B used? | ☐   | ☐   | |

### Method A — Splitting

1. Material spread uniformly on feeder? | ☐   | ☐   |
2. Rate of feed slow enough so that sample flows freely through chutes? | ☐   | ☐   |
3. Material in one pan re-split until desired mass is obtained? | ☐   | ☐   |
4. Chutes are set correctly for material being split? | ☐   | ☐   |

### Method B — Quartering

1. Sample placed on clean, hard, and level surface? | ☐   | ☐   |
2. Mixed by turning over 3 times with shovel or by raising canvas and pulling over pile? | ☐   | ☐   |
3. Conical pile formed? | ☐   | ☐   |
4. Diameter equal to about 4 to 8 times thickness? | ☐   | ☐   |
5. Pile flattened to uniform thickness and diameter? | ☐   | ☐   |
6. Divided into 4 equal portions with shovel or trowel? | ☐   | ☐   |
7. Two diagonally opposite quarters, including all fine material, removed? | ☐   | ☐   |
8. Cleared space between quarters brushed clean? | ☐   | ☐   |
9. Process continued until desired sample size is obtained when two opposite quarters combined? | ☐   | ☐   |

*The sample may be placed upon a blanket and a stick or pipe may be placed under the blanket to divide the pile into quarters.*

First attempt: Pass ☐ Fail ☐ Second attempt: Pass ☐ Fail ☐

Signature of Examiner ____________________________
Comments:
1. SCOPE

1.1 This test method covers the determination of the percentage of evaporable moisture in a sample of aggregate by drying, both surface moisture and moisture in the pores of the aggregate. Some aggregate may contain water that is chemically combined with the minerals in the aggregate. Such water is not evaporable and is not included in the percentage determined by this test method.

1.2 The values stated in English units are to be regarded as the standard. The values stated in parentheses are provided for information only.

1.3 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. For specific precautionary statements, see 5.3.1, 7.2.1, and 7.3.1.

2. REFERENCED DOCUMENTS

2.1 AASHTO Standards:

- M 92 Wire-Cloth Sieves for Testing Purposes
- M 231 Weighing Devices Used in Testing Materials
- R 16 Regulatory Information for Chemicals Used in AASHTO Tests
- T 2 Sampling of Aggregate
- T 19/T 19M Bulk Density (“Unit Weight”) and Voids in Aggregate
- T 84 Specific Gravity and Absorption of Coarse Aggregate
- T 85 Specific Gravity and Absorption of Fine Aggregate

2.2 ASTM Standards:

- C 125 Terminology Relating to Concrete and Concrete Aggregates
- C 670 Practice for Preparing Precision Statements for Test Methods for Construction Materials

3. TERMINOLOGY

3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to ASTM C 125.

---

1 This FOP is based on AASHTO T 255-00.
4. Significance and Use

4.1 This test method is sufficiently accurate for usual purposes, such as adjusting batch quantities of ingredients for concrete. It will generally measure the moisture in the test sample more reliably than the sample can be made to represent the aggregate supply. In rare cases where the aggregate itself is altered by heat, or where more refined measurement is required, the test should be conducted using a ventilated, controlled temperature oven.

4.2 Large particles of coarse aggregate, especially those larger than 2 in. (50 mm), will require greater time for the moisture to travel from the interior of the particle to the surface. The user of this test method should determine by trial if rapid drying methods provide sufficient accuracy for the intended use when drying large size particles.

5. APPARATUS

5.1 Balance — The balances shall have sufficient capacity, be readable to 0.1 percent of the sample mass, or better, and conform to the requirements of M 231.

5.2 Source of Heat — A ventilated oven capable of maintaining the temperature surrounding the sample at 110 ± 5°C (230 ± 9°F). Where close control of the temperature is not required (see Section 4.1), other suitable sources of heat may be used, such as an electric or gas hot plate, electric heat lamps, or a ventilated microwave oven.

5.3 Sample Container — A container not affected by the heat, and of sufficient volume to contain the sample without danger of spilling, and of such shape that the depth of sample will not exceed one fifth of the least lateral dimension.

5.3.1 Precaution — When a microwave oven is used, the container shall be nonmetallic.

Note 1: Except for testing large samples, an ordinary frying pan is suitable for use with a hot plate, or any shallow flat-bottomed metal pan is suitable with heat lamps or oven. Note Precaution in Section 5.3.1.

5.4 Stirrer — A metal spoon or spatula of convenient size.

6. SAMPLING

6.1 Sampling shall generally be accomplished in accordance with FOP for AASHTO T 2, except for the sample size may be as stated in Table 1.

6.2 Secure a sample of the aggregate representative of the moisture content in the supply being tested and having a mass not less than the amount listed in Table 1. Protect the sample against loss of moisture prior to determining the mass.
**Nominal Maximum** A  
<table>
<thead>
<tr>
<th>Size* in.</th>
<th>(mm)</th>
<th>Minimum Mass B</th>
<th>lb</th>
<th>kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>US No. 4</td>
<td>(4.75)</td>
<td>1</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>¼</td>
<td>(6.3)</td>
<td>2</td>
<td>1</td>
<td></td>
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<tr>
<td>⅜</td>
<td>(9.5)</td>
<td>2</td>
<td>1</td>
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<tr>
<td>½</td>
<td>(12.5)</td>
<td>5</td>
<td>2</td>
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<tr>
<td>¾</td>
<td>(16.0)</td>
<td>5</td>
<td>2</td>
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<tr>
<td>¼</td>
<td>(19.0)</td>
<td>7</td>
<td>3</td>
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<tr>
<td>1</td>
<td>(25.0)</td>
<td>13</td>
<td>6</td>
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<tr>
<td>1¼</td>
<td>(31.5)</td>
<td>17</td>
<td>7.5</td>
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<tr>
<td>1½</td>
<td>(37.5)</td>
<td>20</td>
<td>9</td>
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<tr>
<td>2</td>
<td>(50)</td>
<td>22</td>
<td>10</td>
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<tr>
<td>2½</td>
<td>(63)</td>
<td>27</td>
<td>12</td>
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<tr>
<td>3</td>
<td>(75)</td>
<td>33</td>
<td>15</td>
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<tr>
<td>3½</td>
<td>(90)</td>
<td>44</td>
<td>20</td>
<td></td>
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<tr>
<td>4</td>
<td>(100)</td>
<td>55</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>(150)</td>
<td>110</td>
<td>50</td>
<td></td>
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</tbody>
</table>

* For aggregate, the nominal maximum size, (NMS) is the largest standard sieve opening listed in the applicable specification, upon which any material is permitted to be retained. For concrete aggregate, NMS is the smallest standard sieve opening through which the entire amount of aggregate is permitted to pass.

**Note:** For an aggregate specification having a generally unrestrictive gradation (i.e. wide range of permissible upper sizes), where the source consistently fully passes a screen substantially smaller than the maximum specified size, the nominal maximum size, for the purpose of defining sampling and test specimen size requirements may be adjusted to the screen, found by experience to retain no more than 5% of the materials.

**Note:** When determining moisture content for T 99 samples, use approximately 100 grams, and approximately 500 grams for T 180 samples.

A Based on sieves with square openings.
B Determine the minimum sample mass for lightweight aggregate by multiplying the value listed by the dry-loose unit mass of the aggregate in kg/m3 (determined using T 19M/T 19) and dividing by 1600.

Sample Size for Aggregate  
*Table 1*

7. **PROCEDURE**

7.1 Determine the mass of the sample to the nearest 0.1 percent or better of the total sample mass.

7.2 Dry the sample thoroughly in the sample container by means of the selected source of heat, exercising care to avoid loss of any particles. Very rapid heating may cause some particles to explode, resulting in loss of particles. Use a controlled temperature oven when excessive heat may alter the character of the aggregate, or where more precise measurement is required. If a source of heat other than the controlled temperature oven is used, stir the sample during drying to accelerate the operation and avoid localized overheating. When using a microwave oven, stirring of the sample is optional.

7.2.1 Caution — When using a microwave oven, occasionally minerals are present in aggregates that may cause the material to overheat and explode. If this occurs it can damage the microwave oven.
7.3 When a hot plate is used, drying can be expedited by the following procedure. Add sufficient anhydrous denatured alcohol to cover the moist sample. Stir and allow suspended material to settle. Decant as much of the alcohol as possible without losing any of the sample. Ignite the remaining alcohol and allow it to burn off during drying over the hot plate.

7.3.1 Warning — Exercise care to control the ignition operation to prevent injury or damage from the burning alcohol.

7.4 The sample is thoroughly dry when further heating causes, or would cause, less than 0.1 percent additional loss in mass.

**WSDOT NOTE:** When weighing hot samples, use a heat sink to protect the balance.

7.5 Determine the mass of the dried sample to the nearest 0.1 percent or better of the total sample mass after it has to room temperature.

8. **CALCULATION**

8.1 Calculate total evaporable moisture content as follows:

\[ p = \frac{100(W - D)}{D} \]

where:

- \( p \) = total evaporable moisture content of sample, percent;
- \( W \) = mass of original sample, g; and
- \( D \) = mass of dried sample, g

8.2 Surface moisture content is equal to the difference between the total evaporated moisture content and the absorption, with all values based on the mass of a dry sample. Absorption may be determined in accordance with T 85, Test for Specific Gravity and Absorption of Coarse Aggregates, or T 84, Test for Specific Gravity and Absorption of Fine Aggregates

9. **PRECISION AND BIAS**

See AASHTO T 255 for Precision and Bias

10. **REPORT**

Report results using WSDOT Form 422-020, or other report approved by the State Materials Engineer.
Performance Exam Checklist

Total Moisture Content of Aggregate by Drying
FOP for AASHTO T 255

Participant Name __________________________________ Exam Date __________

Procedure Element

Yes  No

1. The tester has a copy of the current procedure on hand? ☐ ☐

2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present? ☐ ☐

3. Representative sample of appropriate mass obtained? ☐ ☐

4. Mass of clean, dry container determined? ☐ ☐

5. Sample placed in container and mass determined? ☐ ☐

6. Test sample mass conforms to the required mass? ☐ ☐

7. Sample mass determined to 0.1 percent? ☐ ☐

8. Loss of moisture avoided prior to mass determination? ☐ ☐

9. Sample dried by a suitable heat source? ☐ ☐

10. Sample cooled prior to mass determination? ☐ ☐

11. If aggregate heated by means other than a controlled oven, is sample stirred to avoid localized overheating? ☐ ☐

12. Mass determined and compared to previous mass – showing less than 0.1 percent loss? ☐ ☐

13. Calculations performed properly and results reported to the nearest 0.1 percent? ☐ ☐

First attempt:  Pass ☐ Fail ☐  Second attempt:  Pass ☐ Fail ☐

Signature of Examiner __________________________________________

Comments: ________________________________
WSDOT FOP for AASHTO T 272

Family of Curves — One-point Method

1. SCOPE

1.1 These methods of tests are for the rapid determination of the maximum density and optimum moisture content of a soil sample utilizing a family of curves and a one-point determination.

1.2 One-point determinations are made by compacting the soil in a mold of a given size with a 5.5 lb (2.5 kg) rammer dropped from a height of 12 in. (305 mm). Four alternate procedures are provided as follows:

   Method A — A 4 in. (101.6 mm) mold; soil material passing a No. 4 (4.75 mm) sieve. Sections 4 and 5.

   Method B — A 6 in. (152.4 mm) mold; soil material passing a No. 4 (4.75 mm) sieve. Sections 6 and 7.

   Method C — A 4 in. (101.6 mm) mold; soil material passing a ¾ in. (19.0 mm) sieve. Sections 8 and 9.

   Method D — A 6 in. (152.4 mm) mold; soil material passing a ¾ in. (19.0 mm) sieve. Sections 10 and 11.

   The preferred method of WSDOT is to use method A.

1.3 The methods described herein correspond to the methods in T 99 and must be chosen accordingly; i.e., when moisture density relationships as determined by T 99 Method C are used to form the family of curves, then Method C described in this procedure must be used for the one-point determination (Note 1).

Note 1: Direct reference to T 99 is made throughout these test methods and most terminology, apparatus and procedures are the same.

1.4 In addition, the concepts described herein are applicable to one-point determinations and moisture-density relationships as specified in T 180 with appropriate apparatus and method used as required.

1.5 The following applies to all specified limits in this standard: For the purposes of determining conformance with these specifications, an observed value or a calculated value shall be rounded off “to the nearest unit” in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding-off method of R 11, Recommended Practice for Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values.

1.6 The values stated in English units are to be regarded as the standard.

---

1 This FOP is based on AASHTO T 272-04
Example of Curves

Figure 1
2. REFERENCED DOCUMENTS
   2.1 AASHTO Standards:
      • R 11, Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values
      • T 19/T 19M, Bulk Density (“Unit Weight”) and Voids in Aggregate
      • T 99, Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 in.) Drop
      • T 180, Moisture-Density Relations of Soils Using a 4.54 kg (10 lb) Rammer and a 457 mm (18 in.) Drop

3. DEFINITION
   3.1 A family of curves is a group of typical soil moisture-density relationships determined using T 99, which reveal certain similarities and trends characteristic of the soil type and source. Soils sampled from one source will have many different moisture-density curves, but if a group of these curves are plotted together certain relationships usually become apparent. In general it will be found that higher unit mass soils assume steeper slopes with maximum dry densities at lower optimum moisture contents, while the lower unit mass soils assume flatter more gently sloped curves with higher optimum moisture contents (Figure 1).

4. APPARATUS
   4.1 See T 99, Section 3.

METHOD A

5. SAMPLE
   5.1 See T 99, Section 4.

6. PROCEDURE
   6.1 Thoroughly mix the selected representative sample with sufficient water to dampen approximately 4 percentage points below optimum moisture content. Greater accuracy in the determination of the maximum density will result as the moisture content used approaches optimum moisture content. Moisture content of the sample should never exceed the optimum water content. When doing a one-point determination in the field, use the sample as obtained and determine the moisture after the test.

   6.2 Form a specimen by compacting the prepared soil in the 4 in. (101.6 mm) mold (with collar attached) in three approximately equal layers to give a total compacted depth of about 5 in. (125 mm). Compact each layer by 25 uniformly distributed blows from the rammer dropping free from a height of 12 in. (305 mm) above the elevation of the soil when a sleeve-type rammer is used, or from 12 in. (305 mm) above the approximate elevation of compacted soil when a stationary mounted type of rammer is used. During compaction, the mold shall rest firmly on a dense uniform, rigid and stable foundation (Note 2).
6.2.1 Following compaction, remove the extension collar, carefully trim the compacted soil even with the top of the mold by means of the straightedge, and determine the mass of the mold and moist soil in kilograms to the nearest 5 grams, or determine the mass in pounds to the nearest 0.01 pounds. For molds conforming to tolerances given in T 99 and masses recorded in kilograms, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 1060, and record the result as the wet density, \( W_1 \), in kilograms per cubic meter, of compacted soil. For molds conforming to tolerances given in T 99 and masses recorded in pounds, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 30, and record the result as the wet density, \( W_1 \), in pounds per cubic foot, of compacted soil. For used molds out of tolerance by not more than 50 percent (T 99), use the factor for the mold as determined in accordance with AASHTO T 19.

6.3 Remove the material from the mold and slice vertically through the center. Take a representative sample of the material from one of the cut faces, determine the mass immediately, and dry in an oven at 110 ± 5°C (230 ± 9°F), for at least 12 hours, or to a constant mass to determine the moisture content in accordance with AASHTO T 255 or T 217. The moisture sample shall have a mass not less than 100 g.

**WSDOT Note:** When developing a compaction curve for free draining soils, such as uniform sands and gravels, where seepage occurs at the bottom of the mold and base plate, taking a representative moisture content sample from the mixing bowl may be preferred in order to determine the amount of moisture available for compaction.

**METHOD B**

7. **SAMPLE**

7.1 Select the representative sample in accordance with Section 4, except that it shall have a mass of approximately 16 lb (7 kg).

8. **PROCEDURE**

8.1 Follow the same procedure as described for Method A in Section 5, except for the following: Form a specimen by compacting the prepared soil in the 6 in. (152.4 mm) mold (with collar attached) in three approximately equal layers to give a total compacted depth of about 5 in. (125 mm), each layer being compacted by 56 uniformly distributed blows from the rammer. For molds conforming to tolerances given in T 99, and masses recorded in kilograms, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 471, and record the result as the wet density, \( W_1 \), in kilograms per cubic meter of compacted...
soil. For molds conforming to tolerances given in T 99, and masses recorded in pounds, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 13.33, and record the result as the wet density, \( W_1 \), in pounds per cubic foot, of the compacted soil. For used molds out of tolerance by not more than 50 percent (T 99), use the factor for the mold as determined in accordance with AASHTO T 19.

**METHOD C**

9. **SAMPLE**

9.1 If the soil sample is damp when received from the field, dry it until it becomes friable under a trowel. Drying may be in air or by use of drying apparatus such that the temperature does not exceed 140°F (60°C). Then thoroughly break up the aggregations in such a manner as to avoid reducing the natural size of individual particles.

9.2 Sieve an adequate quantity of the representative pulverized soil over the \( \frac{3}{4} \) in. (19.0 mm) sieve. Discard the coarse material, if any, retained on the \( \frac{3}{4} \) in. (19.0 mm) sieve (Note 3).

*Note 3:* The use of a replacement method, where the oversized particles are replaced with finer particles to maintain the same percentage of coarse material, is not considered appropriate to compute the maximum density.

9.3 Select a representative sample having a mass of approximately 12 lb (5 kg) or more of the soil prepared as described in Sections 9.1 and 9.2.

10. **PROCEDURE**

10.1 Thoroughly mix the selected representative sample with sufficient water to dampen it to approximately 4 percentage points below optimum moisture content. Greater accuracy in the determination of the maximum density will result as the moisture content used approaches the optimum moisture content.

10.2 Form a specimen by compacting the prepared soil in the 4 in. (101.6 mm) mold (with collar attached) in three approximately equal layers to give total compacted depth of about 5 in. (125 mm). Compact each layer by 25 uniformly distributed blows from the rammer dropping free from a height of 12 in. (305 mm) above the elevation of the soil when a sleeve-type rammer is used or from 12 in. (305 mm) above the approximate elevation of each finely compacted layer when a stationary mounted type rammer is used. During compaction, the mold shall rest firmly on a dense, uniform, rigid and stable foundation (Note 2).

10.2.1 Following compaction, remove the extension collar and carefully trim the compacted soil even with the top of the mold by means of the straightedge. Holes developed in the surface by removal of coarse material shall be patched with smaller size material. Determine the mass of the mold and moist soil in kilograms to the nearest 5 grams, or determine the mass in pounds to the nearest 0.01 pounds. For molds conforming to tolerances given in T 99 and masses recorded in kilograms, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 1060, and record the result as the wet density, \( W_1 \), in kilograms per cubic meter.
of compacted soil. For molds conforming to tolerances given in T 99 and masses recorded in pounds, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 30, and record the result as the wet density, \( W_1 \), in pounds per cubic foot, of compacted soil. For used molds out of tolerance by not more than 50 percent (T 99), use the factor for the mold as determined in accordance with T 19.

10.3 Remove the material from the mold and slice vertically through the center. Take a representative sample of the material from one of the cut faces, determine the mass immediately and dry to a constant mass using a drying apparatus described in T 99 to determine the moisture content. The moisture sample shall have a mass not less than 500 g.

**METHOD D**

11. SAMPLE

11.1 Select the representative sample in accordance with Section 8.3 except that it shall have a mass of approximately 25 lb (11 kg).

12. PROCEDURE

12.1 Follow the same procedure as described for Method C in Section 9, except for the following: Form a specimen by compacting the prepared soil in the 6 in. (152.4 mm) mold (with collar attached) in three approximately equal layers to give a total compacted depth of about 5 in. (125 mm), each layer being compacted by 56 uniformly distributed blows from the rammer. For molds conforming to tolerances given in T 99, and masses recorded in kilograms, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 471, and record the result as the wet density, \( W_1 \), in kilograms per cubic meter, of compacted soil. For molds conforming to tolerances given in T 99, and masses recorded in pounds, multiply the mass of the compacted specimen and the mold, minus the mass of the mold, by 13.33, and record the result as the wet density, \( W_1 \), in pounds per cubic foot, of the compacted soil. For used molds out of tolerance by not more than 50 percent (T 99), use the factor for the mold as determined in accordance with AASHTO T 19.

**CALCULATIONS AND REPORT**

13. CALCULATIONS

13.1 See T 99, Section 12.

14. MAXIMUM DENSITY AND OPTIMUM MOISTURE CONTENT DETERMINATION

14.1 The calculations in Section 12.1 shall be made to determine the moisture content and corresponding over-dry density (mass) in pounds per cubic foot (kilograms per cubic meter) of the compacted specimen. The dry density (unit mass) of the soil shall be plotted as ordinate and the corresponding moisture content as the abscissa to define one point within or on the family of curves (Figure 1).

14.2 If the one-point falls on one of the curves in the family of curves the maximum dry density and optimum moisture content defined by that curve shall be used (Note 4).
14.3 If the one-point falls within the family but not on a curve, a new curve shall be drawn through the plotted one-point parallel and in character with the nearest existing curve in the family of curves. The maximum dry density and optimum moisture content as defined by the new curve shall be used (Note 4).

**Note 4:** If the one-point plotted within or on the family of curves does not fall in the 80 to 100 percent of optimum moisture range, compact another specimen, using the same material, at an adjusted moisture content that will place the one-point within this range.

14.3.1 If the family of curves is such that the profile of a new curve to be drawn through a one-point is not well defined or in any way questionable, then a full moisture-density relationship shall be made for the soil in question to correctly define the new curve and verify the applicability of the family of curves (Note 5).

**Note 5:** New curves drawn through plotted one-point determinations shall not become a permanent part of the family of curves until verified by a full moisture-density relationship.

16. REPORT

16.1 The report shall include the following:

16.1.1 The method used (Method A, B, C, or D).

16.1.2 The optimum moisture content as a percentage to the nearest whole number.

16.1.3 The maximum density to the nearest 1.0 lb/ft$^3$ (0.5 kg/m$^3$).

16.1.4 In Methods C and D indicate if the material retained on the ¾ in. (19.0 mm) sieve was removed or replaced.

16.1.5 Type of face if other than 2 in. (50.8 mm) circular.

**Note 6:** Inherent variability of soils places limitations on this method of test. The person using this test method must realize this and become thoroughly familiar with the material being tested. Knowledge of the AASHTO Soil Classification System and ability to recognize the gradation of soils are requirements for this work.
APPENDIX

DEVELOPING A MOISTURE-DENSITY FAMILY OF CURVES

The purpose of the family of curves is to represent the average moisture-density characteristics of the material. The family must, therefore, be based on moisture-density relationships which adequately represent the entire mass range and all types of material for which the family is to be used. It may be that particular soil types have moisture-density relationships that differ considerably and cannot be represented on one general family of curves; in this case a separate family may be developed. Also, moisture-density relationships for material of widely varying geologic origins should be carefully examined to determine if separate families are required.

When a small number of moisture-density relationships are being used to develop a family of curves, plot the point representing the maximum density and optimum moisture content for each relationship on a single sheet of graph paper. Draw a smooth curve which as closely as possible connects all these points. This line will define the maximum density and optimum moisture content of the material represented by this family of curves. At 2 lb (1 kg) increments draw moisture-density curves with slopes similar to the slopes of the original moisture-density relationships. Slopes should gradually steepen going from low to high maximum density material.

When a great number of moisture-density relationships are available, the above procedure can be modified by using average values. Tabulate the maximum density, optimum moisture content, and slope for all moisture-density relationships in each 2 lb (1 kg) increment of density. Average the maximum densities and optimum moisture contents for each increment and plot these values. As before, draw a smooth curve which as closely as possible connects all these points. Determine the average slope for each increment, and at each 2 lb (1 kg) increment draw a moisture-density curve using this average slope value. A computer, if available, may be used to accomplish this work.

The accuracy of a family of curves can be checked by comparing the maximum density and optimum moisture content from an individual moisture-density relationship with that obtained using the One-Point Method and family of curves. A point representing 80 percent of optimum moisture content is taken from the individual moisture-density relationship and used as described in the One-Point Method to determine the maximum density and optimum moisture content from the family of curves. These values are compared with the values from the individual moisture-density relationship. The difference represents the maximum variance expected when the One-Point Method and family of curves are used for material represented by that individual moisture-density relationship. This comparison should be made for all types of material over the mass range of the family. Based on these results some adjustments may be necessary to the family and/or it may be recognized that the family is not applicable to some types of material. Families based on relatively few moisture-density relationships will generally require the closest scrutiny since it can be expected that a larger number of relationships will give better average conditions.
Performance Exam Checklist

**Family of Curves — One-point Method**

**FOP for AASHTO T 272**

Participant Name ______________________________________ Exam Date ___________

**Procedure Element**

1. The tester has a copy of the current procedure on hand? ☐ ☐
2. One-point determination of dry density and corresponding moisture content made in accordance with the FOP for AASHTO T 99, or AASHTO T 180?
   a. Correct size mold used? ☐ ☐
   b. Correct number of blows per layer used (25 or 56)? ☐ ☐
   c. Correct number of layers used (3, 4, or 5)? ☐ ☐
   d. Moisture content determined in accordance with FOP for AASHTO T 255/T 265 or AASHTO T 217? ☐ ☐
3. One-point plotted on family of curves supplied? ☐ ☐
4. One-point falls within 80 to 100 percent of optimum moisture content in order to be valid? ☐ ☐
5. If one-point does not fall within 80 to 100 percent of optimum moisture content, another one-point determination with an adjusted water content is made? ☐ ☐
6. Maximum dry density and corresponding optimum moisture content correctly estimated? ☐ ☐

First attempt: Pass ☐ Fail ☐ Second attempt: Pass ☐ Fail ☐

Signature of Examiner ______________________________________

Comments:
WSDOT Test Method FOP for AASHTO T 3041
Uncompacted Void Content of Fine Aggregate

1. SCOPE

1.1 This method describes the determination of the loose uncompacted void content of a sample of fine aggregate. When measured on any aggregate of a known grading, void content provides an indication of that aggregate’s angularity, sphericity, and surface texture compared with other fine aggregates tested in the same grading. When void content is measured on an as-received fine aggregate grading, it can be an indicator of the effect of the fine aggregate on the workability of a mixture in which it may be used.

1.2 Three procedures are included for the measurement of void content. Two use graded fine aggregate (standard grading or as-received grading), and the other uses several individual size fractions for void content determinations:

1.2.1 Standard Graded Sample (Method A) – This method uses a standard fine aggregate grading that is obtained by combining individual sieve fractions from a typical fine aggregate sieve analysis. See the section on Preparation of Test Samples for the Grading.

Note WSDOT Specifications require Method A

1.2.2 See the section on Significance and Use for guidance on the method to be used.

1.3 The values stated in English units shall be regarded as the standard.

1.4 This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. REFERENCES DOCUMENTS

AASHTO Standards

T 2 WSDOT FOP for AASHTO for the Sampling of Aggregates
T 248 WSDOT FOP for AASHTO for Reducing Field Samples of Aggregates to Testing Size
T 27/11 WSDOT FOP for WAQTC/AASHTO for the Sieve Analysis of Fine & Coarse Aggregates
T 84 Specific Gravity and Absorption of Fine Aggregate

1 This FOP is based on AASHTO T 308-05 and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
2.1. ASTM Standards:
- B 88, Specification for Seamless Copper Water Tube
- B 88M, Specification for Seamless Copper Water Tube (Metric)
- C 29/29M, Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate
- C 117, Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
- C 125, Terminology Relating to Concrete and Concrete Aggregates
- C 128, Test Method for Specific Gravity and Absorption of Fine Aggregate
- C 136, Test Method for Sieve Analysis of Fine and Coarse Aggregates
- C 702, Practice for Reducing Samples of Aggregate to Testing Size
- C 778, Specification for Standard Sand
- D 75, Practice for Sampling Aggregates

2.2. ACI Document:
- ACI 116R, Cement and Concrete Terminology

3. TERMINOLOGY
3.1. Terms used in this standard are defined in ASTM C 125 or ACI 116R.

4. SUMMARY OF TEST METHOD
4.1. A nominal 100-mL calibrated cylindrical measure is filled with fine aggregate of prescribed grading by allowing the sample to flow through a funnel from a fixed height into the measure. The fine aggregate is struck off, and its mass is determined by weighing. Uncompacted void content is calculated as the difference between the volume of the cylindrical measure and the absolute volume of the fine aggregate collected in the measure. Uncompacted void content is calculated using the bulk dry specific gravity of the fine aggregate. Two runs are made on each sample and the results are averaged.

4.1.1. For a graded sample the percent void content is determined directly, and the average value from two runs is reported.

5. SIGNIFICANCE AND USE
5.1. Methods A provide percent void content determined under standardized conditions which depend on the particle shape and texture of a fine aggregate. An increase in void content by these procedures indicates greater angularity, less sphericity, or rougher surface texture, or some combination of the three factors. A decrease in void content results is associated with more rounded, spherical, smooth surfaced fine aggregate, or a combination of these factors.

5.1.1. The standard graded sample (Method A) is most useful as a quick test which indicates the particle shape properties of a graded fine aggregate. Typically, the material used to make up the standard graded sample can be obtained from the remaining size fractions after performing a single sieve analysis of the fine aggregate.
Suitable Funnel Stand Apparatus with Cylindrical Measure in Place

Figure 2
5.3.4. The bulk dry specific gravity of the fine aggregate is used in calculating the void content. The effectiveness of these methods of determining void content and its relationship to particle shape and texture depends on the bulk specific gravity of the various size fractions being equal, or nearly so. The void content is actually a function of the volume of each size fraction. If the type of rock or minerals, or its porosity, in any of the size fractions varies markedly it may be necessary to determine the specific gravity of the size fractions used in the test.

5.4. Void content information from Method A, will be useful as an indicator of properties such as in bituminous concrete, the effect of the fine aggregate on stability and voids in the mineral aggregate; or the stability of the fine aggregate portion of a base course aggregate.

6. APPARATUS

6.1. Cylindrical Measure – A right cylinder of approximately 100 mL capacity having an inside diameter of approximately 39 mm and an inside height of approximately 86 mm made of drawn copper water tube meeting ASTM Specification B 88 Type M, or B 88 M Type C. The bottom of the measure shall be metal at least 6 mm thick, shall be firmly sealed to the tubing, and shall be provided with means for aligning the axis of the cylinder with that of the funnel. (See Figure 1.)

6.2. Funnel – The lateral surface of the right frustum of a cone sloped 60 ± 4º from the horizontal with an opening of 12.7 ± 0.6 mm diameter. The funnel section shall be a piece of metal, smooth on the inside and at least 38 mm high. It shall have a volume of at least 200 mL or shall be provided with a supplemental glass or metal container to provide the required volume. (See Figure 2.)

Note 1: Pycnometer top C9455 sold by Hogentogler and Co., Inc., 9515 Gerwig, Columbia, MD 21045, 410-381-2390 is satisfactory for the funnel section, except that the size of the opening has to be enlarged and any burrs or lips that are apparent should be removed by light filing or sanding before use. This pycnometer top must be used with suitable glass jar with the bottom removed (Figure 2).

6.3. Funnel stand – A three or four legged support capable of holding the funnel firmly in position with the axis of the funnel colinear (within a 4º angle and a displacement of 2 mm) with the axis of the cylindrical measure. The funnel opening shall be 115 ± 2 mm above the top of the cylinder. A suitable arrangement is shown in Figure 2.

6.4. Glass Plate – A square glass plate approximately 60 mm by 60 mm with a minimum 4-mm thickness used to calibrate the cylindrical measure.

6.5. Pan – A metal or plastic pan of sufficient size to contain the funnel stand and to prevent loss of material. The purpose of the pan is to catch and retain fine aggregate particles that overflow the measure during filling and strike off.
6.6. Metal spatula with a blade approximately 100 mm long, and at least 20 mm wide, with straight edges. The end shall be cut at a right angle to the edges. The straight edges. The straight edge of the spatula blade is used to strike off the fine aggregate.

6.7. Scale or balance accurate and readable to ±0.1 g within the range of use, capable of weighing the cylindrical measure and its contents.

7. SAMPLING

7.1. The sample(s) used for this test shall be obtained using FOP for AASHTO T 2 and FOP for AASHTO T 248, or from sieve analysis samples used for FOP for WAQTC/AASHTO T 27/11, or from aggregate extracted from a bituminous concrete specimen. For Method A, the sample is washed over a 150-um (No. 100) or 75-um (No. 200) sieve in accordance with FOP for WAQTC/AASHTO T 27/11 and then dried and sieved into separate size fractions according to FOP for WAQTC/AASHTO T 27/11 procedures. Maintain the necessary size fractions obtained from one (or more) sieve analysis in a dry condition in separate containers for each size.

8. CALIBRATION OF CYLINDRICAL MEASURE

8.1. Apply a light coat of grease to the top edge of the dry, empty cylindrical measure. Weigh the measure, grease, and glass plate. Fill the measure freshly boiled, deionized water at a temperature of 18 to 24°C. Record the temperature of the water. Place the glass plate on the measure, being sure that no air bubbles remain. Dry the outer surfaces of the measure and determine the combined mass of measure, glass plate, grease, and water by weighing. Following the final weighing, remove the grease, and determine the mass of the clean, dry, empty measure for subsequent test.

8.2. Calculate the volume of the measure as follows:

\[ V = \frac{1000 \, M}{D} \]

where:

\[ V \quad \text{volume of cylinder, mL}, \]

\[ M \quad \text{net mass of water, g, and} \]

\[ D \quad \text{density of water (see table in ASTM C 29/C 29M for density at the temperature used), Kg/m}^3. \]

Determine the volume to the nearest 0.1 mL.

Note 2 – If the volume of the measure is greater than 100.0 mL, it may be desirable to grind the upper edge of the cylinder until the volume is exactly 100.0 mL, to simplify subsequent calculations.
9. PREPARATION OF TEST SAMPLES

9.1. *Method A – Standard Graded Sample* – Weigh out and combine the following quantities of fine aggregate which has been dried and sieved in accordance with FOP for AASHTO T 27/11.

<table>
<thead>
<tr>
<th>Individual Size Fraction</th>
<th>Mass, g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passing</td>
<td>Retained on</td>
</tr>
<tr>
<td>No. 8 (2.36 mm)</td>
<td>No. 16 (1.18 mm)</td>
</tr>
<tr>
<td>No. 16 (1.18 mm)</td>
<td>No. 30 (600 um)</td>
</tr>
<tr>
<td>No. 30 (600 um)</td>
<td>No. 50 (300 um)</td>
</tr>
<tr>
<td>No. 50 (300 um)</td>
<td>No. 100 (150 um)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
</tbody>
</table>

The tolerance on each of these amounts is ±0.2 g.


WSDOT has deleted this section they use Method A

9.3. *Method C – As Received Grading*:

WSDOT has deleted this section they use Method A

9.4. Specific Gravity of Fine Aggregate—If the bulk dry specific gravity of fine aggregate from the source is unknown, determine it on the minus No. 4 (4.75 mm) material according to AASHTO T 84. Use this value in subsequent calculations unless some size fractions differ by more than 0.05 from the specific gravity typical of the complete sample, in which case the specific gravity of the fraction (or fractions) being tested must be determined. An indicator of differences in specific gravity of various particle sizes is a comparison of specific gravities run on the fine aggregate in different gradings. Specific gravity can be run on gradings with and without specific size fractions of interest. If specific gravity differences exceed 0.05, determine the specific gravity of the individual 2.36 mm (No. 8) to 150 um (No. 100) sizes for use with Method A or the individual size fractions for use with Method B either by direct measurement or by calculation using the specific gravity data on gradings with and without the size fraction of interest. A difference in specific gravity of 0.05 will change the calculated void content about one percent.

10. Procedure

10.1. Mix each test sample with the spatula until it appears to be homogeneous. Position the jar and funnel section in the stand and center the cylindrical measure as shown in Figure 2. Use a finger to block the opening of the funnel. Pour the test sample into the funnel. Level the material in the funnel with the spatula. Remove the finger and allow the sample to fall freely into the cylindrical measure.
10.2. After the funnel empties, strike-off excess heaped fine aggregate from the cylindrical measure by a single pass of the spatula with the width of the blade vertical using the straight part of its edge in light contact with the top of the measure. Until this operation is complete, exercise care to avoid vibration or any disturbance that could cause compaction of the fine aggregate in the cylindrical measure. (Note 3) Brush adhering grains from the outside of the container and determine the mass of the cylindrical measure and contents to the nearest 0.1 g. Retain all fine aggregate particles for a second test run.

Note 3: After strike-off, the cylindrical measure may be tapped lightly to compact the sample to make it easier to transfer the container to scale or balance without spilling any of the sample.

10.3. Recombine the sample from the retaining pan and cylindrical measure and repeat the procedure. The results of two runs are averaged. See the Calculation section.

10.4. Record the mass of the empty measure. Also, for each run, record the mass of the measure and fine aggregate.

11. Calculation

11.1. Calculate the uncompacted voids for each determination as follows:

\[ U = \frac{V - (F/G)}{V} \times 100 \]

- \( V \) = volume of cylindrical measure, mL;
- \( F \) = net mass, g, of fine aggregate in measure (gross mass minus the mass of the empty measure);
- \( G \) = Bulk dry specific gravity of fine aggregate; and
- \( U \) = uncompacted voids, percent, in the material.

11.2. For the standard Graded Sample (Method A) calculate the average uncompacted voids for the two determinations and report the result as \( U^s \).

12. REPORT

12.1 For the Standard Graded Sample (Method A) report:

12.1.1. The Uncompacted Voids \( (U^s) \) in percent to the nearest one percent (1%).

12.1.2. The specific gravity value used in the calculations.

12.2 Report Results using WSDOT Form 350-161, or other report approved by the State Materials Engineer.

13. PRECISION AND BIAS

See AASHTO T 304 for Precision and bias

14. KEYWORDS

Angularity; fine aggregate; particle shape; sand; surface texture; void content.

1Copies may be obtained from the American Concrete Institute, Box 19150, Detroit, MI 48219.
Performance Exam Checklist

UNCOMPACTED VOID CONTENT OF FINE AGGREGATE
FOP AASHTO T-304

Participant Name ___________________________ Exam Date ___________

**Procedure Element**

<table>
<thead>
<tr>
<th>Procedure</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

**SAMPLE PREPARATION** (Method A)

Note: If Bulk Dry Specific Gravity is unknown, determine it on the minus No. 4 (4.75 mm) material according to AASHTO T-84

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Field sample obtained per FOP for AASHTO T-2?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. Sample reduced to testing size per FOP for AASHTO T-248?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Sample washed over No. 100 or No. 200 sieve in accordance with FOP for WAQTC/AASHTO T-27/11?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Sample dried to constant weight?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Standard Graded sample achieved per FOP for WAQTC/AASHTO T-27/11?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. Necessary size fractions obtained, maintained in a dry condition in separate containers for Each size?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. Standard Graded sample-weighed out and combined per Section 9.1, FOP for AASHTO T-304?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Procedure Element

PROCEDURE (Method A)

Note: If Bulk Dry Specific Gravity is unknown, determine it on the minus No. 4 (4.75 mm) material according to AASHTO T-84.

1. Test sample mixed until it appears to be homogeneous? □ □
2. Jar and funnel section positioned in stand and cylindrical measure centered on stand? □ □
3. Finger used to block the opening of the funnel? □ □
4. Test sample poured into the funnel and leveled? □ □
5. Finger removed and sample allowed to fall freely into cylindrical measure? □ □
6. After funnel empties, is excess material struck off w/single pass of upright spatula? □ □
7. Was care taken to avoid any vibration or disturbance that could cause compaction of material? □ □
8. All adhering grains brushed off before weighing the cylindrical measure? □ □
9. Mass of the cylindrical measure and contents weighed to nearest 0.1 gram? □ □
10. All fine aggregate particles retained and re-homogenized for a second test run? □ □
11. Percent (%) of Uncompacted Voids calculated for each run, as per FOP for AASHTO T-304, Method A? □ □
12. Were the results for each run averaged for a final result? □ □
13. Was the (%) percent of Uncompacted voids reported to the nearest one percent (1%)? □ □
14. All calculations performed correctly? □ □

First attempt: Pass □ Fail □ Second attempt: Pass □ Fail □

Signature of Examinee: ____________________________________________

Comments:
WSDOT FOP for AASHTO T 308

Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method

1. SCOPE

1.1 This test method covers the determination of asphalt binder content of HMA mixtures by ignition at temperatures that reach the flashpoint of the binder in a furnace. The means of specimen heating may be the convection method or the direct infrared (IR) irradiation method. The aggregate remaining after burning can be used for sieve analysis using FOP for AASHTO T 27/T11.

1.2 The values in English units are to be regarded as the standard.

1.3 This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. REFERENCED DOCUMENTS

2.1 AASHTO Standards

M 231 Weighing Devices Used in the Testing of Materials
T 2 Sampling of Aggregates
T 30 Mechanical Analysis of Extracted Aggregate
T 40 Sampling Bituminous Materials
T 110 Moisture or Volatile Distillates in Hot-Mix Asphalt (HMA)
T 168 Sampling Bituminous Paving Mixtures
T 248 Reducing specimens of Aggregate to Testing Size

2.2 Manufacturer’s Instruction Manual

2.3 WSDOT Standards

FOP for AASHTO T 329 Moisture Content of Asphalt (HMA) by Oven Method
FOP for WAQTC T27/11 Sieve Analysis of Fine and Coarse Aggregates
FOP for AASHTO T 168 Sampling Bituminous Paving Materials
WSDOT 712 Reducing Samples of Hot Mix Asphalt to Testing Size
SOP 728 Method for Determining Ignition Furnace Calibration Factor

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1 This FOP is based on AASHTO T 308-08 and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
3. SUMMARY OF TEST METHOD
   3.1 The asphalt binder in the paving mixture is ignited using the furnace equipment applicable to the particular method.
   3.2 The asphalt binder content is calculated as the difference between the initial mass of the asphalt mixture and the mass of the HMA residual aggregate, with adjustments for the calibration factor, and the moisture content. The asphalt content is expressed as mass percent of moisture-free mixture.

4. SIGNIFICANCE AND USE
   4.1 This method can be used for quantitative determinations of asphalt binder content and gradation in HMA mixtures and pavement specimens for quality control, specification acceptance, and mixture evaluation studies. This method does not require the use of solvents. Aggregate obtained by this test method may be used for gradation analysis according to T 27/11.

5. APPARATUS
   5.1 Ignition Furnace—A forced-air ignition furnace that heats the specimens by either the convection or direct IR irradiation method. The convection-type furnace must be capable of maintaining the temperature at 578°C (1072°F). The furnace chamber dimensions shall be adequate to accommodate a specimen size of 3500 g. The furnace door shall be equipped so that the door cannot be opened during the ignition test. A method for reducing furnace emissions shall be provided. The furnace shall be vented into a hood or to the outside and, when set up properly, shall have no noticeable odors escaping into the laboratory. The furnace shall have a fan with the capability to pull air through the furnace to expedite the test and reduce the escape of smoke into the laboratory.

   5.1.1 For Method A, the furnace shall also have an internal balance thermally isolated from the furnace chamber and accurate to 0.1 g. The balance shall be capable of weighing a 3500-g specimen in addition to the specimen baskets. A data collection system will be included so that the mass can be automatically determined and displayed during the test. The furnace shall have a built-in computer program to calculate the change in mass of the specimen baskets and provide for the input of a correction factor for aggregate loss. The furnace shall provide a printed ticket with the initial specimen mass, specimen mass loss, temperature compensation, correction factor, corrected asphalt binder content (percent), test time, and test temperature. The furnace shall provide an audible alarm and indicator light when the specimen mass loss does not exceed 0.01 percent of the total specimen mass for three consecutive minutes. The furnace shall also allow the operator to change the ending mass loss percentage to 0.02 percent.
5.2 Specimen Basket Assembly—consisting of specimen basket(s), catch pan, and an assembly guard to secure the specimen basket(s) to the catch pan.

5.2.1 Specimen basket(s)—of appropriate size that allows the specimens to be thinly spread and allows air to flow through and around the specimen particles. Sets with two or more baskets shall be nested. The specimen shall be completely enclosed with screen mesh, perforated stainless steel plate, or other suitable material.

Note 1—Screen mesh or other suitable material with maximum and minimum openings of 2.36 mm (No. 8) and 0.600 mm (No. 30), respectively, has been found to perform well.

5.2.2 Catch Pan—of sufficient size to hold the specimen basket(s) so that aggregate particles and melting asphalt binder falling through the screen are caught.

5.3 Oven—Capable of maintaining 110 ± 5°C (230 ± 9°F).

5.4 Balance—of sufficient capacity and conforming to the requirements of M 231, Class G 2.

5.5 Safety Equipment—safety glasses or face shield, dust mask, high temperature gloves, long sleeve jacket, a heat-resistant surface capable of withstanding 650°C (1202°F) and a protective cage capable of surrounding the specimen baskets during the cooling period.

5.6 Miscellaneous Equipment—a pan larger than the specimen basket(s) for transferring the specimen after ignition, spatulas, bowls, and wire brushes.

6. SAMPLING

6.1 Obtain specimens of freshly produced hot-mix asphalt in accordance with WAQTC FOP for AASHTO T 168.

6.2 The test specimen for asphalt content determination shall be the end result of a larger specimen taken in accordance with FOP for AASHTO T 168.

6.3 If the mixture is not sufficiently soft to separate for testing, carefully heat the mixture in an oven until sufficiently soft, not to exceed 350 F or the recommended mixing temperature from the mix design verification report. Do not leave the specimen in the oven for an extended period of time.

6.4 The size of the test specimen shall be governed by the nominal maximum aggregate size of the mixture and shall conform to the mass requirement shown in Table 1. Specimen sizes shall not be more than 500 g greater than the minimum recommended specimen mass. The maximum specimen size including basket shall not exceed the capacity of the balance.

Note 2: Large specimens of fine mixes tend to result in incomplete ignition of asphalt binder.
### Test Method A

#### 7. TEST PROCEDURES

7.1 **Test Initiation**

7.1.1 Preheat the ignition furnace to 1000°F (538°C). Manually record the furnace temperature (set point) prior to the initiation of the test if the furnace does not record automatically.

7.2 Determine the moisture content of the specimen(s) according to FOP for AASHTO T 329 *Moisture Content of Asphalt (HMA) by Oven Method*.

7.3 Enter the calibration factor for the specific mix to be tested.

7.4 Weigh and record the mass of the specimen basket(s) and catch pan (with guards in place) to the nearest 0.1g.

7.5 Prepare the specimen as described in Section 6. Evenly distribute this specimen in the specimen basket(s) that have been placed in the catch pan, taking care to keep the material away from the edges of the basket. Use a spatula or trowel to level the specimen.

7.6 Determine and record the total mass of the specimen, basket(s), catch pan, and basket guards to the nearest 0.1g. Calculate and record the initial mass of the specimen (total mass minus the mass of the specimen basket assembly).

7.7 Input the initial mass of the specimen in whole grams into the ignition furnace controller. Verify that the correct mass has been entered.
7.8  Tare or zero furnace balance, open the chamber door, and gently set the specimen baskets in the furnace. Close the chamber door, and verify that the specimen mass (including the basket(s)) displayed on the furnace scale equals the total mass recorded in Section 7.6 within ± 6 g. Differences greater than 6 g or failure of the furnace scale to stabilize may indicate that the sample basket(s) are contacting the furnace wall.

*Note 3:* Due to the extreme heat of the furnace, the operator should wear safety equipment high temperature gloves, face shield, fire-retardant shop coat—when opening the door to load or unload the specimen.

7.9  Initiate the test by pressing the start/stop button. This will lock the specimen chamber and start the combustion blower.

*Note 4:* The furnace temperature will drop below the setpoint when the door is opened, but will recover with the door closed and when ignition occurs. Specimen ignition typically increases the temperature well above the setpoint, depending on specimen size and asphalt content.

*WSDOT Safety Note:* Do not attempt to open the furnace door until the binder has been completely burned off.

7.10 Allow the test to continue until the stable light and audible stable indicator indicate the test is complete (the change in mass does not exceed 0.01 percent for three consecutive minutes). Press the start/stop button. This operation will unlock the specimen chamber and cause the printer to print out the test results.

7.11 Open the chamber door, remove the specimen basket assembly and place it on a heat resistance surface. Place the protective cage over the specimen basket assembly, and allow specimen to cool to room temperature (approximately 30 minutes).

7.12 Use the corrected asphalt binder content (0.01 percent) from the printed ticket. If a moisture content (0.01 percent) has been determined, subtract the percent moisture from the printed ticket corrected asphalt content, and report the resultant value as the corrected asphalt binder content to 0.1 percent.

**Test Method B**

8.  Test Procedure

   WSDOT does not use Method B and has deleted it from the procedure.

9.  GRADATION

   9.1  Allow the specimen to cool to room temperature in the sample baskets.

   9.2  Empty the contents of the baskets into a flat pan. Use a small wire sieve brush to ensure that any residual fines are removed from the baskets. Determine and record the total mass of the specimen to the nearest 0.1g.

   9.3  Perform the gradation analysis according to FOP for WAQTC T 27/T11.
10. REPORT

10.1 Report the test method (A), corrected asphalt binder content, calibration factor, temperature compensation factor (if applicable), total percent loss, specimen mass, moisture content (if determined) and the test temperature. Attach the original printed tickets to the report for units with internal balances.

10.2 The asphalt percentage and aggregate gradation shall be reported on WSDOT Form 350-560 or other report approved by the State Materials Engineer.

11. PRECISION AND BIAS

See AASHTO T 308 for Precision and Bias
Performance Exam Checklist

Determining the Asphalt Cement Content of Hot Mix Asphalt (HMA) by the Ignition Method for AASHTO T 308

Participant Name ___________________________ Exam Date ____________

Procedure Element Yes No
1. The tester has a copy of the current procedure on hand? ☐ ☐
2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present? ☐ ☐

Procedure
1. Oven at correct temperature 538 °C? ☐ ☐
2. Mass of specimen baskets and catch pan recorded? ☐ ☐ ☐
3. Specimen evenly distributed in basket? ☐ ☐ ☐
4. Mass of specimen recorded? ☐ ☐ ☐

Method A
5. Enter calibration factor for specific mix design? ☐ ☐
6. Initial mass entered into furnace controller? ☐ ☐
7. Specimen correctly placed into furnace? ☐ ☐ ☐
8. Test continued until stable indicator signals? ☐ ☐
9. Binder content obtained on printed ticket? ☐ ☐
10. Binder content corrected for moisture? ☐ ☐
11. All calculations performed correctly? ☐ ☐

First attempt: Pass ☐ Fail ☐ Second attempt: Pass ☐ Fail ☐

Signature of Examiner ____________________________
Comments:
WSDOT FOP for AASHTO T 309\(^1\)

*Temperature of Freshly Mixed Portland Cement Concrete*

1. SCOPE
   1.1 This test method covers the determination of temperature of freshly mixed portland cement concrete.
   1.2 The values stated in English units are to be regarded separately as standard.
   1.3 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. REFERENCED DOCUMENTS
   2.1 *AASHTO Standards:*
       T 141 Sampling Freshly Mixed Concrete
   2.2 *ASTM Standards:*
       C 172 Practice for Sampling Freshly Mixed Concrete

3. SIGNIFICANCE AND USE
   3.1 This test method provides a means for measuring the temperature of freshly mixed concrete. It may be used to verify conformance to a specified requirement for temperature of concrete.
   3.2 Concrete containing aggregate of a nominal maximum size greater than 3 in. [75 mm] may require up to 20 min for the transfer of heat from aggregate to mortar. (See ACI Committee 207.1R Report 3)

4. APPARATUS
   4.1 Container—shall be made of nonabsorptive material and large enough to provide at least 3 in. [75 mm] of concrete in all directions around the sensor of the temperature measuring device; concrete cover must also be at least three times the nominal maximum size of the coarse aggregate.
   4.2 Temperature Measuring Device — The temperature measuring device shall be capable of measuring the temperature of the freshly mixed concrete to \(\pm 1^\circ F\) \((\pm 0.5^\circ C)\) throughout the entire temperature range likely to be encountered in the fresh concrete. Liquid-in-glass thermometers having a range of 0 to 120°F (-18 to 49°C) are satisfactory. Other thermometers of the required accuracy, including the metal immersion type, are acceptable.
   4.3 Partial immersion liquid-in-glass thermometers (and possibly other types) shall have a permanent mark to which the device must be immersed without applying a correction factor.

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\(^1\) This FOP is based on AASHTO T 309-05 and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
5. CALIBRATION OF TEMPERATURE MEASURING DEVICE
   5.1 Each temperature measuring device used for determining temperature of freshly mixed concrete shall be calibrated.

6. SAMPLING CONCRETE
   6.1 The temperature of freshly mixed concrete may be measured in the transporting equipment provided the sensor of the temperature measuring device has at least 3 in. [75 mm] of concrete cover in all directions around it.
   6.2 Temperature of the freshly mixed concrete may be obtained following concrete placement using the forms as the container.
   6.3 If the transporting equipment or placement forms are not used as the container, a sample shall be prepared as follows:
      6.3.1 Immediately, prior to sampling the freshly mixed concrete, dampen (with water) the sample container.
      6.3.2 Sample the freshly mixed concrete in accordance with Practice C 172, except that composite samples are not required if the only purpose for obtaining the sample is to determine temperature.
      6.3.3 Place the freshly mixed concrete into the container.

7. PROCEDURE
   7.1 Place the temperature measuring device in the freshly mixed concrete so that the temperature sensing portion is submerged a minimum of 3 in. (75 mm). Gently press the concrete around the temperature measuring device at the surface of the concrete so that ambient air temperature does not affect the reading.
   7.2 Leave the temperature measuring device in the freshly mixed concrete for a minimum period of 2 min or until the temperature reading stabilizes, then read and record the temperature.
   7.3 Complete the temperature measurement of the freshly mixed concrete within 5 min after obtaining the sample.

8. REPORT
   8.1 Record the measured temperature of the freshly mixed concrete to the nearest 1°F (0.5°C).
   8.2 Report results on concrete delivery ticket (i.e., Certificate of Compliance).
   8.3 The name of the tester who performed the field acceptance test is required on concrete delivery tickets containing test results.

9. PRECISION AND BIAS
   9.1 The precision and bias of this test method have not been determined. A precision and bias statement will be included when sufficient test data have been obtained and analyzed.
Performance Exam Checklist

Temperature of Freshly Mixed Concrete
FOP for AASHTO T 309

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Use calibrated thermometer approved for concrete:</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Place thermometer in sample with a minimum of 3 in. (75 mm) cover around sensor?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Gently press concrete around thermometer?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. Read temperature after a minimum of 2 minutes or when temperature reading stabilizes? Complete temperature measurement within 5 minutes of obtaining sample?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. Record temperature to nearest 1°F (0.5°C)?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

First attempt:  Pass ☐  Fail ☐  Second attempt:  Pass ☐  Fail ☐

Signature of Examiner  ____________________________________________

Comments:
WSDOT FOP for AASHTO T 310

In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1. SCOPEx

1.1 This test method describes the procedure for determining the in-place density and moisture of soil and soil-aggregate by use of nuclear equipment. The density of the material may be determined by direct transmission, backscatter, or backscatter/air-gap ratio method. The WSDOT standard method for determining density is by direct transmission.

1.2 Density — The total or wet density of soil and soil-rock mixtures is determined by the attenuation of gamma radiation where the source or detector is placed at a known depth up to 300 mm (12 in.) while the detector(s) or source remains on the surface (Direct Transmission Method) or the source and detector(s) remain on the surface (Backscatter Method).

1.2.1 The density in mass per unit volume of the material under test is determined by comparing the detected rate of gamma radiation with previously established calibration data.

1.3 Moisture — The moisture content of the soil and soil-rock mixtures is determined by thermalization or slowing of fast neutrons where the neutron source and the thermal neutron detector both remain at the surface.

1.3.1 The water content in mass per unit volume of the material under test is determined by comparing the detection rate of thermalized or slow neutrons with previously established calibration data.

1.4 SI Units — The values stated in SI units are to be regarded as the standard.

1.5 This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. See Section 6. Hazards.

1 This FOP is based on AASHTO 310-06 and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
2. REFERENCED DOCUMENTS

2.1  AASHTO Standards:

T 99  Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

T 180  Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

T 191  Density of Soil In-Place by the Sand-Cone Method

T 217  Determination of Moisture in Soils by Means of a Calcium Carbide Gas Pressure Moisture Tester

T 224  Correction for Coarse Particles in the Soil Compaction Test

T 255  Total Evaporable Moisture Content of Aggregate by Drying

T 265  Laboratory Determination of Moisture Content of Soils

T 272  Family of Curves – One-Point Method

2.2  ASTM Test Method:

D 2216  Laboratory Determination of Moisture Content of Soil

D 2487  Classification of Soils for Engineering Purposes (Unified Soil Classification System)

D 2488  Description and Identification for Soils (Visual-Manual Procedure)

D 2937  Density of Soil in Place by the Drive-Cylinder Method

D 4253  Maximum Index Density and Unit Weight of Soils Using a Vibratory Table

D 4254  Maximum Index Density and Unit Weight of Soils and Calculation of Relative Density


WSDOT Standards:

T 606  Method of Test for Compaction Control of Granular Materials

SOP 615  Determination of the % Compaction for Embankment & Untreated Surfacing Materials using the Nuclear Moisture-Density Gauge

3. SIGNIFICANCE

3.1  The test method described is useful as a rapid, nondestructive technique for the in-place determination of the wet density and water content of soil and soil-aggregate.

3.2  The test method is used for quality control and acceptance testing of compacted soil and rock for construction and for research and development. The non-destructive nature allows repetitive measurements at a single test location and statistical analysis of the results.
3.3 **Density** — The fundamental assumptions inherent in the methods are that Compton scattering is the dominant interaction and that the material under test is homogeneous.

3.4 **Moisture** — The fundamental assumptions inherent in the test method are that the hydrogen present is in the form of water as defined by ASTM D 2216, and that the material under test is homogeneous.

3.5 Test results may be affected by chemical composition, sample heterogeneity, and, to a lesser degree, material density and the surface texture of the material being tested. The technique also exhibits spatial bias in that the gauge is more sensitive to water contained in the material in close proximity to the surface and less sensitive to water at deeper levels.

4. **INTERFERENCES**

4.1 **In-Place Density Interferences**

4.1.1 The chemical composition of the sample may affect the measurement, and adjustments may be necessary.

4.1.2 The gauge is more sensitive to the density of the material in close proximity to the surface in the Backscatter Method.

*Note 1:* The nuclear gauge density measurements are somewhat biased to the surface layers of the soil being tested. This bias has largely been corrected out of the Direct Transmission Method and any remaining bias is insignificant. The Backscatter Method is still more sensitive to the material within the first several inches from the surface. Density measurements with direct transmission is the WSDOT standard method.

4.1.3 Oversize rocks or large voids in the source-detector path may cause higher or lower density determination. Since there is lack of uniformity in the soil due to layering, rock or voids the test site beneath the gauge will be excavated and a representative sample will be taken to determine the gradation per WSDOT SOP 615.

4.1.4 Keep all other radioactive sources at least the minimum distance recommended by the manufacture away from the gauge to avoid affecting the measurement.

4.2 **In-Place Moisture Content Interferences**

4.2.1 The chemical composition of the sample may dramatically affect the measurement and adjustments may be necessary. Hydrogen in forms other than water, as defined by ASTM D 2216, and carbon will cause measurements in excess of the true value. Some chemical elements such as boron, chlorine, and minute quantities of cadmium will cause measurements lower than the true value.
4.2.2 The water content determined by this test method is not necessarily the average water within the volume of the sample involved in the measurement. The measurement is heavily influenced by the water content of the material closest to the surface. The volume of soil and rock represented in the measurement is indeterminate and will vary with the water content of the material. In general, the greater the water content of the material, the smaller the volume involved in the measurement. At 10 lbs/ft.$^3$ (160 kg/m$^3$), approximately 50 percent of the typical measurement results from the water content of the upper 2 to 3 in. (50 to 75 mm).

4.2.3 Keep all other neutron sources at least the minimum distance recommended by the manufacture away from the gauge to avoid affecting the measurement.

5. **APPARATUS**

5.1 **Nuclear Density/Moisture Gauge** — While exact details of construction of the gauge may vary, the system shall consist of:

5.1.1 A sealed source of high energy gamma radiation such as cesium or radium.

5.1.2 **Gamma Detector** — Any type of gamma detector such as a Geiger-Mueller tube(s).

5.2 **Fast Neutron Source** — A sealed mixture of a radioactive material such as americium, radium, or californium-252 and a target material such as beryllium.

5.3 **Slow Neutron Detector** — Any type of slow neutron detector such as boron trifluoride or helium-3 proportional counter.

5.4 **Reference Standard** — A block of material used for checking instrument operation, correction of source decay, and to establish conditions for a reproducible reference count rate.

5.5 **Site Preparation Device** — A plate, straightedge, or other suitable leveling tool which may be used for planing the test site to the required smoothness, and in the Direct Transmission Method, guiding the drive pin to prepare a perpendicular hole.

5.6 **Drive Pin** — A pin not to exceed the diameter of the rod in the Direct Transmission Gauge by more than $\frac{1}{4}$ in (6mm) or as recommended by the gauge manufacturer used to prepare a hole in the material under test for inserting the rod.

5.6.1 A slide hammer, with a drive pin attached, may also be used both to prepare a hole in the material to be tested and to extract the pin without distortion to the hole. In place of a slide hammer a hammer of significant size and weight for preparing a hole in the material to be tested using the drive pin along with an extraction tool.

5.7 **Drive Pin Extractor** — A tool that may be used to remove the drive pin in a vertical direction so that the pin will not distort the hole in the extraction process.
6. HAZARDS

6.1 This gauge utilizes radioactive materials that may be hazardous to the health of the users unless proper precautions are taken. Users of this gauge must become familiar with applicable safety procedures and government regulations.

6.2 Effective user instructions together with routine safety procedures, such as source leak tests, recording and evaluation of film badge data, etc., are a recommended part of the operation and storage of this gauge.

7. CALIBRATION

WSDOT has deleted this section; WSDOT performs calibrations according to the manufacturer’s Operators Manual.

8. Standardization

8.1 Turn the gauge on and allow it to stabilize (approximately 10 to 20 minutes) prior to standardization. Leave the power on during the day’s testing.

8.2 Standardize the nuclear gauge at the construction site at the start of each day’s work and as often as deemed necessary by the operator or agency. Daily variations in standard count shall not exceed the daily variations established by the manufacturer of the gauge. If the daily variations are exceeded after repeating the standardization procedure, the gauge should be repaired and or recalibrated.

8.3 Record the standard count for both density and moisture in the Daily Standard Count Log. The exact procedure for standard count is listed in the manufacturer’s Operators Manual.

9. PROCEDURE

9.1 Turn on the equipment to stabilize (warm up) according to the manufacturer’s recommendations (see 8.2.1). Prior to performing the density test verify that today’s Standardization Count has been performed.

9.2 Prepare the test site in the following manner:

9.2.1 Remove all loose and disturbed material and additional material as necessary to expose the top of the material to be tested.

Note 2: The spatial bias should be considered in determining the depth at which the gauge is to be seated.

9.2.2 Select a horizontal area sufficient in size to accommodate four gauge readings that will be 90° to each other, by planing the area to a smooth condition so as to obtain maximum contact between the gauge and material being tested.

9.2.3 The maximum void beneath the gauge shall not exceed ⅛ in. (3 mm). Use native fines or fine sand to fill the voids and smooth the surface with a rigid plate or other suitable tool. The depth of the filler shall not exceed approximately ⅛ in. (3 mm).
9.3 This Section has been deleted because WSDOT does not use this method

9.4 Direct Transmission Method of In-Place Nuclear Density & Moisture Content

9.4.1 Select a test location where the gauge in test position will be at least the minimum distance recommended by the manufacturer away from any vertical projection. If gauge will be within the minimum distance recommended by the manufacture follow instructions outlined by manufactures instruction manual.

9.4.2 Make a hole perpendicular to the prepared surface using the guide and the hole-forming device (Section 5). The hole shall be a minimum of 2 in. (50 mm) deeper than the desired measurement depth and of an alignment that insertion of the probe will not cause the gauge to tilt from the plane of the prepared area.

9.4.3 Mark the test area to allow the placement of the gauge over the test site and to allow the alignment of the source rod to the hole. Follow manufacturer recommendations if applicable.

**WSDOT Note:** For alignment purposes, the user may expose the source rod for a maximum of ten seconds.

9.4.4 Remove the hole forming device carefully to prevent the distortion of the hole, damage to the surface, or loose material to fall into the hole.

**WSDOT Note:** If the hole cannot be maintained contact Regional Materials Laboratory for directions on how to proceed.

9.4.5 Place the instrument on the material to be tested, making sure of maximum surface contact as described above.

9.4.6 Lower the source rod into the hole to the desired test depth. Pull gently on the gauge in the direction that will bring the side of the probe to face the center of the gauge so that the probe is in intimate contact with the side of the hole in the gamma measurement path.

9.4.7 When selecting a test location, the tester shall visually select a site where the least compactive effort has been applied. Select a test location where the gauge will be at least 6 in. (150 mm) away from any vertical mass. If closer than 24 in. (600 mm) to a vertical mass, such as in a trench, follow gauge manufacturer correction procedures.

The test location should be at least 33 ft (10 m) away from other sources of radioactivity and at least 10 ft (3 m) away from large objects or the minimum distance recommended by the manufacturer, whichever is the greater distance.

9.4.8 If the gauge is so equipped, set the depth selector to the same depth as the probe before recording the automated (gauge computed densities, moisture contents, and weights) values.
9.4.9 Secure and record one, one minute dry density and moisture content readings, then turn the gauge 90° and perform another set of readings. If the two dry density readings are not within 3 lbs/cf (50 kg/m³) of each other see Note 5.

Note 5: If two readings are not within tolerances stated, rotate gauge 90° and retest. Again compare both 90° readings. If after four readings, the results are not within the tolerances stated, rotate gauge 90° and retest. Again compare both readings. If these reading are still not within tolerances stated move to another location to perform test.

10. CALCULATION OF RESULTS

10.1 If dry density is required, the in-place water content may be determined by using the nuclear methods described herein; gravimetric samples and laboratory determination; or other approved instrumentation.

10.1.1 If the water content is determined by nuclear methods, use the gauge readings directly.

10.1.2 If the water content is determined by other methods, and is in the form of percent, proceed as follows:

\[ d = \frac{100}{100+W} (m) \]

where:

\( d \) = dry density in lb/ft.³ (kg/m³),
\( m \) = wet density in lb/ft.³ (kg/m³),
and
\( W \) = water as a percent of dry mass.

10.2. Percent Compaction

WSDOT has deleted this section refer to WSDOT SOP 615 for determining the percent compaction.

11. REPORT

WSDOT has deleted this section refer to WSDOT SOP 615 for reporting.

12. Precision and Bias

This section has been deleted by WSDOT. Refer to AASHTO T310 for precision and bias information.

APPENDIX

WSDOT has deleted this section; WSDOT uses the manufacturer’s software to calibrate the gauge.
Performance Exam Checklist

In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
FOP FOR AASHTO T 310

Participant Name ___________________________ Exam Date __________

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Gauge turned on and allowed to stabilize per manufacturer’s recommendations?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Gauge standardized and standard count recorded in accordance with manufacturer’s instructions?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Test location selected per WSDOT SOP 615?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. Loose, disturbed material removed?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. Flat, smooth area prepared?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8. Surface voids filled with native fines (¼ in. (3 mm) maximum thickness)?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>9. Hole driven 2 in. (50 mm) deeper than material to be tested?</td>
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<td>☐</td>
</tr>
<tr>
<td>10. Gauge placed, probe placed, and source rod lowered without disturbing loose material?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>11. For alignment purposes, did not expose the source rod for more than 10 seconds.</td>
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<td>☐</td>
</tr>
<tr>
<td>12. Method B:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Gauge firmly seated, and gently pulled back so that source rod is against hole?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>b. A one minute count taken; dry density and moisture data recorded?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c. Gauge turned 90° (180° in trench)?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d. Gauge firmly seated, and gently pulled back so that source rod is against hole?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>e. A second one-minute count taken; dry density and moisture data recorded?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>f. Density counts within 3 lb/ft3 (50 kg/m3)?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>g. Average of two tests?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>13. A minimum 9 lbs. (4 kg) sample obtained from below gauge?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>14. Oversize determined following WSDOT SOP 615?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>15. All calculations performed correctly?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>16. Nuclear Gauge secured in a manner consistent with current DOH requirements?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

First attempt: Pass ☐ Fail ☐ Second attempt: Pass ☐ Fail ☐

Signature of Examiner ___________________________
Comments:
WSDOT FOP for AASHTO T 312¹

Preparing Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor

1. SCOPE

1.1. This standard covers the compaction of cylindrical specimens of hot-mix asphalt (HMA) using the Superpave gyratory compactor.

1.2. This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. REFERENCED DOCUMENTS

2.1 AASHTO Standards:

• M 231, Weighing Devices Used in Testing of Materials
• TP 71, Evaluation of the Superpave Gyratory Compactor (SGC) Internal Angle of Gyration Using Simulated Loading
• R 30, Mixture Conditioning of Hot-Mix Asphalt (HMA)
• R 35, Superpave Volumetric Design for Hot-Mix Asphalt (HMA)
• T 166, Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
• T 168, Sampling Bituminous Paving Mixtures
• T 209, Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
• T 275, Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
• T 316, Viscosity Determination of Asphalt Binder Using Rotational Viscometer

2.2 Other Standards:

• WSDOT SOP 731, Method for determining volumetric properties of asphalt concrete pavement class superpave
• WSDOT SOP 732, Superpave Volumetric Design for Hot-Mix Asphalt (HMA)

¹ This FOP is based on AASHTO T 312-08 and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
3. **SIGNIFICANCE AND USE**

3.1. This standard is used to prepare specimens for determining the mechanical and volumetric properties of HMA. The specimens simulate the density, aggregate orientation, and structural characteristics obtained in the actual roadway when proper construction procedure is used in the placement of the paving mix.

3.2. This test method may be used to monitor the density of test specimens during their preparation. It may also be used for field control of an HMA production process.

4. **APPARATUS**

4.1. **Superpave Gyratory Compactor**—An electrohydraulic or electromechanical compactor with a ram and ram heads as described in Section 4.3. The axis of the ram shall be perpendicular to the platen of the compactor. The ram shall apply and maintain a pressure of 600 ± 18 kPa perpendicular to the cylindrical axis of the specimen during compaction (Note 1). The compactor shall tilt the specimen molds at an average internal angle of 1.16 ± 0.02° (20.2 ± 0.35 mrad), determined in accordance with AASHTO TP 71. The compactor shall gyrate the specimen molds at a rate of 30.0 ± 0.5 gyrations per minute throughout compaction.

*Note 1:* This stress calculates to 10,600 ± 310 N total force for 6 inches (150 mm) specimens.

4.1.1 **Specimen Height Measurement and Recording Device**—When specimen density is to be monitored during compaction, a means shall be provided to continuously measure and record the height of the specimen to the nearest 0.1 mm during compaction once per gyration.

4.1.2 The system may include a connected printer capable of printing test information, such as specimen height per gyration. In addition to a printer, the system may include a computer and suitable software for data acquisition and reporting.

4.2 **Specimen Molds**—Specimen molds shall have steel walls that are at least 0.3 inches (7.5 mm) thick and are hardened to at least a Rockwell hardness of C48. The initial inside finish of the molds shall have a root mean square (rms) of 1.60 μm or smoother (Note 2). Molds shall have an inside diameter of 5.9 to 6.0 inches (149.90 to 150.00 mm) and be at least 9.8 inches (250 mm) high at room temperature.

*Note 2:* Smoothness measurement is in accordance with ANSI B 46.1. One source of supply for a surface comparator, which is used to verify the rms value of 1.60 μm, is GAR Electroforming, Danbury, Connecticut.

4.3 **Ram Heads and Mold Bottoms**—Ram heads and mold bottoms shall be fabricated from steel with a minimum Rockwell hardness of C48. The ram heads shall stay perpendicular to its axis. The platen side of each mold bottom shall be flat and parallel to its face. All ram and base plate faces (the sides presented to the specimen) shall be flat to meet the smoothness requirement in Section 4.2 and shall have a diameter of 5.88 to 5.90 inches (149.50 to 149.75 mm).

4.4 **Thermometric Device**—used for determining the temperature of aggregates, binder, and HMA between 18 to 418°F (10 and 232°C).
4.5 Balance – A balance meeting the requirements of M 231, Class G5, for determining the mass of aggregates, binder, and HMA.

4.6 Oven – An oven, thermostatically controlled to ±5°F (± 3°C), for heating aggregates, binder, HMA, and equipment as required. The oven shall be capable of maintaining the temperature required for mixture conditioning in accordance with R 30.

4.7 Miscellaneous – Flat-bottom metal pans for heating aggregates, scoop for batching aggregates, containers (grill-type tins, beakers, containers for heating asphalt), large mixing spoon or small trowel, large spatula, gloves for handling hot equipment, paper disks, mechanical mixer (optional), lubricating materials recommended by the compactor manufacturer.

4.8 Maintenance – In addition to routine maintenance recommended by the manufacturer, check the Superpave gyratory compactor’s mechanical components for wear, and perform repair, as recommended by the manufacturer.

5. HAZARDS

5.1 Use standard safety precautions and protective clothing when handling hot materials and preparing test specimens.

6. STANDARDIZATION

6.1 Items requiring periodic verification of calibration include the ram pressure, angle of gyration, gyration frequency, LVDT (or other means used to continuously record the specimen height), and oven temperature. Verification of the mold and platen dimensions and the inside finish of the mold are also required. When the computer and software options are used, periodically verify the data processing system output using a procedure designed for such purposes. Verification of calibration, system standardization, and quality checks may be performed by the manufacturer, other agencies providing such services, or in-house personnel. Frequency of verification shall follow the manufacturer’s recommendations.

6.2 The angle of gyration the internal angle (tilt of mold with respect to end plate surface within the gyratory mold). The calibration of the internal angle of gyration should be verified in accordance with AASHTO TP 71.

7. PREPARATION OF APPARATUS

7.1 Immediately prior to the time when the HMA is ready for placement in the mold, turn on the main power for the compactor for the manufacturer’s required warm-up period.

7.2 Verify the machine settings are correct for angle, pressure, and number of gyrations.

7.3 Lubricate any bearing surfaces as needed per the manufacturer’s instructions.

7.4 When specimen height is to be monitored, the following additional item of preparation is required. Immediately prior to the time when the HMA is ready for placement in the mold, turn on the device for measuring and recording the height of the specimen, and verify the readout is in the proper units, mm, and the recording device is ready. Prepare the computer, if used, to record the height data, and enter the header information for the specimen.
8. HMA MIXTURE PREPARATION

8.1 Weigh the appropriate aggregate fractions into a separate pan, and combine them to the desired batch weight. The batch weight will vary based on the ultimate disposition of the test specimens. If a target air void level is desired, as would be the case for Superpave mix analysis and performance specimens, batch weights will be adjusted to create a given density in a known volume. If the specimens are to be used for the determination of volumetric properties, the batch weights will be adjusted to result in a compacted specimen having dimensions of 6 inches (150 mm) in diameter and 4.53 ± 0.12 inches (115 ± 5 mm) in height at the desired number of gyrations.

Note 3: It may be necessary to produce a trial specimen to achieve this height requirement. Generally, 4500 – 4700 g of aggregate are required to achieve this height for aggregates with combined bulk specific gravities of 2.55-2.70, respectively.

8.2 Place the aggregate and binder container in the oven, and heat them to the required mixing temperature.

8.2.1 The mixing temperature range is defined as the range of temperatures where the unaged binder has a kinematic viscosity of 170 ± 20 mm²/s (approximately 0.17 ± 0.02 Pa·s for a binder density of 1.00 g/cm³) measured in accordance with T 316.

Note 4: Modified asphalts may not adhere to the equi-viscosity requirements noted, and the manufacturer’s recommendations should be used to determine mixing and compaction temperatures.

Note 5: The SI unit kinematic viscosity is m²/s; for practical use, the submultiple mm²/s is recommended. The more familiar centistokes is a cgs unit of kinematic viscosity; it is equal to 1 mm²/s. The kinematic viscosity is the ratio of the viscosity of the binder to its density. For a binder with a density equal to 1.000 g/cm³, a kinematic viscosity of 170 mm²/s is equivalent to a viscosity of 0.17 Pa·s measured in accordance with T 316.

8.3 Charge the mixing bowl with the heated aggregate from one pan, and dry-mix thoroughly. Form a crater in the dry blended aggregate, and weigh the required amount of binder into the mix. Immediately initiate mixing.

8.4 Mix the aggregate and binder as quickly and thoroughly as possible to yield HMA having a uniform distribution of binder. As an option, mechanical mixing may be used.

8.5 After completing the mixture preparation perform the required mixture conditioning in accordance with R 30.

8.6 Place a compaction mold and base plate in an oven above the required compaction temperature for a minimum of 60 minutes prior to the estimated beginning of compaction (during the time the mixture is being conditioned in accordance with R 30).
8.7 Following the mixture conditioning period specified in R 30, if the mixture is at the compaction temperature, proceed immediately with the compaction procedure as outlined in Section 9. If the compaction temperature is different from the mixture conditioning temperature used in accordance with R 30, place the mix in another oven at the compaction temperature for a brief time (maximum of 30 minutes) to achieve the required temperature.

8.7.1 The compaction temperature is the mid-point of the range of temperatures where the unaged binder has a kinematic viscosity of 280 ± 30 mm²/s (approximately 0.28 ± 0.03 Pa·s) measured in accordance with T 316 (Note 4).

8.8 If loose HMA plant mix is used, the sample should be obtained in accordance with T 168. The mixture shall be brought to the compaction temperature range by careful, uniform heating in an oven immediately prior to molding.

9. COMPACTION PROCEDURE

9.1 When the temperature of the HMA is five degrees above the compaction temperature as shown on the “Mix Design Verification Report,” remove the heated mold, base plate, and upper plate (if required) from the oven. Place the base plate and a paper disk in the bottom of the mold.

9.2 Remove the pan of HMA from the oven and in one motion invert the pan onto the construction paper, vinyl mat, etc. Quickly remove any material that remains in the pan and include it with the HMA sample to be compacted. Grasp opposing edges of the paper and roll them together to form the HMA into a cylindrical shape. Insert one end of the paper roll into the bottom of the compaction mold and remove the paper as the HMA slides into the mold. This process needs to be accomplished in approximately 60 seconds. Place the mixture into the mold in one lift. Care should be taken to avoid segregation in the mold. After all the mix is in the mold, level the mix, and place another paper disk and upper plate (if required) on top of the leveled materials.

9.3 Load the charged mold into the compactor, and center the loading ram.

9.4 Apply a pressure of 600 ± 18 kPa on the specimen.

9.5 Apply a 1.16 ± 0.02° (20.2 ± 0.35 mrad) average internal angle, as appropriate, to the mold assembly, and begin.

9.6 Allow the compaction to proceed until the desired number of gyrations specified in R 35 is reached and the gyratory mechanism shuts off.

9.7 Remove the angle from the mold assembly; retract the loading ram; remove the mold from the compactor (if required); and extrude the specimen from the mold.

_Note 6:_ The specimens can be extruded from the mold immediately after compaction for most HMA. However, a cooling period of 5 to 10 minutes in front of a fan may be necessary before extruding some specimens to insure the specimens are not damaged.
9.8 Remove the paper disks from the top and bottom of the specimens.

*Note 7:* Before reusing the mold, place it in an oven for at least 5 minutes. The use of multiple molds will speed up the compaction process.

10. **DENSITY PROCEDURE**

10.3 When the specimen height is to be monitored, record the specimen height to the nearest 0.1 mm after each revolution.

11. **DENSITY CALCULATIONS**

WSDOT has removed this section refer to WSDOT SOP 731.

12. **REPORT**

WSDOT has removed this section refer to WSDOT SOP 731.

12.2 Report results on WSDOT form 350-162 or other report approved by the State Materials Engineer.

13. **PRECISION AND BIAS**

See AASHTO T 312 for Precision and Bias
**Performance Exam Checklist**

**Determining Density of Hot Mix Asphalt (HMA) Specimens by Means of the SHRP Gyratory Compactor**

**FOP For AASHTO T 312**

<table>
<thead>
<tr>
<th>Participant Name</th>
<th>Exam Date</th>
</tr>
</thead>
</table>

### Procedure Element

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Main power for compactor turned on for manufacturer’s required warm-up period if applicable?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Angle, pressure and number of gyrations set?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Bearing surfaces, rotating base surface and rollers lubricated?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

### Preparation of Mixtures

<table>
<thead>
<tr>
<th>Preparation of Mixtures</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is mixture at compaction temperature? If not, was mixture placed in an oven and brought up to compaction temperature?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. Mold and base plate heated for a minimum of 60 minutes in an oven at a temperature not to exceed the compaction temperature by 25 F?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

**Plant mix – Loose mix brought to compaction temperature by uniform heating immediately prior to molding.**

<table>
<thead>
<tr>
<th>Plant mix</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mold, base plate and upper plate (if required) removed from oven and paper disk placed on bottom of mold?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. Mixture placed into mold in one lift, mix leveled, and paper disk and upper plate (if required) placed on top of material?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Mold loaded into compactor and a pressure of 600 ± 18 kPa applied?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Angle of 1.16 ± 0.02° (20.2 ± 0.35 mrad) applied to the mold assembly and gyratory compaction started?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Compactor shuts off when appropriate gyration level is reached?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. Mold removed and specimen extruded?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. Paper disks removed?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8. If specimens are used for determination of volumetric properties, are the heights of the specimens 115 ± 5mm?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>9. All calculations performed correctly?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

First attempt: Pass ☐ Fail ☐  
Second attempt: Pass ☐ Fail ☐

Signature of Examiner  ________________________________
Comments:
1. SCOPE

1.1. This method is intended for the determination of moisture content of hot mix asphalt (HMA) by drying in an oven.

1.2. The values stated in SI units are to be regarded as the standard.

1.3. This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. REFERENCED DOCUMENTS

2.1. AASHTO Standards:
   - M 231, Weighing Devices Used in the Testing of Materials
   - T 168, Sampling Bituminous Paving Mixtures
   - T 248, Reducing Samples of Aggregate to Testing Size

WSDOT Standards:
   - T 712 Standard Method of Reducing Hot Mix Asphalt Paving Mixtures

3. TERMINOLOGY

3.1. Constant mass shall be defined as the mass at which further drying at 325 ± 25°F (163 ± 14°C) does not alter the mass by more than 0.1 percent.

4. SUMMARY OF TEST METHOD

4.1. A sample of HMA is dried in a forced-air, ventilated, or convection oven to a constant mass.

5. APPARATUS

5.1. Balance or Scale—4.4-lb (2-kg) capacity, readable to at least 0.1 g and conforming to the requirements of M 231.

5.2. Forced-Air, Ventilated, or Convection Oven—capable of maintaining the temperature surrounding the sample at 325 ± 25°F (163 ± 14°C).

5.3. Sample Container—the container in which the sample is dried shall be of sufficient size to contain the sample without danger of spilling and to allow the sample to be evenly distributed in a manner that will allow completion of the test in an expeditious manner.

5.4. Thermometers-Armored glass, Infrared gun or dial-type thermometers with metal stems for determining the temperature of aggregates, binder, and HMA.

---

This FOP is based on AASHTO T 329-08 and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
6. SAMPLE
6.1 A sample of HMA shall be obtained in accordance with WAQTC FOP for AASHTO T 168.
6.2 The sample shall be reduced in size in accordance with WSDOT T 712. The size of the test sample shall be a minimum of 1,000 g.

7. PROCEDURE
7.1 Determine and record the mass of the sample container to the nearest 0.1 g.
7.2 Place the test sample in the sample container. Determine and record the temperature of the test sample. To facilitate drying, evenly distribute the test sample in the sample container.
7.3 Determine and record the total mass of the sample container and moist test sample to the nearest 0.1 g.
7.4 Preheat the oven to drying temperature. The drying temperature shall fall within the Job Mix Formula mixing temperature range. If a mixing temperature range is not supplied, a temperature of 325 ± 25°F (163 ± 14°C) will be used.

Note 1—For repeatability between operators and/or laboratories the difference between drying temperatures for samples should not exceed 15°F (9°C).
7.5 Calculate the mass of the initial, moist test sample by subtracting the mass of the sample container determined in Section 7.1 from the total mass of the sample container and moist test sample determined in Section 7.3.
7.6 The test sample shall be initially dried for a minimum of 90 minutes, and its mass determined. Then, at 30 min intervals until constant mass is achieved.

Note 2—The moisture content of test samples and the number of test samples in the oven will affect the rate of drying at any given time. Placing wet test samples in the oven with nearly dry test samples could affect the drying process.
7.7 Cool the sample container and test sample to approximately the same temperature as determined in Section 7.2.
7.8 Determine and record the total mass of the sample container and dry test sample to the nearest 0.1 g.

Note 3—Do not attempt to remove the test sample from the sample container for the purposes of determining the dry mass of the test sample.
7.9 Calculate the mass of the final, dry test sample by subtracting the mass of the sample container determined in Section 7.1 from the total mass of the sample container and dry test sample determined in Section 7.8.
8. CALCULATIONS

8.1. WSDOT uses the following formula to calculate moisture content:

\[
\text{Moisture Content, } \% = \frac{M_i - M_f}{M_i} \times 100
\]

where:
- \(M_i\) = mass of the initial, moist test sample; and
- \(M_f\) = mass of the final, dry test sample.

Example: \(M_i = 541.2\) g
\(M_f = 536.0\) g

\[
\text{Moisture Content} = \frac{541.2\text{ g} - 536.0\text{ g}}{541.2\text{ g}} \times 100 = 0.96\%
\]

9. REPORT

9.1. Report the moisture content to the nearest 0.01 percent.

9.2. Results shall be reported on standard forms approved for use by the agency.
Performance Exam Checklist

Moisture Content of Asphalt (HMA) by Oven Method
WSDOT FOP for AASHTO T 329

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>has the current calibration/verification tags present?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test for Moisture

<table>
<thead>
<tr>
<th>Test for Moisture</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Representative sample obtained; 1,000 g minimum?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Mass of sample determined to nearest 0.1 g?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Initial temperature recorded?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Sample placed in drying oven for a minimum of 90 minutes?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Sample dried to a constant weight within the mixing temperature range if known or at 325 ±25°F?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Samples checked for additional loss?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Sample and container cooled to approximately the initial temperature before mass determined?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Calculation of moisture content performed correctly?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% Moisture as percent of Wet Mass

\[
\frac{M_i - M_r}{M_i} \times 100
\]

First attempt: Pass ☐ Fail ☐ Second attempt: Pass ☐ Fail ☐

Signature of Examiner ________________________________________________

Comments:

WSDOT Test Method T 420

Test Method for Determining the Maturity of Compost (Solvita Test)

1. SCOPE
   The Solvita test is used for evaluating compost conditions.

2. REFERENCE DOCUMENTS
   AASHTO T-2

3. TERMINOLOGY
   3.1 Definitions
   3.1.1 Compost shall be stable, mature, decomposed organic solid waste that is the result of the accelerated, aerobic biodegradation and stabilization under controlled conditions. The result is a uniform dark, soil-like appearance.
   3.1.2 Maturity of any compost sample may be judged using both color test results from paddle A and C. Paddle A is a styrene paddle with a gel component that measures the ammonia content of the compost. Paddle C is a styrene paddle with a gel component that measures the carbon dioxide emitted by the compost sample.

4. SUMMARY OF TEST METHOD
   There are three easy steps involved in using the Solvita test kit to evaluate compost.
   4.1 Obtain and prepare the sample.
   4.2 Perform the test by placing both Solvita gel-paddles in the jar.
   4.2 Determine compost maturity using the color keys provided in the kit.

5. SIGNIFICANT AND USE
   This test is used to determine the maturity of compost materials delivered in the field for use. This test measures the amount of ammonia and carbon dioxide in the compost.

6. APPARATUS
   6.1 Solvita Kit containing the following:
   • a testing jar with lid
   • a carbon-dioxide paddle (marked with “C”) is purple
   • an ammonia paddle (marked with “A”) is yellow
   • color determination charts
6.2 Shovel  
6.3 Small trowel or spoon  
6.4 A clean container large enough to combine the sample (approximately 5 gallons)  
6.5 A clean surface for mixing the sample such as a tarp or plywood  

7. SAMPLE PREPARATION  
7.1 A composite sample (approximately 1 cubic foot) representing the lot to be tested should be sampled in accordance with AASHTO T-2 “Sampling from Stockpiles” or “Sampling from Transport Units”.  
7.2 Place the sample on a hard, clean, level surface where there will be neither loss of material nor the accidental addition of foreign material.  
7.3 Particles such wood chips which are too large for the jar (over ½ inch) should be removed or screened from the compost sample.  
7.4 Checking for optimal moisture is absolutely necessary for accurate maturity testing. Samples which are either too wet or too dry are not likely to produce accurate results. The moisture level should be judged by the squeeze test before proceeding. Perform the Squeeze test by squeezing a small handful of compost. When squeezed tightly the compost should feel wet without producing any free water. Compost that is too dry is dusty and will not clump with hard squeezing.  
7.5 Mix the material thoroughly by turning the entire sample over three times. With the last turning, the entire sample shall be placed into a conical pile.  
7.6 Using a small trowel, or other device, remove a portion from the center of the pile.  
7.7 Fill the jar to the fill line and obtain proper density by sharply tapping the bottom of the jar on a counter. Fluffy or coarse composts should be compacted by pressing firmly into the jar.  
7.8 If compost to be tested is in an optimal state, allow to air out for one hour.  
7.9 If compost to be tested in not in an optimal state, then the following should be performed:  
1. If the sample is hot, it should be covered and allowed to cool to room temperature before testing.  
2. If the sample is too wet, it should be dried until it passes the squeeze test.  
3. If the sample is too dry, add clean water until it passes the squeeze test. This sample shall be covered and allowed to stand at room temperature for 24 hours before performing the test.
8. PROCEDURE

8.1 Open each package by tearing along the top strip and carefully remove the paddle by grasping the handle. Do not touch the special gel surface, and don’t allow compost to touch it. Once the gelpack is opened, the test should be started within 30-minutes. The gel is not harmful to touch, but should be kept out of the mouth and eyes.

8.2 Insert the paddles into the sample at right angles to each other so that they can be seen through the viewing side. The edges of the paddles can be touching in the middle. Position the two paddles as indicated by the color squares on the jar label. Push the paddle tips into the compost to the bottom of the jar. Be careful not to jostle or tip the jar. Do not use a paddle if the gel is dried out or if the color is not the “Control Color” indicated on the respective color charts.

8.3 Screw the lid on tight, and keep the jar at room temperature 68-77°F (20-25°C) out of direct sunlight for 4 hours ± 10 minutes.

9. EVALUATING THE RESULTS

9.1 Read the Solvita paddle colors 4 hours after the test is started. To read the colors, observe the paddles through the viewing side of the jar with the lid in place and illuminated from the front. Color rendition is best in moderate-intensity, fluorescent room light. Compare to the color charts provided with the kit, and record the color numbers that most closely match. Since the Solvita colors may continue to change after 4-hours, the proper interpretation for this test is based on a 4-hour ± 10 minute reading.

10. REPORTS

10.1 Report both the readings for the “A” paddle and the “C” paddle in the Inspector’s Daily Report.
# Performance Exam Checklist

**Determining the Maturity of Compost (Solvita Test)**

**WSDOT Test Method T 420**

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

## Sample Preparation

<table>
<thead>
<tr>
<th>Sample Preparation</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Representative sample obtained per AASHTO T-2?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. Sample placed on clean hard surface?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Check for optimal moisture?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Sampled mixed thoroughly?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Small sample taken from the center of the pile?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. Sample filled in jar to the proper line and compacted?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. Sample allowed to air out for 1 hour or equilibrate for 24 hours?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

## Sample Preprocedure

<table>
<thead>
<tr>
<th>Sample Preprocedure</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Open the gel packs with out touching the gel sticks?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. Is the test started within 30 minutes of opening the gel pack?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Are the paddles inserted in the compost at right angles to each other?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Are the paddles positioned to be seen through the viewing window?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Are the paddles pushed to the bottom of the jar?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. Is the lid screwed on tight?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. Is the jar at room temperature 68-77°F?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8. Is the test run for 4 hours ± 10 minutes?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>9. Maturity determined per Manufacturers instructions?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

First attempt: Pass ☐ Fail ☐  Second attempt: Pass ☐ Fail ☐

Signature of Examiner ________________________________
Comments:
WSDOT Standard Operating Procedure SOP 615

Determination of the % Compaction for Embankment & Untreated Surfacing Materials using the Nuclear Moisture-Density Gauge

1. SCOPE

This procedure covers the procedures for determining the in-place density, moisture content, gradation analysis, oversize correction, and determination of maximum density of compacted soils and untreated surfacing materials using a nuclear density device in the direct transmission mode.

2. REFERENCES

a. WSDOT FOP for AASHTO T 99 for Method of Test for Moisture-Density Relations of Soils
b. WSDOT FOP for AASHTO T 180 for Method of Test for Moisture-Density Relations of Soils
c. WSDOT FOP for AASHTO T 224 for Correction for Coarse Particles in Soil Compaction Test
d. WSDOT FOP for AASHTO T 255 for Total Moisture Content of Aggregate by Drying
e. WSDOT FOP for AASHTO T 272 for Family of Curves — One Point Method
f. WSDOT FOP for AASHTO T 310 for In-Place Densities and Moisture Content of Soils and Soil-Aggregate by Nuclear Methods (Shallow Depth)
g. WSDOT T 606 Method of Test for Compaction Control of Granular Materials

3. TEST LOCATION

When selecting a test location, the tester shall visually select a site where the least compactive effort has been applied. Select a test location where the gauge will be at least 6 in. (150 mm) away from any vertical mass. If closer than 24 in. (600 mm) to a vertical mass, such as in a trench, follow gauge manufacturer correction procedures.

Note: When retesting is required due to a failing test; retest within a 10 foot radius of the original station and offset.

4. NUCLEAR DENSITY TEST

Determine the dry density and moisture content of soils and untreated surfacing materials using the nuclear moisture-density gauge in accordance with WSDOT FOP for AASHTO T 310, and record on DOT Form 350-074 “Field Density Test”
5. OVERSIZE DETERMINATION

a. WSDOT FOP AASHTO T 99 and WSDOT T 606

A sample weighing a minimum of 9 lbs. will be taken from beneath the gauge. Care shall be taken to select material that is truly representative of where the moisture density gauge determined the dry density and moisture content.

There are two methods for determining the amount of material retained on the No. 4 sieve:

Method 1

1. Dry the sample to SSD conditions, (i.e. dried until no visible free moisture is present, material may still appear damp). Allow the sample to cool sufficiently and record mass to the nearest 0.1 percent of the total mass or better.

2. Shake sample by hand over the No. 4 (4.75 mm) sieve. Limit the quantity of material on the sieve so that all particles have the opportunity to reach the sieve openings a number of times during the sieving operation. The mass retained on the No. 4 (4.75 mm) sieve at the completion of the sieving operation shall not exceed 800 grams, 1.8 pounds, for a 12" sieve, or 340 grams, 0.75 pounds; for a 8" sieve.

3. Remove and weigh the material on the No. 4 (4.75 mm) sieve to the nearest 0.1% of the total mass or better and record.

Method 2

This method is only recommended for crushed surfacing materials, materials with high clay content or other granular materials that are at or near the optimum moisture content for compaction.

1. Determine the mass of the sample to the nearest 0.1% of the total mass or better and record.

2. Charge the material in a suitable container with water, agitate the material to suspend the fines, then slowly decant and screen the material over a verified No. 4 (4.75 mm) sieve. Repeat as necessary to remove as much of the No. 4 (4.75 mm) minus material as possible. DO NOT overload the sieve.

3. Place the washed sample retained on the No. 4 (4.75 mm) sieve into a tared container. Blot the material to a SSD condition (i.e. no visible free moisture present, material may still appear damp) during this step.

4. Weigh the mass of the material on the No. 4 (4.75 mm) sieve to the nearest 0.1% of the total mass or better and record.

b. WSDOT FOP AASHTO T 180

Follow the either Method 1 or Method 2 in 5 a. with the following exception; sieve the material over a ¾ in (19.0 mm) sieve rather than a No. 4 (4.75 mm)sieve.
c. Calculate the percent retained and the percent passing the sieve used to the nearest percent and record on DOT Form 350-074 by the following formula:

\[
\% \text{ of oversized particles of sieve used} = 100 \times \frac{\text{Mass retained on sieve used}}{\text{Initial Mass}}
\]

Note: "Sieve used" is defined as No. 4 sieve for T 99 and the ¾" sieve for T 180.

6. CORRECTION OF OPTIMUM MOISTURE CONTENT

a. Obtain the moisture content of the fine particles and oversize particles of the material used during compaction from the Moisture Density Gauge.

b. Obtain the approximate Optimum Moisture Content for material from the appropriate density curve.

c. Calculate the corrected optimum moisture content:

Corrected Optimum moisture content for WSDOT FOP for AASHTO T 99:

\[
\text{Corrected Optimum Moisture} = \frac{(\text{Optimum Moisture of material passing No. 4}) \times (\% \text{ Passing No. 4})}{100}
\]

Corrected Optimum moisture content for WSDOT FOP for AASHTO T 180:

\[
\text{Corrected Optimum Moisture} = \frac{(\text{Opt. Moisture of material passing ¾ in. sieve}) \times (\% \text{ Passing ¾ in. sieve})}{100}
\]

Corrected Optimum moisture content for WSDOT T 606:

\[
\text{Corrected Optimum Moisture} = \frac{(\text{Optimum Moisture of material passing No. 4}) \times (\% \text{ Passing No. 4}) + (\text{Optimum Moisture of material retained No. 4}) \times (\% \text{ Retained No. 4})}{100}
\]

d. Record the Optimum Moisture Content and Corrected Optimum Moisture Content on DOT Form 350-074.

7. % COMPACTION DETERMINATION BASED ON WSDOT FOP AASHTO T 99

a. This process is applicable to silty materials with less than 30 percent retained on the No. 4 (4.75 mm) sieve. WSDOT FOP AASHTO Test Method T-99 and WSDOT FOP for AASHTO T-272 are used to determine the maximum density of the material passing the No. 4 (4.75 mm) sieve. Record the maximum density on DOT Form 350-074 line “Maximum Density”

b. Using the appropriate computer-generated chart, determine the corrected theoretical maximum density, based on the percent retained on the No. 4 (4.75 mm) sieve. This value should be entered on DOT Form 350-074 line “Corrected Maximum Density”. When less than 5% is retained on the No. 4 (4.75 mm) sieve, no correction is necessary.

c. Percent Compaction is calculated by the following formula and entered on DOT Form 350-074:

\[
\% \text{ Compaction (kg/m}^3) = \frac{\text{Dry Density lbs./ft.}^3 \text{ (kg/m}^3) \times 100}{\text{Corrected Maximum Dry Density lbs/ft}^3 \text{ (kg/m}^3)}
\]
8. % COMPACTION DETERMINATION BASED ON WSDOT FOP AASHTO T 180
   a. This process is applicable to materials with 30 percent or more retained on the No. 4 (4.75 mm) sieve and less than 30 percent retained on the ¾ in (19.0 mm) sieve. WSDOT FOP AASHTO T 180 is used to determine the maximum density of the material passing the ¾ in (19.0 mm) sieve. Record the maximum density on DOT Form 350-074 line “Maximum Density”.
   b. Using the appropriate computer-generated chart, determine the corrected theoretical maximum density, based on the percent retained on the ¾ in. sieve (19.0 mm) sieve. This value should be entered on DOT Form 350-074 line “Corrected Maximum Density”. When 5% or less is retained on the ¾ in (19.0 mm) sieve, no correction is necessary.
   c. Percent Compaction is calculated by the following formula and entered on DOT Form 350-074.

\[
\text{% Compaction (kg/m}^3\text{)} = \frac{\text{Dry Density lbs./ft}^3\text{(kg/m}^3\text{)} \times 100}{\text{Corrected Maximum Dry Density lbs/ft}^3\text{(kg/m}^3\text{)}}
\]

9. % COMPACTION DETERMINATION BASED ON WSDOT TEST METHOD T 606.
   a. This process is applicable to granular, free-draining materials and to materials with 30 percent or more retained on the No. 4 (4.75 mm) sieve. Test Method 606 requires specialized equipment and is run only by the Region or State Materials Laboratory.
   b. Using the appropriate computer-generated chart, determine the maximum density, based on the percent passing the No. 4 (4.75 mm) sieve. This value should be entered on DOT Form 350-074 on line “Maximum Density”.
   c. Percent of compaction is then calculated by the formula and entered on DOT Form 350-074:

\[
\text{% Compaction} = \frac{\text{Dry Density lbs./ft}^3\text{(kg/m}^3\text{)} \times 100}{\text{Maximum Dry Density lbs/ft}^3\text{(kg/m}^3\text{)}}
\]

10. REPORT
    Report compaction data of DOT Form 350-074, “Field Density Test” and on DOT Form 351-015 “Daily Compaction Test, or other report approved by the State Materials Engineer.
    Report percent compaction to the nearest whole number.
### Performance Exam Checklist

**WSDOT Standard Operating Procedure SOP 615**  
*Determination of the % Compaction for Embankment & Untreated Surfacing Materials using the Nuclear Moisture-Density Gauge*

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

#### Gradation Analysis

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Percent of oversize material identified?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. Sample Dried to a SSD condition (dried until no visible free moisture present) and mass recorded?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Sample allowed to cool sufficiently prior to sieving?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Sample was shaken by hand through the appropriate sieve for T 99 or T 180 for a sufficient period of time?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Recorded mass of material retained on the sieve used?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. Calculated and recorded percent of material retained and passing for the sieve used?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

#### Correction for Coarse Particles

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Used the appropriate computer-generated chart to determine the maximum density?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8. All calculations performed correctly?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

First attempt:  Pass ☐  Fail ☐  
Second attempt:  Pass ☐  Fail ☐

Signature of Examiner  ____________________________
WSDOT Test Method T 712

Standard Method of Reducing Hot Mix Asphalt Paving Mixtures

Significance

Samples of bituminous paving mixes taken in accordance with FOP AASHTO T 168 are composites and are large to increase the likelihood that they are representative of the product being tested. Materials sampled in the field need to be reduced to appropriate sizes for testing. It is extremely important that the procedure used to reduce the field sample not modify the material properties.

1. SCOPE

This method covers the procedure for reducing samples of Hot Mixed Asphalt (HMA). The samples are to be acquired in accordance with FOP AASHTO T 168. The sample is to be representative of the average of the HMA being produced.

2. APPARATUS

• Flat-bottom scoop,
• Broom or brush,
• Non-stick splitting surface such as metal, paper, canvas blanket or heat-resistant plastic,
• Large spatulas, trowels, metal straight edge or 12 in. dry wall taping knife, sheet metal quartering splitter,
• Mechanical Splitter—The splitter shall have four equal width chutes, which will discharge the material into four appropriate size containers. The splitter shall be designed with a receiving hopper that will hold the HMA field sample until a handle releases the material to fall through a divider and is distributed into four equal portions. The splitter shall be designed so that the HMA field sample will flow smoothly and freely through the divider without loss of materials (See Figures 1 to 3.).
• Oven — An oven of appropriate size, capable of maintaining a uniform temperature within the allowable tolerance for the grade of asphalt.
• Miscellaneous equipment including trowel(s), spatula(s), hot plate, non-asbestos heat-resistant gloves or mittens, pans, buckets, cans.
Significance

Samples of bituminous paving mixes taken in accordance with FOP AASHTO T 168 are composites and are large to increase the likelihood that they are representative of the product being tested. Materials sampled in the field need to be reduced to appropriate sizes for testing. It is extremely important that the procedure used to reduce the field sample not modify the material properties.

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- Oven — An oven of appropriate size, capable of maintaining a uniform temperature within the allowable tolerance for the grade of asphalt.
- Miscellaneous equipment including trowel(s), spatula(s), hot plate, non-asbestos heat-resistant gloves or mittens, pans, buckets, cans.

3. SAMPLE PREPARATION

The sample must be warm enough to separate. If not, warm in an oven until it is sufficiently soft to mix and separate easily.

4. PROCEDURE

Initial Reduction of Field Sample

A. Place the sample on a hard, clean, non-stick, level surface where there will be neither loss of material nor the accidental addition of foreign material. The surface may be

a. Elevation View of the Top Portion of the Splitter

b. Plan View of the Bottom Portion of the Splitter

Elevation and Plan View of Bottom Portion of Splitter

Figure 3
3. SAMPLE PREPARATION

The sample must be warm enough to separate. If not, warm in an oven until it is sufficiently soft to mix and separate easily.

4. PROCEDURE

**Initial Reduction of Field Sample**

A. Place the sample on a hard, clean, non-stick, level surface where there will be neither loss of material nor the accidental addition of foreign material. The surface may be covered with a canvas blanket, heavy paper or other suitable material. Remove the sample from the agency approved containers by dumping into a conical pile.

![Figure 4](image)

B. Divide the sample into four approximately equal quarters with a spatula, trowel, flat metal plate, sheet metal quartering splitter, or mechanical splitter.

C. With the quartering device in place remove all the material from each quarter. If needed for additional testing the material should be placed in agency approved containers for storage or shipment.

*Note 1:* When testing lean mixes or mixes with aggregate larger than ¾ in. (19 mm), sampling as described in Method B will be used, with no remixing and no removal of a similar amount of material from the opposite quarter, is recommended at this point to obtain samples for each acceptance test.

D. Pay particular attention that excessive amounts of materials is not left on the splitting surface or splitting equipment.

F. When the further reduction of the HMA is to be done, proceed according to step 2 of methods A, B, or C.

*Note 2:* Identify the opposite quarter as the “Challenge Sample.”
Reducing to Test Size — Method A

1. On a hard, clean, non-stick, level surface where there will be neither loss of material nor the accidental addition of foreign material. Remove the sample from the agency approved containers by dumping into a conical pile. The surface shall be covered with either a canvas blanket, heavy paper or other suitable material.

2. With the material on the canvas or paper, mix the sample thoroughly by turning the entire sample over the minimum amount of times to achieve a uniform distribution. Alternately lift each corner of the canvas or paper and pull it over the sample diagonally toward the opposite corner causing the material to be rolled. With the last turning, lift both opposite corners to form a conical pile.

3. Grasp the canvas or paper, roll the material into a loaf and flatten the top.

![Figure 5](image1.png)

4. Pull the canvas or paper so approximately ¼ of the length of the loaf is off the edge of the counter. Allow this material to drop into a container to be saved. As an alternate, use a straight edge to slice off approximately ¼ of the length of the loaf and place in a container to be saved.

![Figure 6](image2.png)

5. Pull additional material (loaf) off the edge of the counter and drop the appropriate size sample into a sample pan or container. As an alternate use a straigntedge to slice off an appropriate size sample from the length of the loaf and place in a sample pan or container.

6. Repeat step 5 until the proper size sample has been acquired. Step 5 is to be repeated until all the samples for testing have been obtained.

**Note 3:** When reducing the sample to test size it is advisable to take several small increments determining the mass each time until the proper minimum size is achieved. Unless, the sample size is below the minimum or exceeds the maximum test size use the sample as reduced for the test.
Reducing to Test Size — Method B

1. On a hard, clean, non-stick, level surface where there will be neither loss of material nor the accidental addition of foreign material. Remove the sample from the agency approved containers by dumping into a conical pile. The surface shall be covered with either a canvas blanket, heavy paper or other suitable material. (See Note 1)

2. With the material on the canvas or paper, mix the sample thoroughly by turning the entire sample over the minimum amount of times to achieve a uniform distribution. Alternately lift each corner of the canvas or paper and pull it over the sample diagonally toward the opposite corner causing the material to be rolled. With the last turning, lift both opposite corners to form a conical pile.

3. Quarter the conical pile using a quartering device or straightedge.

4. With the quartering device in place using a suitable straight edge slice through the quarter of the HMA from the apex of the quarter to the outer edge. Pull or drag the material from the quarter holding one edge of the straight edge in contact with the quartering device. Two straightedges may be used in lieu of the quartering device.

5. Slide or scoop the material into a sample pan. Repeat steps 4 & 5 removing a similar amount of material from the opposite quarter. Steps 4 & 5 are to be repeated until all the samples for testing have been obtained.

Note 4: When reducing the sample to test size it is advisable to take several small increments determining the mass each time until the proper minimum size is achieved. Unless, the sample size is below the minimum or exceeds the maximum test size use the sample as reduced for the test.
Reducing to Test Size — Method C

1. On a hard, clean, non-stick, level surface where there will be neither loss of material nor the accidental addition of foreign material. Remove the sample from the agency approved containers by dumping into a conical pile. The surface shall be covered with either a canvas blanket, heavy paper or other suitable material.

2. With the material on the canvas or paper, mix the sample thoroughly by turning the entire sample over the minimum amount of times to achieve a uniform distribution. Alternately lift each corner of the canvas or paper and pull it over the sample diagonally toward the opposite corner causing the material to be rolled. With the last turning, lift both opposite corners to form a conical pile.

3. Quarter the conical pile using a quartering device or straightedge.

4. Remove the opposite quarters saving the material for future use.

5. Repeat step 2 through 4 until the proper size sample has been achieved.

6. When additional test specimens are required, dump the removed material into a conical pile as in step 1 and repeat steps 2 through 5. This process may be repeated until the sample have has been reduced to testing size for all tests.

7. SAMPLE IDENTIFICATION
   (1) Each sample submitted for testing shall be accompanied by a transmittal letter completed in detail. Include the contract number, acceptance and mix design verification numbers, mix ID.
   (2) Samples shall be submitted in standard sample boxes, secured to prevent contamination and spillage.
   (3) Sample boxes shall have the following information inscribed with indelible-type marker: Contract number, acceptance and mix design verification numbers, mix ID.
   (4) The exact disposition of each quarter of the original field sample shall be determined by the agency.
## Performance Exam Checklist

Reducing Samples of Hot Mix Asphalt to Testing Size  
WSDOT Test Method T 712

### Participant Name  
Exam Date

### Procedure Element  
<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. Sample warmed if not sufficiently soft?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

#### Method A
<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Sample placed on paper on clean, hard, and level surface?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Sample mixed thoroughly?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Rolled into loaf and then flattened?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. At least ¼ of loaf removed by slicing off or dropping off edge of counter?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. Proper sample size quantity of material sliced off or dropped off edge of</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>counter onto sample container?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Method B
<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Sample thoroughly mixed and conical pile formed?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>9. Divided into 4 equal portions with quartering device or straightedge?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>10. With two straight edges or a splitting device and one straight edge.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>11. Was a sample sliced from apex to outer edge of the quarter?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>12. Process continued until proper test size is obtained?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

#### Method C
<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. Sample thoroughly mixed and conical pile formed?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>14. Divided into 4 equal portions with quartering device or straightedge?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>15. Two diagonally opposite quarters removed and saved?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>16. Cleared spaces scraped clean?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>17. Process repeated until proper test size is obtained?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>18. Were opposite quarters and combined to make sample?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

First attempt:  Pass ☐  Fail ☐  Second attempt:  Pass ☐  Fail ☐

Signature of Examiner  

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*WSDOT Materials Manual  M 46-01.03  Page 7 of 8  January 2009*
WSDOT Test Method T 716

*Method of Random Sampling for Locations of Testing and Sampling Sites*

1. **SCOPE**
   a. This method outlines the procedure for selecting sampling and testing sites in accordance with accepted random sampling techniques. It is intended that all testing and sampling locations be selected in an unbiased manner based entirely on chance.
   
   b. Testing and sampling locations and procedures are as important as testing. For test results or measurements to be meaningful, it is necessary that the sampling locations be selected at random, typically by use of a table of random numbers. Other techniques yielding a system of randomly selected locations are also acceptable.
   
   c. This procedure is divided into several sections:
      • Applications for Hot Mixture Asphalt Density and Challenge Cores, Section 5
      • Applications for Hot Mixture Asphalt (HMA) Sampling, Section 6
      • Applications for Portland Cement Concrete, Section 7
      • Applications for Aggregate and other materials, Section 8

2. **Straight Random Sampling vs. Stratified Random Sampling:**
   Straight random sampling considers an entire lot as a single unit and determines each sample location based on the entire lot size. Stratified random sampling divides the lot into a specified number of sublots or units and then determines each sample location within a distinct sublot. Both methods result in random distribution of samples to be tested for compliance with the agency’s specification.

3. **PROCEDURE**
   a. Determine the lot, or sublot size and number of tests per LOT or sublot.
   
   b. Determine the “X” and/or “Y” random number by using values from the random number table.
   
   c. Multiply the lot or sublot size by the random number. This will give you the approximate test location within the lot or sublot to do the testing.

4. **Stratified Random Sampling**
   a. Following determination of the LOT length in Example 1, determine the length increment for individual sublots by dividing by the number of such desired sublots. In the case of Hot Mix Asphalt Pavement this would be five sublots.
   
   b. Determine random location factors “X” and/or “Y” values by random entry to the table.
c. To determine the location of test No. 1 in subplot No. 1 multiply the subplot increment by the selected “X” or “Y” factor from the Random Number table, then add this amount to the beginning location. Test locations within each of the subsequent sublots are determined by calculating the fractional location within the subplot interval then adding the increment of the preceding subplot.

d. For irregular lot or subplot sizes at the end of production, determine the location by dividing the final increment into 5 equal parts and define a test location within each.

5. APPLICATIONS FOR HOT MIX ASPHALT DENSITY AND CHALLENGE CORES (ENGLISH UNITS)

*Note:* For metric projects refer to Appendix A.

a. Determine the LOT size and number of tests per LOT. The Standard specifications set the size of a density test lot for Hot Mix Asphalt Pavement to no greater than a single day’s production or 400 tons, whichever is less, and require five tests per LOT. At the end of a day’s production the final lot may be increased to a maximum of 600 tons.

b. Convert this LOT size to an area segment of the roadway based on the roadway section and depth being constructed for the course being tested. The calculations in Example 1 show how this is performed. Table 1 has been provided to give you recommend lot lengths for standard lane widths at various depths. Lot length needs to be determined to the nearest 100 feet.

**Example 1**

Sample Computation for Lot Length

Using nominal compacted density of 2.05 tons/cy, and a 400 ton lot:

\[
\text{Tons per linear foot} = \frac{(1.0 \text{ (foot)} \times \text{width (feet)} \times \text{depth (feet)}) \times 2.05 \text{ Tons/cy}}{27}
\]

\[
\text{Tons per linear Foot} = \frac{1.0 \text{ ft} \times 12 \text{ ft} \times 0.15 \text{ ft} \times 2.05 \text{ tons}}{27} = 0.137 \text{ Tons per linear Foot.}
\]

\[
\text{Lot length} = \frac{400 \text{ Tons}}{0.137 \text{ Tons per linear Foot}} = 2900 \text{ linear Feet}
\]

<table>
<thead>
<tr>
<th>Lane Width</th>
<th>Compacted Depth</th>
<th>Computed Lot Length</th>
<th>Recommended Lot Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 feet</td>
<td>0.12</td>
<td>3655</td>
<td>3700</td>
</tr>
<tr>
<td></td>
<td>0.15</td>
<td>2924</td>
<td>2900</td>
</tr>
<tr>
<td></td>
<td>0.20</td>
<td>2193</td>
<td>2200</td>
</tr>
<tr>
<td></td>
<td>0.25</td>
<td>1754</td>
<td>1800</td>
</tr>
<tr>
<td>11 feet</td>
<td>0.12</td>
<td>3987</td>
<td>4000</td>
</tr>
<tr>
<td></td>
<td>0.15</td>
<td>3189</td>
<td>3200</td>
</tr>
<tr>
<td></td>
<td>0.20</td>
<td>2392</td>
<td>2400</td>
</tr>
<tr>
<td></td>
<td>0.25</td>
<td>1913</td>
<td>1900</td>
</tr>
</tbody>
</table>

Hot Mix Asphalt Density Test Lot Length

400 Ton lot at 2.05 tons/cubic yard

*Table 1*
LOT length may also be determined based on Nominal Designated LOT sizes. To utilize this concept, compacted mix volumes equivalent to the designated mix quantity per LOT have been determined using the nominal compacted unit weight of Hot Mix asphalt. These volumes are then converted into Density LOT lengths using the typical lane width and specified compacted depth. The included tables present the values for LOT Lengths based on English units.

c. Determine the locations of the test (or sampling) sites by using values from the random number table (Table 2) to determine the coordinate location on the roadway. In the table, use the “X” values as decimal fractions of the total length of the lot; use the “Y” values as fractions of the width, customarily measured from the right edge of the pavement. The values in the table have been set so that no measurements are taken within 1.5 LF (0.45 m) of the edge of the pavement. Whenever a test location is determined to fall within such an area (i.e., bridge end, track crossing, or night joint) the test location should be moved ahead or back on stationing, as appropriate, by 25 LF (8 m).

<table>
<thead>
<tr>
<th>Y values are selected so that lateral locations are no closer than 1.5 feet (0.45m) from the edge of a paving strip.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
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<td>6</td>
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<td>7</td>
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<td>23</td>
</tr>
<tr>
<td>24</td>
</tr>
<tr>
<td>25</td>
</tr>
</tbody>
</table>

Random Numbers with X and Y values

Table 2
d. In order to determine which “X” and “Y” values should be used, enter the table on a line chosen by chance. Recommended procedure is selection of a line based on the last two digits from the most recent standard count on the nuclear density gage. Subsequent “X” and “Y” values are then taken from the lines that follow. Based on the specified sampling frequency, 20 lots can be accommodated by one cycle through the table. Start each shift with a set of values determined by chance in order to obtain random selection.

e. Example 2 shows the calculations for determining the testing location for asphalt pavement density. No Figure 1

**Example 2**

*Test Location Within the LOT for Hot Mix Asphalt Density*

For the lot: (12 ft. wide, 0.15 ft. deep, starting at station 168 + 75 with paving progressing ahead on station), Lot length was previously determined as 2,900 LF. Using the last two digits of the standard count, as in the example, 2951, assume “X” and “Y” values from line (51) in table 2: X = 0.762, Y = 0.65.

**For the first test:**

Beginning station: 168 + 75
Sublot length increment: 580 × 0.762 = 442
Width offset: 12 × 0.65 = 7.8 ft. (from right edge)
Location is: station: (168+75) + 442 = 173 + 17, 7.8 ft. from right edge

**For the Second test:**

Beginning station: (168 + 75) + (580) = 174 + 55
Sublot length increment: 580 × 0.285 = 165
Width offset: 12 × 0.28 = 3.4 ft. (from right edge)
Location is: station: (174 + 55) + 165 = (176 + 20), 3.4 ft. from right edge

**For the Third test:**

Beginning station: (168 + 75) + 580 + 580 = 180 + 35
Sublot length increment: 580 × 0.347 = 201
Width offset: 12 × 0.87 = 10.4 ft. (from right edge)
Location is: station: (180 + 35) + 201 = (182 + 36), 10.4 ft. from right edge

6. **APPLICATIONS FOR HOT MIX ASPHALT (HMA) PAVEMENT MIXTURE**

a. Determine the sublot size. The Standard Specifications define a lot as the total quantity of material or work produced for each job mix formula (JMF). The sublot size for HMA gradation, binder content, and/or volumetrics is a maximum of 800 tons, and shall be determined to the nearest 100 tons. At the end of production, the final sublot may be increased to a maximum of 2 times the sublot quantity calculated. Sampling of binder shall be every other mixture sample.

b. Determine the locations of the test (or sampling) sites as defined in Section 3 using random numbers from table 3, or from another Random Number Generator. Do not sample from the first or last 25 tons. Once the two-digit number is selected the corresponding four-digit number becomes the factor for determining the selection of the next sample. Random sample tonnage may be adjusted per sublot to accommodate field testing. Adjustments to random sample tonnage should be documented.
Random Numbers

Table 3

<table>
<thead>
<tr>
<th>X</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) 0.186</td>
<td>(21) 0.256</td>
<td>(41) 0.201</td>
<td>(61) 0.508</td>
<td>(81) 0.431</td>
</tr>
<tr>
<td>(2) 0.584</td>
<td>(22) 0.753</td>
<td>(42) 0.699</td>
<td>(62) 0.884</td>
<td>(82) 0.509</td>
</tr>
<tr>
<td>(3) 0.965</td>
<td>(23) 0.108</td>
<td>(43) 0.785</td>
<td>(63) 0.648</td>
<td>(83) 0.962</td>
</tr>
<tr>
<td>(4) 0.044</td>
<td>(24) 0.626</td>
<td>(44) 0.874</td>
<td>(64) 0.398</td>
<td>(84) 0.315</td>
</tr>
<tr>
<td>(5) 0.840</td>
<td>(25) 0.885</td>
<td>(45) 0.604</td>
<td>(65) 0.142</td>
<td>(85) 0.721</td>
</tr>
<tr>
<td>(6) 0.381</td>
<td>(26) 0.418</td>
<td>(46) 0.087</td>
<td>(66) 0.962</td>
<td>(86) 0.637</td>
</tr>
<tr>
<td>(7) 0.756</td>
<td>(27) 0.320</td>
<td>(47) 0.334</td>
<td>(67) 0.516</td>
<td>(87) 0.056</td>
</tr>
<tr>
<td>(8) 0.586</td>
<td>(28) 0.098</td>
<td>(48) 0.189</td>
<td>(68) 0.615</td>
<td>(88) 0.905</td>
</tr>
<tr>
<td>(9) 0.480</td>
<td>(29) 0.791</td>
<td>(49) 0.777</td>
<td>(69) 0.226</td>
<td>(89) 0.195</td>
</tr>
<tr>
<td>(10) 0.101</td>
<td>(30) 0.717</td>
<td>(50) 0.704</td>
<td>(70) 0.881</td>
<td>(90) 0.981</td>
</tr>
<tr>
<td>(11) 0.282</td>
<td>(31) 0.868</td>
<td>(51) 0.946</td>
<td>(71) 0.369</td>
<td>(91) 0.600</td>
</tr>
<tr>
<td>(12) 0.957</td>
<td>(32) 0.583</td>
<td>(52) 0.426</td>
<td>(72) 0.001</td>
<td>(92) 0.044</td>
</tr>
<tr>
<td>(13) 0.377</td>
<td>(33) 0.385</td>
<td>(53) 0.266</td>
<td>(73) 0.744</td>
<td>(93) 0.433</td>
</tr>
<tr>
<td>(14) 0.456</td>
<td>(34) 0.465</td>
<td>(54) 0.791</td>
<td>(74) 0.229</td>
<td>(94) 0.762</td>
</tr>
<tr>
<td>(15) 0.778</td>
<td>(35) 0.101</td>
<td>(55) 0.711</td>
<td>(75) 0.906</td>
<td>(95) 0.678</td>
</tr>
<tr>
<td>(16) 0.243</td>
<td>(36) 0.285</td>
<td>(56) 0.122</td>
<td>(76) 0.413</td>
<td>(96) 0.347</td>
</tr>
<tr>
<td>(17) 0.578</td>
<td>(37) 0.829</td>
<td>(57) 0.895</td>
<td>(77) 0.827</td>
<td>(97) 0.274</td>
</tr>
<tr>
<td>(18) 0.966</td>
<td>(38) 0.998</td>
<td>(58) 0.371</td>
<td>(78) 0.984</td>
<td>(98) 0.114</td>
</tr>
<tr>
<td>(19) 0.373</td>
<td>(39) 0.539</td>
<td>(59) 0.221</td>
<td>(79) 0.641</td>
<td>(99) 0.480</td>
</tr>
<tr>
<td>(20) 0.834</td>
<td>(40) 0.060</td>
<td>(60) 0.011</td>
<td>(80) 0.068</td>
<td>(100) 0.685</td>
</tr>
</tbody>
</table>

In order to determine which random values should be used, enter the table on a line chosen by chance. Recommended procedure is selection of a line based on the last two digits of the ignition furnace calibration.

d. Example 3 shows the calculations for determining the testing location for HMA WSDOT Form DOT 350-160 will calculate the testing location for you.

Example 3

Test Location for a Sublot of HMA

The Ignition Furnace calibration is 0.45%. Use 45 as the starting point to enter the random number table 3. The starting random number is 0.604.

For the First test point:

Beginning tonnage: 0
Sublot increment: $800 \times 0.604 = 483$
Testing tonnage is at: 483 tons

For the Second test point:

Beginning tonnage: 800
Sublot increment: $800 \times 0.087 = 70$
Testing tonnage is at: $800 + 70 = 870$ tons
For the Third test point:

- Beginning Tonnage: 800 + 800 = 1600
- Sublot increment: 800 × 0.334 = 267
- Testing tonnage is at: 1600 + 267 = 1867 tons

For the Fourth test point:

- Beginning Tonnage: 1600 + 800 = 2400
- Sublot increment: 800 × 0.189 = 151
- Testing tonnage is at: 2400 + 151 = 2551 tons

7. APPLICATIONS FOR PORTLAND CEMENT CONCRETE

a. Determine the sublot size. The Standard Specifications states after two successive tests indicate that the concrete is within specified limits; the sampling and testing frequency may decrease to one for every five truck load. Concrete samples other than initial load samples or samples for questioned acceptance will be taken from each sublot by a random selection. Random selection will be accomplished by using the random number table 3. For each day of concrete delivery and placement a new random number will be selected and the process repeated.

b. Determine the locations of the test (or sampling) sites as defined in Section 3 using random numbers from table 3, or from another Random Number Generator. Do not sample concrete from the first ½ cubic yard of the truck.

c. In order to determine which random values should be used, enter the table on a line chosen by chance. As a suggestion, select a line corresponding to the last two numbers on the first civilian license plate you see or other acceptable random means. Subsequent “X” values for following sublots on the same day are taken from the lines, which follow. Start each day with an “X” value determined by chance in order to obtain a random selection.

d. Example 4 shows the calculations for determining the testing location for Portland Cement Concrete.

**Example 4**

Test Location for a Sublot of Portland Cement Concrete

For this example the random number selected is “37.” Enter the random number table 3 at (37) and the corresponding four-digit number is 0.829, this is the factor.

Based on the delivery of 10 cubic yard loads to the project. This would be adjusted by the quantity of concrete actually being delivered per load.

Next five trucks loads => 10 CY x 5 = 50 CY

50 CY x 0.829 = 41 CY to be sampled

20 CY (first two trucks) + 41 CY = sample at the 61 CY point

Therefore, the sample will be taken from the truck containing the 61st CY. (This would be samples from the first ⅓ of the truck) After approximately ⅓ CY of concrete has been discharged the sample should be taken. This is actually the seventh truckload delivered to the project this day as the first two truckloads were sampled before the random selection process started.
The next sample would be taken at random number “38.” Enter the random number table 3 at (39) and the corresponding four-digit number is 0.998, this is the factor.

Based on the delivery of 10 cubic yard loads to the project. This would be adjusted by the quantity of concrete actually being delivered per load.

Next five trucks loads => 10 CY x 5 = 50 CY

50 CY x 0.998 = 50 CY to be sampled

20 CY (first two trucks) 50 CY (from first random test) + 50 CY = sample at the 120 CY point. (This would be samples from the last ⅓ of the truck)

The next sample would be taken at random number “39.” Enter the random number table 3 at (38) and the corresponding four-digit number is 0.539, this is the factor.

Based on the delivery of 10 cubic yard loads to the project. This would be adjusted by the quantity of concrete actually being delivered per load.

Next five trucks loads => 10 CY x 5 = 50 CY

50 CY x 0.539 = 27 CY to be sampled

20 CY (first two trucks) 50 CY (from first random test) + (50 CY from second random test) + 27 CY = sample at the 147 CY point. (This would be samples from the middle to last ⅓ of the truck)

8. APPLICATIONS FOR AGGREGATE AND OTHER MATERIALS

a. Determine the lot or sublot size according to the contract documents. The lot or sublot shall be determined to the nearest 100 tons.

b. Determine the locations of the test (or sampling) sites as defined in Section 3 using random numbers from table 3, or from another Random Number Generator.

c. In order to determine which random values should be used, enter the table on a line chosen by chance. The first two or last two digits of the next automobile license plate you see is one way to select the entry point. Another way is to start a digital stopwatch and stop it several seconds later, using the decimal part of the seconds as your entry point.

**Sampling from a Belt or Flowing Stream:** Example: The specification calls for one sample from every 1000 Tons of aggregate. If the random number is 0.371, the sample would be taken at (0.371) (1000 Tons) = 371 Tons.

**Sampling from Haul Units:** Example: The specification calls for the samples to be based on a number of haul units. Determine the number of hauling units that comprise a lot. Multiply the selected random number(s) by the number of units to determine which unit(s) will be sampled.

If 20 haul units comprise a lot and one sample is needed, using the random number 0.773, the sample would be taken from the (0.773) (20) = 15.46, or 15th haul unit.
Sampling from a Roadway with Previously Placed Material: Example: The specification calls for a sample from a location on a job. The process as defined in Section 5, Applications for Asphalt Paving Density should be used where a X and Y measurement is needed to determine the testing location.

Appendix A
APPLICATIONS FOR HOT MIX ASPHALT DENSITY AND CHALLENGE CORES

a. Determine the LOT size and number of tests per LOT. The Standard specifications set the size of a density test lot for Asphalt Pavement to no greater than a single day’s production or approximately 400 tonne, whichever is less, and require five tests per LOT. At the end of a days production and the final lot is greater than 400 tonne, it should be broken up into two lots.b. Convert this LOT size to an area segment of the roadway based on the roadway section and depth being constructed for the course being tested. The calculations in Example 1 show how this is performed. Table 1 has been provided to give you recommend lot lengths for standard lane widths at various depths. Lot length needs to be determined to the nearest 30 meters.

Example 1
Sample Computation for Lot Length (Metric Units)

Using nominal compacted density of 2 439 kg/m3, compacted depth of 40 mm and paving width of 3.6 m:

Lot Length:

400 tonnes equate to 400 000 kg
Cross-section pavement area: 3.6 m wide, 0.040 m (40 mm) deep = 0.144 m2
Unit weight per meter length = 0.144 m2 × 2439 kg/m3 = 351.2 kg/m

Length = 400 000 kg/351.2 kg/m = 1138.9 m round to 1140 m

Sublot length = 1140 m × 0.2 = 228 m the paving involved.

<table>
<thead>
<tr>
<th>Lane Width</th>
<th>Compacted Depth</th>
<th>Computed Lot Length</th>
<th>Recommended Lot Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.6 meters</td>
<td>40 mm</td>
<td>1139</td>
<td>1140</td>
</tr>
<tr>
<td></td>
<td>45 mm</td>
<td>1012</td>
<td>1010</td>
</tr>
<tr>
<td></td>
<td>60 mm</td>
<td>759</td>
<td>760</td>
</tr>
<tr>
<td></td>
<td>75 mm</td>
<td>607</td>
<td>610</td>
</tr>
<tr>
<td>3.3 meters</td>
<td>40 mm</td>
<td>1242</td>
<td>1240</td>
</tr>
<tr>
<td></td>
<td>45 mm</td>
<td>1104</td>
<td>1100</td>
</tr>
<tr>
<td></td>
<td>60 mm</td>
<td>828</td>
<td>830</td>
</tr>
<tr>
<td></td>
<td>75 mm</td>
<td>663</td>
<td>660</td>
</tr>
</tbody>
</table>

Hot Mix Asphalt Density Test Lot Sizes
Metric Units 400 tonne lot at 2 439 kg/m3 = 164 m3

Table 1
LOT length may also be determined based on Nominal Designated LOT sizes. To utilize this concept, compacted mix volumes equivalent to the designated mix quantity per LOT have been determined using the nominal compacted unit weight of Hot Mix Asphalt pavement. These volumes are then converted into Density LOT lengths using the typical lane width and specified compacted depth. The included tables present the values for LOT Lengths based on English units.

c. Determine the locations of the test (or sampling) sites by using values from the random number table (Table 2) to determine the coordinate location on the roadway. In the table, use the “X” values as decimal fractions of the total length of the lot; use the “Y” values as fractions of the width, customarily measured from the right edge of the pavement. The values in the table have been set so that no measurements are taken within 1.5 LF (0.45 m) of the edge of the pavement. Whenever a test location is determined to fall within such an area (i.e., bridge end, track crossing, or night joint) the test location should be moved ahead or back on stationing, as appropriate, by 25 LF (8 m).

d. In order to determine which “X” and “Y” values should be used, enter the table on a line chosen by chance. Recommended procedure is selection of a line based on the last two digits from the most recent standard count on the nuclear density gage. Subsequent “X” and “Y” values are then taken from the lines that follow. Based on the specified sampling frequency, 20 lots can be accommodated by one cycle through the table. Start each shift with a set of values determined by chance in order to obtain random selection.

e. Example 2 shows the calculations for determining the testing location for asphalt pavement density. No Figure 1

Example 2
Test Location Within the LOT for Hot Mix Asphalt Pavement Density (Metric Units)

For the lot defined above (3.6 m wide, 1140 m long) starting at station 10 000.00 m

Using the last two digits of the standard count. Determine the “X” and “Y” values from line (51) in the table: X = 0.762, Y = 0.65 (these are illustrative examples only. Table format and generation have been randomized so that each replication of the table will vary).

Beginning station: 10 000.00
Sublot length increment: 228 × 0.762 = 173.7 m
Width offset: 3.6 × 0.65 = 2.3 m (from right edge)
Location is station: 10 000 + 173.7 = 10 173.7, 2.2 m from right edge
WSDOT Test Method T 724

Method of Preparation of Aggregate for HOT MIX ASPHALT (HMA) Mix Designs

1. SCOPE

This method of test is intended for the processing and preparation of aggregate samples for use in HMA mix designs and Ignition Furnace calibration samples for Hot Mix Asphalt, asphalt treated base, or open graded products.

2. APPARATUS

a. Sieves — shall conform to the specifications of sieves for testing purposes.
b. Mechanical sieve shaker — of sufficient size to separate the material to the specification sieves.
c. Oven(s) — of appropriate size, capable of maintaining a uniform temperature of 325 ± 25°F (163 ± 14°C).
d. Container — pans or containers of suitable size to dry and store the aggregate.
e. Balance — capacity of at least 8 kg sensitive to 0.1 g and meeting the requirements of AASHTO M 231.
f. Aggregate washer (optional).

3. PROCEDURE

a. Representative sample(s) of the production aggregates shall be obtained.
b. Dry the aggregate in an oven to a constant mass not to exceed 350°F.

Note: When developing an Ignition Furnace Calibration Factor, samples from separate stockpiles can be combined in the same percentages as the job mix formula prior to further processing. The combined sample should be at least four times the amount required for a single test (i.e., IFCF determination).
c. Sieve the aggregate over all the specification sieves designated for class of mix being tested. Place the material retained on each sieve in separate containers.
d. Wash the separated aggregate samples, except the portion passing the No. 200 (0.075 mm) sieve, in accordance with WSDOT FOP for WAQTC/AASHTO T 27/11.
e. Dry the washed, aggregate samples to constant mass.
f. Recombine the aggregate samples to match the grading of the job mix formula. The sample size as determined by the specific test procedure performed.
## Performance Exam Checklist

*Method of Preparation of Aggregate for ACP Mix Designs*

*WSDOT Test Method T 724*

<table>
<thead>
<tr>
<th>Participant Name</th>
<th>Exam Date</th>
</tr>
</thead>
</table>

### Procedure Element

<table>
<thead>
<tr>
<th>Procedure Element</th>
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<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required,</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>has the current calibration/verification tags present?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Representative sample(s) of the production aggregates obtained.</td>
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</tr>
<tr>
<td>4. Aggregate dried in an oven to a constant mass?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Aggregate sieved over designated sieves for class of mix being tested?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. Material retained on each sieve placed in separate containers?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. Separated aggregates washed, except the portion passing the No. 200</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>(0.075mm) sieve, in accordance with FOP for AASHTO T27/T11?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8. Washed aggregate samples dried in an oven to a constant mass?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>9. Aggregate recombined to match the grading of the job mix formula?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>10. Sample size determined by the specific test procedure to be performed?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

First attempt: Pass ☐ Fail ☐  
Second attempt: Pass ☐ Fail ☐

Signature of Examiner  
__________________________________________

Comments:
WSDOT Test Method T 726

Mixing Procedure for Hot Mix Asphalt (HMA)

1. SCOPE

This is the mixing procedure for laboratory prepared samples of asphalt concrete, asphalt treated base, or open graded asphalt products mixtures. The aggregates used in this procedure are prepared by means of WSDOT Test Method No. 724.

2. EQUIPMENT

a. Mixing Spoon — A large metal spoon capable of handling hot mix asphalt.
b. Scoop — A metal scoop of ample size, capable of handling hot mix asphalt.
c. Curing Pan — A heat resistant pan of ample size to handle samples of hot mix asphalt.
d. Mixing Bowl — A heat resistant bowl for hand mixing or mechanical mixer of ample size to handle samples of hot mix asphalt.
e. Mechanical Mixer — A mechanical mixer with heat source may be used in lieu of hand mixing.
f. Balance — The balance shall have capacity of 11 kg and sensitive to 0.1 gm.
g. Oven — An oven of appropriate size, capable of maintaining a uniform temperature within the allowable tolerance for the grade of asphalt binder.
h. Thermometer- Armored glass or dial-type thermometers with metal stems or probe for determining the temperature of aggregates, binder, and HMA between 180° and 418° F (100° and 232° C).

3. PROCEDURE

a. Heat asphalt binder, aggregate sample(s), and mixing bowl(s) in a preheated oven to the mixing temperature specified by the supplier of asphalt binder or as indicated on mix design report.
b. Stir the asphalt binder and verify that the temperature of asphalt binder is within the temperature recommended by the asphalt supplier or as indicated on mix design report.
c. After the materials are heated place mixing bowl on balance and tare.
d. Place heated aggregate sample in the tared mixing bowl and determine the mass of the aggregate sample. Use this mass to calculate the mass of asphalt binder required to produce a sample of HMA at the Job Mix Formula (JMF) asphalt binder content (See calculation below).
e. Form a crater in the aggregate sample and weigh in asphalt binder as determined above.

*Note:* If mixing bowl is not buttered an additional sample should be prepared, mixed and then discarded to properly coat the mixing bowl with asphalt and fines.

f. Mix aggregate sample and asphalt binder for approximately 3 minutes or until aggregate sample is completely coated with asphalt binder. This can be accomplished by hand mixing or by mechanical mixer.

*Note:* Reheating of the HMA for a short period of time may be necessary to assure complete coating of the aggregate.

g. Transfer mixed HMA to the proper container for other testing as required.

h. Repeat steps A thru H for each sample to be mixed.

Calculation for Mass of Asphalt Binder:

Designated Mass of Asphalt binder = \( \frac{(A) D}{(1 - A)} \)

Where:
- \( A \) = Designated asphalt binder content (expressed in decimal)
- \( D \) = dry aggregate mass (from step 3(c))

Example:

The designated asphalt binder content is 5.3\%, and dry aggregate mass is 1567.1 grams.

Designated Mass of Asphalt binder = \( \frac{(0.053)1567.1}{(1 - 0.053)} \) = \( \frac{83.1}{0.947} \) = 87.7g
# Performance Exam Checklist

*Mixing Procedure for Asphalt Concrete*

*WSDOT Test Method T 726*

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Aggregate samples prepared as per WSDOT Test Method T724?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Mixing bowl(s), aggregate and asphalt binder heated to appropriate mixing temperature?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Asphalt binder stirred and temperature confirmed by thermometer?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. Heated mixing bowl placed on scale and scale then tared?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. Heated aggregate sample placed in bowl and scale then tared?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8. Crater formed into center aggregate, weigh in asphalt binder in accordance with mix design information?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>9. Mix aggregate and asphalt for approximately 3 minutes or until aggregate is completely coated?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>10. When mixing is complete carefully scrape off mixing apparatus, tools and bowl is dumped into correctly marked pan?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>11. Repeat steps 4 - 8 for each sample to be mixed?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>12. All calculations performed correctly?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

First attempt: Pass ☐ Fail ☐  
Second attempt: Pass ☐ Fail ☐

Signature of Examiner  ____________________________________

Comments:
1. SCOPE

This method may be affected by the type of aggregate in the mixture. Accordingly, to optimize accuracy, a calibration factor will be established with the testing of a set of HMA calibration samples for each mix type. This procedure must be performed before any acceptance testing is completed. The calibration process should be repeated each time there is a significant change in the mix ingredients or design.

2. APPARATUS

a. Equipment as described to perform FOP for AASHTO T 308 Method A.

3. SAMPLE PREPARATION

a. Prepare a minimum of two HMA calibration samples in accordance with WSDOT Test Method No. 724 and No. 726 or use previously prepared HMA calibration samples.

b. If the HMA calibration samples are not sufficiently soft to separate for testing, carefully heat the samples in an oven until sufficiently soft. Dry sample to a constant mass, not to exceed 325 ± 25°F (163 ± 14°C). Do not heat the sample basket assemblies.

4. PROCEDURE

a. Test two HMA calibration samples in accordance with WSDOT FOP for AASHTO T 308.

b. Determine the measured asphalt binder contents for each sample from the printed tickets.

c. If the difference between the measured asphalt binder contents of the two samples exceeds 0.15 percent, test two additional HMA calibration samples. From the four tests, discard the high and low results and determine the IFCF from the two remaining results. Calculate the difference between the actual and measured asphalt binder contents for each sample. The IFCF is the average of the differences expressed in percent by mass of the HMA.
WSDOT SOP 729

In-Place Density of Bituminous Mixes Using the Nuclear Moisture-Density Gauge FOP for WAQTC TM 8

1. Number and Locations of Nuclear Tests
   a. Control lots representing 400 tons (400 metric tons) or less of mix as determined in the Standard Specification shall be established. Nuclear gauge tests for compaction control during paving construction shall be taken at a minimum of five locations per control lot. The locations will be picked at random by WSDOT Test Method No. 716.

2. Theoretical Maximum Density determination FOR PAVEMENT COMPACTION CONTROL
   a. Theoretical Maximum Density is to be determined daily per WSDOT FOP for AASHTO T 209.
   b. On the initial day of production of a new Job Mix Formula (JMF), two determinations shall be made to establish an initial average value. The samples shall not be from the same truck. Average the two Theoretical Maximum Densities and report the result to the Moisture Density Gauge Operator. The Theoretical Maximum Density value from the Mix Design shall not be included in the average.
   c. If the two Theoretical Maximum Densities determined on the initial day do not agree within 3.0 lb./ft.\(^3\) (48 kg/m\(^3\)), a third determination shall be made. The average density shall be based on the two closest sets of results.
   d. The moving average is defined as the average of the most recent last five determinations for the HMA being placed. All Theoretical Maximum Density determinations performed in a day or shift of paving will be included in the moving average. For Non Volumetric projects, a rice density test shall be taken with the first mix sample each day. For Volumetric projects, a rice density test shall be taken with each mix sample and all tests included in the moving average. Until five Theoretical Maximum Density values have been determined, the average will consist of the number of Theoretical Maximum Densities currently available. When five Theoretical Maximum Density values have been determined, the moving average for each day or shift will include the last four Theoretical Maximum Density determinations performed plus the first Theoretical Maximum Density determined for the current day or shift of paving. This new value will be used for the entire day or shift of paving. This new value will continue to be used until a new moving average is established.
e. Subsequent Theoretical Maximum Density determinations shall be compared with the previously computed moving average. If a determination deviate from the moving average by more than 3.0 lb./ft.\(^3\) (± 48 kg/m\(^3\)), a second determination shall be made on another portion of the same sample. If the second determination is within 3.0 lb./ft.\(^3\) (± 48 kg/m\(^3\)) of the first determination a new moving average will be initiated, discarding all previous results. The new moving average will be sent to the Moisture Density Gauge operator and will replace the current moving average. If the second determination agrees within 3.0 lb./ft.\(^3\) (± 48 kg/m\(^3\)) of the moving average then the first determination will be discarded and the second determination will be included in the moving average.

f. An average Theoretical Maximum Density (moving average) will be sent to the Moisture Density Gauge operator once per day or shift change a new moving average is established, unless two determinations during a day or shift are not within 3.0 lb./ft.\(^3\) (± 48 kg/m\(^3\)), then a new moving average will be calculated in accordance with “e” of this procedure and sent to the Moisture Density Gauge operator as the new moving average for the day or shift. The Moisture Density Gauge Operator will continue to use the previous moving average until a new moving average is available.

3. Acceptance

a. For acceptable compaction, nuclear gauge test results for the control lot shall be determined by WAQTC FOP for TM8, as required by current specifications or contract plans.

b. The percent compaction equals the average of two in place nuclear gauge wet density readings in accordance with TM8, times the gauge correlation factor divided by the current average Theoretical Maximum Density multiplied by 100.

\[
\text{percent compaction} = \left( \frac{\text{WD}}{\text{Average Theoretical Maximum Density}} \right) \times (100)
\]

\[
\text{WD} = \text{average of two inplace nuclear gauge wet density readings in accordance with TM8.}
\]

\[
\text{CF} = \text{gauge correlation factor.}
\]

4. REPORT

Report the results on the Asphalt Concrete Pavement Compaction Test Report DOT Form 350-092.

Report the percent compaction to the nearest tenth of a percent (0.1 percent).
WSDOT SOP 730

Correlation of Nuclear Gauge Densities with Hot Mix Asphalt (HMA) Cores

1. Gauge-core correlation shall be required for statistical evaluation of degree of asphalt compaction.
   a. For each combination of gauge and job mix formula.
   b. For direct transmission and for back scatter modes (when used).
   c. If gauge is recalibrated.

2. A new gauge correlation is not required.
   a. For different contracts if JMF and gauge are the same.
   b. For a change in bases (i.e., surfacing to overlay).
   c. When the job mix formula has been adjusted in accordance with Section 9-03.8(6)A of the Standard Specifications.

3. Gauge correlation is based on 10 density determinations and 10 cores taken at corresponding locations. Gauge densities shall be determined in accordance with WSDOT FOP for WAQTC TM 8. Cores should be taken no later than the day following paving and before traffic has been allowed on roadway. The sites for correlation cores do not have to be record density locations and therefore consideration should be given to selecting sites out of the travel way.

   Note1: If a core becomes damaged, it may be eliminated from the average.

   Note2: Cores may be taken sooner than the day after paving by cooling the pavement to allow for hardening of the HMA to prevent damage to the core when taking the sample. Water, ice, or even dry-ice would be expedient means to cool the pavement. Nitrogen gas or CO2 uses as replacement drilling fluids may also be involved.

4. Obtain a pavement core from each of the test sites in accordance with WSDOT SOP 734. The core shall be taken in between the two nuclear gauge footprints. If direct transmission was used, locate the core at least 1 in. (25 mm) away from the edge of the drive pin hole.

5. Core densities shall be determined in conformance with AASHTO T 166 Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens.

6. Correlation factor shall be determined to 0.001 using Standard Form 350-112: Correlation Nuclear Gauge to Core Density, or other comparable forms.
WSDOT SOP 731

Method for Determining Volumetric Properties of Hot Mix Asphalt Class Superpave

1. SCOPE

This procedure covers the determination of volumetric properties of Asphalt Concrete Pavement Class Superpave i.e. Air Voids (Va), Voids in Mineral Aggregate (VMA), Voids Filled with Asphalt (VFA), and Dust to Binder Ratio (P_{#200}/P_{be}).

2. REFERENCES

a. T 329, WSDOT FOP for AASHTO Moisture content of Bituminous Mixtures by Oven
b. T27/11, WSDOT FOP for WAQTC/AASHTO for Sieve Analysis of Fine and Coarse Aggregates
c. T 166, WSDOT FOP for AASHTO for Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
d. T 168, WSDOT FOP for WAQTC/AASHTO for Sampling of Hot Mix Asphalt Paving Mixtures
e. T 209, WSDOT FOP for AASHTO FOP for Maximum Specific Gravity of Hot Mix Asphalt Paving Mixtures “Rice Density”
f. T 308, WSDOT FOP for AASHTO FOP for Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method
g. T 312, WSDOT FOP for AASHTO for Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor
h. T 712, WSDOT Test Method for Standard Method of Reducing Hot Mix Asphalt Paving Mixtures

3. CALIBRATION OF COMPACTOR

a. The gyratory compactor will be calibrated in accordance with WSDOT VP-58 and according to the manufacturer’s established calibration procedure. Anytime the gyratory compactor is moved to a new testing site a new calibration is required in accordance with WSDOT VP-58.
4. TEST SAMPLES
   a. All test samples shall be obtained per WSDOT FOP for WAQTC/AASHTO T 168, and reduced in accordance with WSDOT Test Method No. 712. It is recommended that the gyratory test sample be the first sample acquired in order to minimize heat loss.
   b. The size of the gyratory sample shall be such that it will produce a compacted specimen 115.0 ± 5.0 mm in height. Generally, the reference mix design verification report from the State materials Laboratory initial starting mass is adequate.
   c. Place the gyratory sample in an oven set no more than 25°F above the compaction temperature (Note 1) as soon as possible to reduce sample cooling. The gyratory test is temperature sensitive. The sample should only be heated five degrees above until it achieves the compaction temperature as shown on the mix design verification report.

   Note 1: The compaction temperature for each mix design can be found on the mix design report. Any change in compaction temperature must be confirmed by the temperature viscosity chart provided by the asphalt supplier, which can be obtained from the Paving Contractor.

5. PROCEDURE
   a. Place a compaction mold, base plate, and top plate (if required), in an oven set at no more than 25°F above compaction temperature (Note 2) for a minimum of 60 minutes prior to the estimated beginning of compaction. Subsequent uses of a conditioned mold will require 5 minutes reheating.

   Note 2: Never heat any gyratory compactor mold in excess of 350°F.
   b. Place a thermometer into the center of the mix, do not stir the mixture. (Note 3) Compact the sample immediately upon achieving compaction temperature in accordance with step 4 (c).

   Note 3: While the gyratory test sample is heating it is beneficial to prepare and/or run the other tests as times permits.
   c. Perform the sample compaction in accordance with WSDOT FOP for AASHTO T312 Section 9.
   d. Determine Rice Density per WSDOT FOP for AASHTO T 209.
   e. Determine asphalt content and gradation per WSDOT FOP for AASHTO T 308 and WSDOT FOP for WAQTC/AASHTO T27/11.
   f. Determine moisture content per WSDOT FOP for AASHTO T 329.
   g. Allow the gyratory compacted specimen to cool at room temperature for 15 to 24 hours. Determine the Bulk Specific Gravity (Gmb) of the specimen in accordance with WSDOT FOP for AASHTO T 166 Method A.

   Note 4: For repeatability between operators the challenge sample should be cooled for the same amount of time at room temperature as the original specimen. When sending challenge samples to the Region or State Laboratory, note the time the original sample was cooled at room temperature in the remarks section of the transmittal.
6. VOLUMETRIC CALCULATIONS

CALCULATIONS

a. Calculate %G_{mm} @N_{design} as follows:

\[
%G_{mm} @N_{design} = \frac{G_{mb}}{G_{mm}} \times 100
\]

Example:

\[
%G_{mm} @N_{design} = \frac{2.383}{2.493} \times 100 = 95.6\%
\]

Where:

\[
%G_{mm} @N_{design} = \% \text{ Theoretical Maximum Specific Gravity @ } N_{design}
\]

\[
G_{mb} = \text{ bulk specific gravity of the compacted specimen}
\]

\[
G_{mm} = \text{ maximum specific gravity of the paving mixture (Rice)}
\]

\[
N_{design} = \text{ Number of design gyrations}
\]

b. Calculate %G_{mm} @N_{ini} as follows:

\[
%G_{mm} @N_{ini} = 100 \times \left( \frac{G_{mb} \times h_d}{G_{mm} \times h_i} \right)
\]

Example:

\[
%G_{mm} @N_{ini} = 100 \times \left( \frac{2.383 \times 110.0}{2.493 \times 123.1} \right) = 85.4\%
\]

Where:

\[
%G_{mm} @N_{ini} = \% \text{ Theoretical Maximum Specific Gravity @ } N_{initial}
\]

\[
h_d = \text{ height of specimen at design gyration level}
\]

\[
h_i = \text{ height of specimen at initial design gyration level}
\]

\[
N_{initial} = \# \text{ of initial gyrations}
\]

c. Calculate Air Voids (V_a) as follow:

\[
V_a = 100 \times \left(1 - \frac{G_{mb}}{G_{mm}}\right)
\]

Example:

\[
V_a = 100 \times \left(1 - \frac{2.383}{2.493}\right) = 4.4\%
\]

Where:

\[
V_a = \text{ percent air voids}
\]
d. Calculate Voids in Mineral Aggregate (VMA) as follows:

\[
VMA = 100 - \left( \frac{G_{sb} \times P_s}{G_b} \right)
\]

Example:

\[
VMA = 100 - \left( \frac{2.383 \times 94.8}{2.630} \right) = 14.1\%
\]

Where:
- \( P_s \) = percent of aggregate in the mix (use decimal form in calculation)
- \( P_s = 100 - P_b \)

Example: 100% mix – 5.2% asphalt = 94.8% aggregate

\( G_{sb} \) = bulk specific gravity of the combined aggregate
\( VMA \) = Voids in Mineral Aggregate, percent

e. Calculate Voids Filled with Asphalt (VFA) as follows:

\[
VFA = 100 \times \left( \frac{VMA - V_s}{VMA} \right)
\]

Example:

\[
VFA = 100 \times \left( \frac{14.1 - 4.4}{14.1} \right) = 68.8\%
\]

Where:
- \( VFA \) = Voids Filled with Asphalt, percent

f. Calculate Gravity Stone Effective (\( G_{se} \)) as follows:

\[
G_{se} = \left( \frac{100 - P_b}{G_{mm} \times \left( \frac{P_b}{G_b} \right)} \right)
\]

Example:

\[
G_{se} = \left( \frac{100 - 5.2}{2.493 \times \left( \frac{5.2}{1.025} \right)} \right) = 2.706
\]

Where:
- \( G_{se} \) = Gravity Stone Effective (specific gravity of aggregates, excluding voids permeable to asphalt)
- \( P_b \) = The percent by mass of binder in the total mixture including binder and aggregate
- \( G_b \) = Gravity Binder

Note 4: \( G_b \) is the specific gravity of the asphalt binder. It is imperative that current \( G_b \) is used in the volumetric calculations. Any changes in the binder specific gravity must be confirmed by the temperature viscosity curve provided by the asphalt supplier, which can be obtained from the paving Contractor.
g. Calculate Percent Binder Effective ($P_{be}$) as follows:

$$P_{be} = P_b - \left( \frac{(P_s \times G_b)(G_{se} - G_{sb})}{(G_{se} \times G_{sb})} \right)$$

Examples:

$$P_{be} = 5.2 \times \left( \frac{(94.8 \times 1.025)(2.706 - 2.630)}{(2.706 \times 2.630)} \right)$$

Where:

- $P_{bc}$ = percent binder effective, the percent by mass of effective asphalt content minus the quantity of binder lost by absorption into the aggregate particles.
- $P_s$ = percent aggregate in the mixture
- $G_b$ = Gravity binder
- $G_{se}$ = effective specific gravity of the aggregate
- $G_{sb}$ = bulk specific gravity of the combined aggregate
- $P_b$ = percent binder

h. Calculate dust-to-binder ratio ($P_{200}/P_{be}$) as follows:

$$P_{200}/P_{be} = \frac{P_{200}}{P_{be}}$$

Example: $5.0 \div 3.6 = 1.4$

Where:

- $P_{200}/P_{be}$ = dust-to-binder ratio
- $P_{200}$ = percent of aggregate passing the No. 200 sieve

7. REPORT

Report asphalt content, gradation, and moisture content on WSDOT Form 350-560EF, and report volumetric properties on WSDOT Form 350-162 or other report approved by the State Materials Engineer.
INTRODUCTION
This test method explains how to locate and test for cyclic density. WSDOT field personnel are to systematically measure the locations where the new hot mix asphalt (HMA) pavement density may vary due to “spots, streaks” or visual pavement irregularities that may be related to temperature differentials or aggregate surface segregation. The described test method will identify density variations due to both causes.

1. GENERAL SCOPE
   a. Temperature differentials is defined as any area where the surrounding new HMA pavement temperature is 25°F or greater.
   b. Temperature differentials shall be determined when the new HMA pavement has been on the roadway for less than 1 minute, and no compaction has been applied.
   c. aggregate segregation “Spots, streaks” or visual pavement irregularities is defined as areas of new HMA pavement that has a significantly different texture than the surrounding material.
   d. A systematic density reading shall be performed on locations where a temperature differential exists or where the HMA pavement shows spots, streaks, or has a significantly different texture after then finished rolling.
   e. Only systematic density readings located within the compaction lot should be marked and tested for density.
   f. Hot Mix Asphalt density measurements are made in accordance with WSDOT FOP for WAQTC TM-8 using a nuclear moisture density gauge in direct transmission mode.
   g. A density measurement shall be the result of a single four minute reading taken at the described location.
   h. Gauge-core correlation shall be in accordance with WSDOT SOP 730 is required for the systematic density testing.
   i. Normal Quality Assurance Testing will be performed throughout the entire job, as described in WSDOT SOP 729, in addition to any systematic density readings.

2. EQUIPMENT
   a. An approved infrared camera OR a handheld noncontact infrared thermometer (features for both should include continuous reading, minimum, maximum, and average readings, laser sighting, and a minimum distance to spot size ratio (D:S) of 30:1.
b. Nuclear density gauge and standardizing block (reference standard).
c. Tape measure.
d. A can of spray paint for marking test locations.
e. Required report form.

3. GAUGE CALIBRATION
   a. Shall be in accordance with WSDOT FOP for WAQTC TM-8. Follow the gauge calibration as outlined in FOP for WAQTC TM 8.

4. TEMPERATURE CRITERIA
   a. If the new HMA pavement temperature differentials are 25°F or greater then the surrounding new pavement, then a systematic density test is required.
   b. If the new HMA pavement temperature differentials are less than 25°F, then there is no need to perform testing unless an area shows signs of visual pavement irregularities, surface segregation or a significantly different texture.

5. USE OF INFRARED CAMERA
   a. View at least five consecutive truckloads of HMA (as described in steps b, c, d, e, and f) being placed and observe the location and temperature of any cool spots within the compaction lot. These observations should allow the operator to become familiar with the location and extent of the temperature differentials, if any, and if the temperature differentials are occurring in a cyclic manner.
   b. Viewing should occur from the side of the paved lane approximately 15 to 20 feet back from the paver looking toward the paver.
   c. The camera should be focused on the freshly placed HMA pavement prior to rolling. The camera should be adjusted to show the high and low temperatures.
   d. One truckload of HMA begins when the truck starts to dump into the paver or material transfer device and ends when another truck starts to dump.
   e. The “spot” function on the camera should be used to obtain the temperature of the cool area and the surrounding HMA to assess the temperature differential.
   f. Only temperature differentials located within the compaction lot should be marked for density testing.
   g. If the temperature differential is 25°F or more, locate the approximate center of the temperature differential area with the camera. The offset is from the center of the temperature differential area to the edge of the lane. Mark the location to be tested for systematic density by placing a paint mark at the edge of the lane corresponding to the center of the temperature differential. Record the HMA surface temperature, temperature differential, offset, and station as shown in Figure 1.
   h. If the temperature differential is less than 25°F, there is no need to mark the location unless an area within the paved lane has a significantly different texture. If testing is performed because of a significantly different textured area, locate the center of the affected area and mark the location as described in step g and as shown in Figure 1 with an (S) after the temperature differential.
6. USE OF HANDHELD NONCONTACT INFRARED THERMOMETER

   a. View at least five consecutive truckloads of HMA (as described in steps b, c, d, e, and f) being placed at varying offsets and observe the location and temperature of any cool spots within the compaction lot. These observations should allow the operator to become familiar with the location and extent of the temperature differentials, if any, and if the temperature differentials are occurring in a cyclic manner.

   b. Begin the longitudinal scan when a truck starts to dump into the paver or material transfer device and continue until the paver stops (discontinuous mix delivery) or until another truck starts to dump (continuous mix delivery).

   c. To perform the longitudinal scan, stand at the edge of the paving lane about 5 to 10 feet back from the paver. Scan the mat with the handheld noncontact thermometer continuously in a longitudinal manner by walking behind the paver in the direction of paving, staying the same distance away from the paver for one truckload of HMA. The offset for the longitudinal profile should be anywhere from 18 inches from the edge to no more than half the width of the paved lane. (The need to vary the longitudinal offset will be necessary to get an accurate representation of the whole mat.) Scanning temperatures for the other half of the paved lane should be performed from the other side.

   Note: Typically, temperature differentials or surface segregation at the beginning or end of a truckload can be captured with the longitudinal scan.

   d. Perform a transverse scan after completion of the longitudinal scan, making sure to scan the entire width of the paved lane excluding the outer 18 inches on each side. It should be performed approximately 5 to 10 feet behind the paver (to check for streaking of the mat).

   Note: Typically, streaking caused by temperature differentials or surface segregation will be captured by the transverse scan.

   e. The temperature scan can be stopped as soon as a temperature differential greater than 25°F has been located.

   f. Only temperature differentials located within the compaction lot should be marked for density testing.

   g. If the temperature differential is 25°F or more, locate the approximate center of the temperature differential area by scanning that specified location. The offset is from the center of the temperature differential area to the edge of the paved lane. Mark the location to be tested for systematic density by placing a paint mark at the edge of the lane corresponding to the center of the temperature differential. Record the HMA surface temperature, temperature differential, offset, and station as shown in Figure 1.

   h. If the temperature differential is less than 25°F, there is no need to mark the location unless an area within the paved lane has visual pavement irregularities, surface segregation or a significantly different texture. If testing is performed because of a significantly different textured area, locate the center of the affected area and mark the location as described in step g and as shown in Figure 1 with an (S) after the temperature differential.
7. SYSTEMATIC DENSITY PROCEDURE
   a. Testing shall be performed after the Contractor has finished compaction of the paved lane.
   b. Locate the mark (Figure 1) and record the information as listed.
   c. The probe of the gauge shall be placed at the offset listed and perform the testing according to WSDOT FOP for WAQTC TM 8 (direct transmission mode).
   d. Record the data on the Hot Mix Asphalt Concrete Pavement Compaction Report for Cyclic Density Form.

8. NUMBER AND LOCATION OF TEMPERATURE PROFILES AND SYSTEMATIC DENSITY TESTS
   a. If any temperature differentials were found in the initial assessment of paving operations (as described in 5a or 6a), the Engineer or Inspector shall take at least one temperature profile for every 5 trucks delivered to the paving operation.
   b. If the operation is not producing temperature differentials greater than 25°F in a cyclic pattern or the Engineer is not able to find 4 or more locations to be tested per compaction lot, the testing frequency can be reduced, but should be checked randomly throughout the day and the results recorded.
   c. If any significant equipment or weather changes occur, temperature profiles should be performed to determine if the new operation is capable of producing uniform HMA temperatures. If the paving machine in use is causing surface segregation, spotting or streaking that creates a finish that has a significantly different texture than the surrounding HMA, density tests should be performed in accordance with section 7 of this SOP.
   d. No temperature profiles shall be performed within the first or last 25 tons of production each day or within 25 feet of any transverse joint.
   e. Systematic density testing shall be performed on any location marked for testing.

Marking Location of Temperature Differential.

Figure 1
WSDOT SOP 734

Sampling Hot Mix Asphalt After Compaction (Obtaining Cores)

1. SCOPE

• This method describes the process for obtaining Hot Mix Asphalt test cores for Laboratory testing after compaction has been completed. Cores may range in size from 2 in. to 12 in.

2. SIGNIFICANCE AND USE

• Samples obtained in accordance with the procedure given in this practice may be used for measuring pavement thickness, density, and acceptance testing.
• When cores are used to determine nuclear gauge correlation, refer to WSDOT SOP 730.
• When cores are used to determine pavement density, the Bulk Specific Gravity ($G_{mb}$) is determined according to WSDOT FOP for AASHTO T 166.

3. APPARATUS

• Core Drill Machine – A Core Drill Machine of sufficient horsepower and depth to minimize distortion of the compacted cores of Hot Mix Asphalt.
• Core Bit – The cutting edge of the core drill bit shall be of hardened steel or other suitable material with diamond chips embedded in the metal cutting edge or as recommended by the core drill bit manufacturer. Typically the core drill bit should have an inside diameter of $4\text{”} \pm 0.25\text{”} \ (100 \text{ mm} \pm 6 \text{ mm})$ or $6\text{”} \pm 0.25\text{”} \ (150 \text{ mm} \pm 6 \text{ mm})$, these core bit dimensions are agency preferred alternatives. Suitable larger and smaller diameter core bit alternatives shall be employed as required by the agency.
• Tools – Core layers may be separated using a saw or other suitable device which provides a clean smooth surface and does not damage the core.
• Retrieval Device (Optional) – The retrieval device used for removing core samples from holes must preserve the integrity of the core. The device may be a steel rod of suitable length and with a diameter that will fit into the space between the core and the pavement material. There may be a 90 degree bend at the top to form a handle and a 90 degree bend at the bottom, approximately 2 in. (50 mm) long, forming a hook to assist in the retrieval of the core or other suitable device.

4. SAFETY

This standard does not purport to address all of the safety concerns, associated with its use. It is the responsibility of the user of this standard operating procedure to establish a pre activity safety plan prior to use.
5. TEST SITE LOCATION
   • The quantity of cores to be obtained shall be determined by the test procedure to
     be performed or agency requirements. Refer to WSDOT SOP 730 when taking
     correlation cores.
   • Determine the location of the core(s) as required by the agency.

6. PROCEDURE
   • For freshly placed Hot Mix Asphalt materials, the core shall be taken when the material
     has had sufficient amount of time to cool to prevent damage to the core.
   • Pavement may be cooled to expedite the removal of the core by the following methods;
     water, ice water, ice, or dry ice or liquid nitrogen.
   • Place the coring machine and core bit over the selected location.
   • Keep the core bit perpendicular to the Hot Mix Asphalt surface during the coring
     process.
     Note 1: If any portion of the coring machine shifts during the operation, the core may
     break or distort.
   • Constant downward pressure should be applied on the core bit. Failure to apply constant
     pressure, or too much pressure, may cause the bit to bind or distort the core.
   • Continue the coring operation until the desired depth is achieved.
   • If necessary, use a retrieval device to remove the core.
   • Clearly identify the cores location and offset without causing damage (i.e., lumber
     crayon or grease pencil).
     Note 2: If the core is damaged to a point that it cannot be used for its intended purpose,
     a new core shall be obtained within 6 in. of the original location.

7. FILLING CORE HOLES
   • When necessary, the hole made from the coring operation shall be filled with a material
     that will not separate from the surrounding material. If a Hot Mix Asphalt is available
     and used, it shall be compacted into the hole. A fast set grout product may be used in
     lieu of a Hot Mix Asphalt. A black dye can be used to color the grout on wearing lifts.

8. TRANSPORTING CORES
   • Transport cores in a suitable container(s) that prevents damage from jarring, rolling,
     hitting together, and/or impact with any object.
   • Prevent cores from freezing or excessive heat above 130º F (54º C), during transport.
     Note 1: In extreme ambient temperature conditions, cores should be placed in water
     during transport.
   • If the core is damaged in transport to a point it can not be utilized for its intended
     purpose the core will not be used.
9. SEPARATE THE LAYERS
   • When necessary, separate the lifts or layers of pavement courses by using a water cooled saw to cut the core on the designated lift line or separate by other suitable methods that will not damage the lifts or layers to be tested.
   
   Note #4: Lift lines are often more visible by rolling the core on a flat surface and/or surface drying the core.

10. LENGTH DETERMINATION
    Measure the thickness of the designated lift to the nearest 0.01’ or ⅛” according to WSDOT Test Method 720.

11. REPORT
    Core information shall be reported on standard agency forms and should include the following information.
    • The date the cores were obtained
    • Paving date
    • Contract number
    • Project title
    • Location of test
    • The lift being evaluated
    • Type of material being evaluated
    • Mix Design Lab Number
    • Average thickness of each core (to the nearest 0.01’ or ⅛ “)
    • Average Theoretical Maximum Density
WSDOT SOP 735

Standard Operating Procedure for Longitudinal Joint Density

1. GENERAL SCOPE
   a. In addition to the 5 random Quality Assurance (QA) density tests performed per compaction lot, one density test at each longitudinal joint will be performed on a confined or unconfined edge.

2. LONGITUDINAL JOINT TESTING
   a. The longitudinal joint test will be conducted in accordance with WSDOT FOP for WAQTC TM-8, except “Test Site Location, Section 1, subsection c, which is modified by this procedure to read “No closer than 18 in. (450mm) to any vertical mass, or less than 6 in. (152 mm) from a vertical pavement edge,” making sure the gauge will sit flush with the hot-mix asphalt (HMA). See Figure 1.

   Note: Hot lap joints are not included in longitudinal joint testing.

3. NUMBER OF LONGITUDINAL JOINT TESTS
   a. One reading at each longitudinal joint to be tested, will be taken within each compaction lot at the same station location as the third sublot.

4. CALCULATION OF RESULTS
   a. Calculate the Longitudinal Joint Density as defined in step 3b of WSDOT SOP 729.

5. REPORT
   a. Report the test results on the Data sheet Longitudinal Joint DOT Form 350-095 EF.

   Note: Lot Number corresponds to the lot where the set of longitudinal joint readings were taken. The station corresponds to the station within the lot (i.e. third sublot) where the set of longitudinal joint readings were taken.
Longitudinal Joint Testing Locations

*Figure 1*
Longitudinal Test Location Examples

Figure 2

- The test location of a confined notch wedge may or may not be located on the slope of the cold lane paved.
WSDOT FOP for C 805

*Rebound Hammer Determination of Compressive Strength of Hardened Concrete*

1. Scope *

1.1 This test method covers the determination of a rebound number of hardened concrete using a spring-driven steel hammer.

1.2 The values stated in inch-pound units are to be regarded as the standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 125 Terminology Relating to Concrete and Concrete Aggregates

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

E 18 Test Methods for Rockwell and Rockwell Superficial Hardness of Metallic Materials

3. Significance and Use

3.1 This test method is not intended as the basis for acceptance or rejection of concrete because of the inherent uncertainty in the estimated strength.

4. Apparatus

4.1 *Rebound Hammer,* consisting of a spring-loaded steel hammer that when released strikes a steel plunger in contact with the concrete surface. The spring-loaded hammer must travel with a consistent and reproducible velocity. The rebound distance of the steel hammer from the steel plunger is measured on a linear scale attached to the frame of the instrument.

*NOTE 1—* Use a type N rebound hammers are commercially available to accommodate testing of various sizes and types of concrete construction.

4.2 *Abrasive Stone,* consisting of medium-grain texture silicon carbide or equivalent material.

4.3 *Test Anvil,* approximately 150-mm (6-in.) diameter by 150-mm (6-in.) high cylinder made of tool steel with an impact area hardened to 66 ± 2 HRC as measured by Test Methods E 18. An instrument guide is provided to center the rebound hammer over the impact area and keep the instrument perpendicular to the surface.

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1 This FOP is based on AASHTO C 805 and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
4.4 **Verification**—Rebound hammers shall be serviced and verified annually and whenever there is reason to question their proper operation. Verify the functional operation of a rebound hammer using the test anvil described in 6.3. During verification, support the test anvil on a bare concrete floor or slab. The manufacturer shall report the rebound number to be obtained by a properly operating instrument when tested on an anvil of specified hardness.

**NOTE 2**—Typically, a rebound hammer will result in a rebound number of 80 ± 2 when tested on the anvil described in 6.3. The test anvil needs to be supported on a rigid base to obtain reliable rebound numbers. Verification on the test anvil does not guarantee that the hammer will yield repeatable data at other points on the scale. The hammer can be verified at lower rebound numbers by using blocks of polished stone having uniform hardness. Some users compare several hammers on concrete or stone surfaces encompassing the usual range of rebound numbers encountered in the field.

5. **Test Area and Interferences**

5.1 **Selection of Test Surface**—Concrete members to be tested shall be at least 100 mm (4 in.) thick and fixed within a structure. Smaller specimens must be rigidly supported. Avoid areas exhibiting honeycombing, scaling, or high porosity. Do not compare test results if the form material against which the concrete was placed is not similar (see Note 3). Troweled surfaces generally exhibit higher rebound numbers than screeded or formed finishes. If possible, test structural slabs from the underside to avoid finished surfaces.

5.2 **Preparation of Test Surface**—A test area shall be at least 150 mm (6 in.) in diameter. Heavily textured, soft, or surfaces with loose mortar shall be ground flat with the abrasive stone described in 6.2. Smooth-formed or troweled surfaces do not have to be ground prior to testing (see Note 3). Do not compare results from ground and unground surfaces.

5.3 Do not test frozen concrete.

**NOTE 4**—Moist concrete at 0 °C (32 °F) or less may exhibit high rebound values. Concrete should be tested only after it has thawed. The temperatures of the rebound hammer itself may affect the rebound number. Rebound hammers at -18 °C (0 °F) may exhibit rebound numbers reduced by as much as 2 or 37.

5.4 For readings to be compared, the direction of impact, horizontal, downward, upward, or at another angle, must be the same or established correction factors shall be applied to the readings.

5.5 Do not conduct tests directly over reinforcing bars with cover less than 0.75 in. [20 mm].

**NOTE 5**—The location of reinforcement may be established using reinforcement locators or metal detectors. Follow the manufacturer’s instructions for proper operation of such devices.
6. Procedure
   6.1 Hold the instrument firmly so that the plunger is perpendicular to the test surface. Gradually push the instrument toward the test surface until the hammer impacts. After impact, maintain pressure on the instrument and, if necessary, depress the button on the side of the instrument to lock the plunger in its retracted position. Read the rebound number on the scale to the nearest whole number and record the rebound number. Take ten readings from each test area. No two impact tests shall be closer together than 25 mm (1 in.). Examine the impression made on the surface after impact, and if the impact crushes or breaks through a near-surface air void disregard the reading and take another reading.

7. Calculation
   7.1 Discard readings differing from the average of 10 readings by more than 6 units and determine the average of the remaining readings. If more than 2 readings differ from the average by 6 units, discard the entire set of readings and determine rebound numbers at 10 new locations within the test area.

8. Report
   8.1 Report the following information for each test area:
      8.1.1 Date and time of testing.
      8.1.2 Identification of location tested in the concrete construction and the type and size of member tested,
         8.1.2.1 Description of the concrete mixture proportions including type of coarse aggregates if known, and
         8.1.2.2 Design strength of concrete tested.
      8.1.3 Description of the test area including:
         8.1.3.1 Surface characteristics (trowelled, screeded) of area,
         8.1.3.2 If surface was ground and depth of grinding, 5 Gaynor, R. D., “In-Place Strength of Concrete—A Comparison of
         8.1.3.3 Type of form material used for test area,
         8.1.3.4 Curing conditions of test area,
         8.1.3.5 Type of exposure to the environment,
      8.1.4 Hammer identification and serial number,
         8.1.4.1 Air temperature at the time of testing,
         8.1.4.2 Orientation of hammer during test,
      8.1.5 Average rebound number for test area, and
         8.1.5.1 Remarks regarding discarded readings of test data or any unusual conditions.
10. Precision and Bias
   See ASTM C 805 Precision and Bias

11. Keywords
   11.1 Concrete; in-place strength; nondestructive testing; rebound hammer; rebound number
Performance Exam Checklist

Rebound Hammer Determination of Compressive Strength of Hardened Concrete
FOP For ASTM C 805

Participant Name ___________________________ Exam Date _____________

Procedure Element

Preparation

1. Copy of current procedure available at test site? □ □
2. Hammer properly serviced and calibrated or verified? □ □
3. Test location properly prepared? □ □
4. Test location meets minimum size requirement? □ □
5. Ten acceptable readings taken in each test area? □ □
6. Readings properly spaced in test area? □ □
7. Test readings properly converted to estimated strength? □ □
8. Test information properly recorded? □ □
9. All calculations performed correctly? □ □

Equipment

10. Where required are calibration/verifications tags present on equipment used in this procedure? □ □
11. All equipment functions according to the requirements of this procedure? □ □

First attempt: Pass □ Fail □ Second attempt: Pass □ Fail □

Signature of Examiner ________________________________

Comments:
WSDOT Test Method T 813

Field Method of Fabrication of 2-in. (50-mm) Cube Specimens for Compressive Strength Testing of Grouts and Mortars

1. SCOPE

This method covers the fabrication of 2-in. (50-mm) cube specimens for compressive strength testing of grouts and mortars.

2. EQUIPMENT

a. Specimen Molds

Specimen molds for the 2-in. (50-mm) cube specimens shall be tight fitting. The molds shall not have more than three cube compartments and shall not be separable into more than two parts. The parts of the molds, when assembled, shall be positively held together. The molds shall be made of hard metal not attacked by the cement mortar. For new molds, the Rockwell hardness number shall not be less than HRB 55. The sides of the molds shall be sufficiently rigid to prevent spreading or warping. The interior faces of the molds shall conform to the tolerances of Table 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>2 in. Cube Molds</th>
<th>50-mm Cube Molds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planeness of Sides</td>
<td>&lt;0.001 in.</td>
<td>&lt;0.002 in.</td>
</tr>
<tr>
<td>Distance Between Opposite Sides</td>
<td>2 in. + 0.005 in.</td>
<td>2 in. + 0.02 in.</td>
</tr>
<tr>
<td>Height of Each Compartment</td>
<td>2 in. + 0.001 in. to -0.005 in.</td>
<td>2 in. + 0.01 in. to -0.015 in.</td>
</tr>
<tr>
<td>Angle Between Adjacent FacesA</td>
<td>90 ± 0.5°</td>
<td>90 ± 0.5°</td>
</tr>
</tbody>
</table>

A Measured at points slightly removed from the intersection. Measured separately for each compartment between all the interior faces and the adjacent face and between interior faces and top and bottom planes of the mold.

b. Base Plates

Base plates shall be made of a hard metal not attacked by cement mortar. The working surface shall be plane and shall be positively attached to the mold with screws into the side walls of the mold.
c. Cover Plates

Cover plates shall be made of a hard metal or glass not attacked by cement mortar. The surface shall be relatively plane.

d. Tamper

The tamper shall be made of a nonabsorptive, nonabrasive, nonbrittle material such as a rubber compound having a Shore A durometer hardness of 80 ± 10, or seasoned oak wood rendered nonabsorptive by immersion for 15 minutes in paraffin at approximately 392°F (200°C), and shall have a cross-section of ½ in. × 1 in. (13 mm × 25 mm) and a length of about 5 to 6 in. (125 to 150 mm). The tamping face shall be flat and at right angles to the length of the tamper.

e. Trowel

A trowel which has a steel blade 4 to 6 in. (100 to 150 mm) in length, with straightedges.

3. FIELD PROCEDURE

a. Three or more specimens shall be made for each period of test specified.

b. All joints shall be water tight. If not water tight, seal the surfaces where the halves of the mold join by applying a coating of light cup grease. The amount should be sufficient to extrude slightly when the halves are tightened together. Repeat this process for attaching the mold to the base plate. Remove any excess grease.

c. Apply a thin coating of release agent to the interior faces of the mold and base plate. (WD-40 has been found to work well as a release agent) Wipe the mold faces and base plate as necessary to remove any excess release agent and to achieve a thin, even coating on the interior surfaces. Adequate coating is that which is just sufficient to allow a distinct fingerprint to remain following light finger pressure.

d. Begin molding the specimens within an elapsed time of not more than 2½ minutes from completion of the mixing.

e. For plastic mixes, place a first layer of mortar about 1 in. (25 mm) deep in all the cube compartments (about one-half the depth of the mold). Tamp the mortar in each cube compartment 32 times in about 10 seconds making four rounds, each round perpendicular to the other and consisting of eight adjoining strokes over the surface of the specimen, as illustrated in Figure 1, below. The tamping pressure should be just sufficient to ensure uniform filling of the molds. The four rounds of tamping (32 strokes) shall be completed in one cube before going on to the next. When the tamping of the first layer is completed, slightly over fill the compartments with the remaining mortar and then tamp as specified for the first layer. During tamping of the second layer, bring in the mortar forced out onto the tops of the molds after each round of tamping, by means of gloved fingers and the tamper, before starting the next round of tamping. On completion of tamping, the tops of all the cubes should extend slightly above the tops of the molds.
f. Bring in the mortar that has been forced out onto the tops of the molds with a trowel and smooth off the cubes by drawing the flat side of the trowel (with the leading edge slightly raised) once across the top of each cube at right angles to the length of the mold. Then, for the purpose of leveling the mortar and making the mortar that protrudes above the top of the mold of more uniform thickness, draw the flat trailing edge of the trowel (with leading edge slightly raised) once lightly along the length of the mold. Cut off the mortar to a plane surface flush with the top of the mold by drawing the straight edge of the trowel (held nearly perpendicular to the mold) with a sawing motion over the length of the mold.

g. When fabricating fluid mixes, steps e. and f. need not be followed. Instead, the cube mold is filled with mortar and cut off to a plane surface with a sawing motion over the length of the mold.

h. Immediately after molding, place cover plate on top of the mold, cover the sample with wet burlap, towels, or rags, seal it in a plastic sack in a level location out of direct sunlight, and record the time. Allow the sample to set undisturbed, away from vibration, for a minimum of four six hours before moving.

i. Deliver the sample to the Regional or State Materials Laboratory in the mold with the cover plate in wet burlap, towels or rags sealed in a plastic bag within 24 hours. Time of molding MUST be recorded on the Concrete Transmittal. If delivery within 24 hours is unachievable, contact the Laboratory for instructions on caring for the cubes.

j. Once received in the lab, the molded sample is to be immediately placed in a moist curing room, with the upper surfaces exposed to the moist air but protected from dripping until the sample is a minimum of 20 hours old or has cured sufficiently that removal from the mold will not damage the cube. If the specimens are removed from the mold before they are 24 hours old they are to be kept on the shelves of the moist curing room until they are 24-36 hours old.
k. When the specimens are 24-36 hours old, immerse them in a lime-saturated water storage tank. (Note 1) The specimens are to remain in the storage tank until time of test. (Curing test specimens of material other than hydraulic cement shall be in conformance with the manufacturer’s recommendations.)

**Note 1:** The storage tank shall be made of noncorroding materials. The water shall be saturated with calcium hydroxide such that excess is present. Stir the lime-saturated water once a month and clean the bath as required by AASHTO M-201.
Performance Exam Checklist

Field Method of Fabrication of 50-mm (2-in.) Cube Specimens for Compressive Strength Testing of Grouts and Mortars

WSDOT Test Method T 813

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Three cubes made for each time period of test?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. All joints (mold halves, mold to base plate) shall be water tight?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Adequate coating of release agent applied to interior surfaces of the mold?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Molding began within 2-½ minutes from completion of mixing?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Molding performed in two lifts? (not necessary if mix is fluid)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Lifts tamped 32 times, made up of 4 rounds of 8, each perpendicular to the other? (not required if mix is fluid)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. For second layer, mortar forced out of the mold brought back in before each round? (not required if mix is fluid)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Mix extends slightly above the mold at the completion of tamping?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Mortar smoothed by drawing flat side of trowel across each cube at right angles?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Mortar leveled by drawing the flat side of trowel lightly along the length of mold?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Mortar cut off flush with mold with edge of trowel using sawing motion?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Time of molding recorded?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Cover plate placed on top of the mold and covered with wet burlap, towel or rag?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Covered sample sealed in a plastic sack in a level location out of sunlight?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Sample delivered to the laboratory in the mold within 24 hours?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Transmittal includes the time of molding?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

First attempt: Pass ☐ Fail ☐
Second attempt: Pass ☐ Fail ☐

Signature of Examiner

__________________________________________
Comments:
WSDOT Test Method T 914

Practice for Sampling of Geosynthetic Material for Testing

1. SCOPE
   a. This practice covers a procedure for use in the division of shipments of Geosynthetic Material into lots and the sampling of lots for testing.

2. DEFINITIONS
   a. Geogrid- A regular network of integrally connected polymer tensile elements with an aperture geometry sufficient to permit mechanical interlock with the surrounding backfill.
   b. Geosynthetic Material- general term which includes all geotextiles, geogrids, and prefabricated drainage mats.
   c. Geotextile — Any permeable textile used with foundation, soil, rock, earth, or any other geotechnical material, as an integral part of a manmade product, structure, or system.
   d. Lot — All geosynthetic material rolls within a consignment (i.e., all rolls sent to the project site) which were manufactured at the same manufacturing plant having the same product name and specifications, style, or physical characteristics of a particular geosynthetic material product.
   e. Lot Sample — Sample(s) from one or more geosynthetic material rolls taken at random to represent an acceptance sampling lot and used as a source of laboratory samples.
   f. Production Unit — As referred to in this practice, it shall be considered to be synonymous with the geosynthetic material roll as shipped by the manufacturer. Two or more geosynthetic material rolls joined together by sewn seams shall be considered as separate rolls.
   g. Minimum Average Roll Value — The test results of any sampled roll in a lot shall meet or exceed the minimum values specified.

3. SUMMARY OF PRACTICE
   a. Instructions are given within this practice for dividing shipments or consignments of geosynthetic material into lots and for the determination of the number of production units in a lot sample.
4. SIGNIFICANCE AND USE
   a. This sampling procedure will provide a representation of the lot which is adequate
to establish minimum average roll values as defined by this practice.

5. PROCEDURE
   a. Division into lots — Divide the shipment or consignment into lots as defined
      by 2.b. above.
   b. Determination of lot sample size.
      (1) Take geosynthetic material rolls for the lot sample. Consider the geosynthetic
      material roll to be the primary sampling units.
      (2) Select at random the number of geosynthetic material rolls from each lot for
      the lot sample corresponding to the total number of units in the lot, as shown
      in Table 1. If the lot as defined in this practice contains only a portion of
      a geosynthetic material roll, the lot shall be considered to contain one
      production unit for the purpose of sampling.
   c. Laboratory sample selection.
      (1) Obtain a laboratory sample from each geosynthetic material roll in the
      lot sample. The minimum laboratory sample size shall be a minimum
      of 6 feet long by the full width of the geosynthetic material roll. The
      laboratory sample must also contain a minimum area of 6.0 yd.² (5.0 m²)
      of geosynthetic material.
      (2) The laboratory sample should not be taken from the outer wrap of the
      roll nor the inner wrap of the core (i.e., do not take the sample from the
      geosynthetic material at the very ends of the roll).
      (3) Protect the sample from exposure to Ultraviolet light.

<table>
<thead>
<tr>
<th>Number of Rolls in Lot</th>
<th>Number of Rolls to be Selected for Lot Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 24</td>
<td>1</td>
</tr>
<tr>
<td>25 to 49</td>
<td>2</td>
</tr>
<tr>
<td>50 to 99</td>
<td>3</td>
</tr>
<tr>
<td>100 to 125</td>
<td>5</td>
</tr>
<tr>
<td>125 to 216</td>
<td>6</td>
</tr>
<tr>
<td>217 to 343</td>
<td>7</td>
</tr>
<tr>
<td>344 to 512</td>
<td>8</td>
</tr>
<tr>
<td>513 to 729</td>
<td>9</td>
</tr>
<tr>
<td>730 to 1,000</td>
<td>10</td>
</tr>
</tbody>
</table>

Number of Rolls to be Selected as Lot Sample
Table 1
6. SAMPLE SUBMITTAL

a. All geotextile samples submitted to the State Material Laboratory are to be prepared and shipped as follows:

   Roll sample around a 4-in diameter minimum, tube such as PCV pipe or cardboard mailing tube and wrap to protect sample from shipping damage and ultraviolet light (UV) exposure.

b. If sample is for Acceptance of Lots used on project, the following information must be submitted with the sample:

   (1) Manufacturer’s name and current address.
   (2) Full product name.
   (3) Roll number(s).
   (4) Proposed use(s).
   (5) Certified test results from the manufacturer.
   (6) The Lot Number being submitted for acceptance. In lieu of a manufacturer provided Lot Number, the Bill of Lading Number can be used.

Testing by the State Materials Laboratory will not begin until all of the required information is received.
Performance Exam Checklist

Practice for Sampling Geosynthetic Material for Testing

WSDOT Test Method T 914

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Sampling</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>a. Shipment or consignment divided into lots.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>b. Determine the number of rolls in the shipment or consignment to be sampled from Table 1.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c. Rolls to be sampled selected at random.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d. Samples are a minimum 1.5 yd. (1.37 m) long by the full width of the roll and a minimum of 6 sy (5 square meters).</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>e. Sample does not include outer wrap or inner wrap of the roll.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Shipment Preparation</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>a. Wrap the sample to protect from ultra-violet light exposure.</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

First attempt: Pass ☐ Fail ☐ Second attempt: Pass ☐ Fail ☐

Signature of Examiner

Comments:
WSDOT Test Method for ASTM C 939\(^1\)

*Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)*

This standard is issued under the fixed designation C 939; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (e) indicates an editorial change since the last revision or reapproval. *This specification has been approved for use by agencies of the Department of Defense.*

1. **SCOPE**

   1.1 This test method covers a procedure, used both in the laboratory and in the field, for determining the time of efflux of a specified volume of fluid hydraulic cement grout through a standardized flow cone and used for preplaced-aggregate (PA) concrete; however, the test method may also be used for other fluid grouts.

   1.2 It is for use with neat grout and with grouts containing fine aggregate all passing a No. 8 (2.36-mm) sieve.

   1.3 This test method is intended for use with grout having an efflux time of 35 s or less.

   1.4 When efflux time exceeds 35 s, flowability is better determined by flow table, found in Test Method C 109, using 5 drops in 3 s.

   1.5 The values stated in SI units are to be regarded as the standard.

   1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. **REFERENCED DOCUMENTS**

2.1 *ASTM Standards:*

   C 109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)

   C 938 Practice for Proportioning Grout Mixtures for Preplaced-Aggregate Concrete

3. **SUMMARY OF TEST METHOD**

3.1 The time of efflux of a specified volume of grout from a standardized flow cone is measured.

4. **SIGNIFICANCE AND USE**

4.1 This test method is applicable to the determination of the fluidity of various fluid grout mixtures.

---

\(^1\) This Test Method is based on ASTM C 939-97.
5. **INTERFERENCES**

5.1 The presence of solid particles retained on the No. 8 (2.36 mm) sieve or lumps of unmixed material in the grout may cause the grout to flow unevenly through the discharge tube of the flow cone or stop the flow completely. Uneven flow will result in slower transit of the grout, thereby indicating a false consistency.

6. **APPARATUS**

6.1 *Flow Cone*, with dimensions as shown in Figure 1. The discharge tube shall be stainless steel. The body and discharge tube can be stainless steel, cast aluminum, or other essentially non-corroding metal.

*Note 1:* Cones with high-density polyethylene bodies are acceptable for field use in situations where precision as described in this test method is not required.

6.2 *Receiving Container*, capacity 2000 mL, minimum.

6.3 *Ring Stand* or other device, capable of supporting the flow cone in a vertical, steady position over the receiving container.

6.4 *Level*, carpenter’s or similar.

6.5 *Stop Watch*, least reading of not more than 0.2 s.

6.6 *Grout Mixer*, conforming to Practice C 938.

7. **TEST SAMPLE**

7.1 The grout test sample shall be in excess of 1725 mL and shall be representative of the grout in the mixer.

7.2 When sampling and testing is being done for the purpose of proportioning or comparing mixes or for qualifying materials, the temperature of the dry materials and mixing water shall be such that the temperature of the freshly mixed grout is 73.4 ± 3°F (23 ± 1.7°C), unless otherwise specified.

8. **CALIBRATION OF APPARATUS**

8.1 Mount the flow cone firmly in such a manner that it is free of vibration. Level the top to assure verticality. Close the outlet of the discharge tube with a finger or a stopper. Introduce 1725 ± 5 mL of water into the cone. Adjust the point gage to indicate the level of the water surface. Then allow the water to drain.

8.2 Before first use of the flow cone with grout and periodically thereafter, check the accuracy of the cone by filling it with water as described in 8.1. After checking or adjusting the point gage, start the stop watch and simultaneously remove the finger. Stop the watch at the first break in the continuous flow of water. The time indicated by the stop watch is the time of efflux of water. If this time is 8.0 ± 0.2 s, the cone may be used for determining the time of efflux of grout.

*Note:* It is imperative that the water be completely still prior to allowing it to flow from the cone, any movement will cause the time of efflux to increase.
9. PROCEDURE

9.1 Moisten the inside of the flow cone by filling the cone with water and, 1 min before introducing the grout sample, allow the water to drain from the cone. Close the outlet of the discharge tube with a finger or a stopper. Introduce the grout into the cone until the grout surface rises to contact the point gage, start the stop watch, and simultaneously remove the finger or stopper. Stop the watch at the first break in the continuous flow of grout from the discharge tube, then look into the top of the cone; if the grout has passed sufficiently, such that light is visible through the discharge tube, the time indicated by the stop watch is the time of efflux of the grout. If light is not visible through the discharge tube, then the use of the flow cone is not applicable for grout of this consistency. At least two tests having times of efflux within 1.8 s of their average shall be made for each grout mixture.

9.2 The test for time of efflux shall be made within 1 min of drawing of the grout from the mixer or transmission line. When grout is being placed over a significant period of time, the time of efflux may be determined at selected intervals to demonstrate that the consistency is suitable for the work.

10. REPORT

10.1 Report the following information:

10.1.1 Identification of sample,

10.1.2 Identification of materials in the sample, the proportions, and whether laboratory prepared or taken from the field production mix,

10.1.3 Average time of efflux to nearest 0.2 s and time interval from completion of mixing at which the test was made, and

Note 2: Other means of indicating grout level may be used as long as accurate indication of grout level on volume is obtained.

10.1.4 Temperature, ambient and of the sample at the time of test.

11. PRECISION AND BIAS

11.1 Precision — The following within-laboratory, multiple-operator precision applies. The single laboratory standard deviation has been found to be 0.88 s. Therefore, results from two properly conducted tests on the same material should not differ by more than 2.49 s.

11.2 Bias — No statement on bias can be prepared because there are no standard reference materials.

12. KEYWORDS

12.1 flow cone; grout; preplaced—aggregate concrete; time of efflux
1. Scope

1.1 These test methods cover the nondestructive measurement of the dry film thickness of nonmagnetic coatings applied over a ferrous base material using commercially available test instruments. The test methods are intended to supplement manufacturers’ instructions for the manual operation of the gages and are not intended to replace them. They cover the use of instruments based on magnetic measuring principles only. Test Method A provides for the measurement of films using mechanical magnetic pull-off gages and Test Method B provides for the measurement of films using magnetic electronic gages.

1.2 These test methods are not applicable to coatings that will be readily deformable under the load of the measuring instruments, as the instrument probe must be placed directly on the coating surface to take a reading.

1.3 The values given in SI units of measurement are to be regarded as the standard. The values in parentheses are for information only.

1.4 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards:

D 609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products

D 823 Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels

2.2 Steel Structures Painting Council Standard:

SSPC-PA2 Measurement of Dry Paint Thickness with Magnetic Gages

TEST METHOD A—MAGNETIC PULL-OFF GAGES

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1 This FOP is based on ASTM D 1186-01 and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
3. Summary of Test Method

3.1 Instruments complying with this test method measure thickness by using a spring calibrated to determine the force required to pull a magnet from a ferrous base coated with a nonmagnetic film. The instrument must be placed directly on the coating surface to take a reading.

3.2 The attractive force of the magnet to the substrate varies inversely with the thickness of the applied film. The spring tension required to overcome the attraction of the magnet to the substrate is shown on the instrument scale as the distance (in mils or microns) between the magnet and the substrate.

4. Significance and Use

4.1 Many coating properties are markedly affected by the thickness of the dry film such as adhesion, corrosion protection, flexibility, and hardness. To be able to compare results obtained by different operators, it is essential to know film thickness.

4.2 Most protective and high performance coatings are applied to meet a requirement or a specification for the dry-film thickness of each coat, or for the complete system, or both. Coatings must be applied within certain minimum and maximum thicknesses to fill their expected function. In addition to potential performance deficiencies, it is uneconomical to apply more material than necessary when coating large areas. This test method is used to measure film thickness of coatings on ferrous metals.

5. Apparatus

5.1 Permanent Magnet, small, either attached directly to a coil spring (“pencil” gage) or to a horizontal lever arm that is attached to a helical spring (“dial-type” gage). Increasing force is applied to the magnet by extending the coil spring in the first case or turning a graduated dial that coils the helical spring in the second. The readings obtained are shown directly on the instrument scale.

5.2 Coating Thickness Standards, with assigned values traceable to national standards are available from several sources, including most manufacturers of coating thickness gages.

1Available from SSPC: The Society for Protective Coatings, 40 24th St., Sixth Floor, Pittsburgh, PA 15222–4643 (see www.sspc.org).

6. Test Specimens

6.1 When this test method is used in the field, the specimen is the coated structure or article on which the thickness is to be evaluated.

6.2 For laboratory use, apply the material to be tested to panels of similar roughness, shape, thickness, composition and magnetic properties on which it is desired to determine the thickness.

NOTE 1: Applicable test panel description and surface preparation methods are given in Practice D 609.

NOTE 2: Coatings should be applied in accordance with Practices D 823 or as agreed upon between the contracting parties.
7. Verification of Calibration of Apparatus

7.1 Different gage manufacturers follow different methods of calibration adjustment. Verify calibration according to manufacturer’s instructions.

7.2 The section of the type of standards used to verify calibration should be predicated upon which type provides the best and most appropriate calibration considering: type of gage, sample surface geometry, and contract requirements. Appendix X1 provides information helpful to making an informed selection of standards.

7.3 Following the manufacturer’s operating instructions, measure the thickness of a series of calibration standards covering the expected range of coating thickness. To guard against measuring with an inaccurate gage, recheck the gage at regular intervals. That interval should be set by agreement between contracting parties and maintained throughout the control process.

NOTE 3: Generally “Dial-type” instruments can be used in any position, while “pencil-type” instruments may be used in the vertical position only unless they have separate indicators for the horizontal and vertical positions. Follow the manufacturer’s recommendations.

8. Procedure

8.1 Use the instrument only after calibration has been verified in accordance with Section 7.

8.2 Ensure that the coating is dry prior to use of the instrument.

8.3 Inspect the probe tip and surface to be measured to ensure that they are clean. Adherent magnetic filings or other surface contaminants will affect gage readings.

8.4 Take readings in locations free of electrical or magnetic fields. The location should also be free of vibration when using mechanical magnetic pull-off instruments.

8.5 The accuracy of the measurement can be influenced when made within 25 mm (1 in.) of the edge or right angle in the sample.

8.6 Measure the coating, following the manufacturer’s instructions.

8.7 Verify calibration periodically to ensure that the instrument continues to read properly. If the instrument is found to be out of adjustment, remeasure the thicknesses taken since the last satisfactory calibration check was made.

8.8 Take a sufficient number of readings to characterize the surface.

8.8.1 For laboratory measurements, a recommended mini-mum is three for a 75 by 150-mm (3 by 6-in.) panel and more in proportion to size.

8.8.2 For field measurements, a recommended minimum is five determinations at random for every 10 m² (100 ft²) of surface area. Each of the five determinations should be the mean of three separate gage readings within the area of a 4-cm (1.5-in.) diameter circle.
8.9 Make measurements at least 13 mm (½ in.) away from any edge or corner of the specimen. If it is necessary to measure closer than 13 mm (½ in.), verify the effect (if any), the edge has on the measurement.

**NOTE 4:** For additional information describing the number of measurements to be taken on large structures, and on non-smooth surfaces, refer to SSPC PA-2.

9. **Report**

9.1 Report the following information:

9.1.1 Instrument used, serial number,

9.1.2 Range, and mean of the thickness readings, and

9.1.3 Depending upon the application, record the individual readings as well.

Report the information on the attached form.

Material represented by the test specimens when tested under this method and found to meet the specified minimum coating thickness may be accepted. Any specimens which does not meet the minimum coating thickness will not be retested using this test method. Samples of the material will be submitted to either the Eastern Region Consolidated Materials Laboratory or the State Material laboratory for referee testing in accordance with AASHTO T 65.
Field Report of Thickness of Nonmagnetic Coating on a Ferrous Base

Contract __________________    Bid Item No ________     Item ______________________________
Specimen No. ____________________________
Specification: ___________________    Coating Thickness Required ____________ (mils),(mm)
Surface area of test specimen _______________ m$^2$ (ft$^2$)    Test represents _______________
Instrument Serial No. ____________________________     Calibration Date ________________
Tested by: __________________________________________________    Date: ___/___/20___

<table>
<thead>
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<td>Average</td>
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</table>

WSDOT Materials Manual    M 46-01.013    Page 5 of 10
January 2009
10. Precision and Bias

10.1 A new round-robin study was performed recently. Data are being analyzed statistically. When completed, the required “Repeatability and Reproducibility” sections of this test method will be written and the round-robin study documented in an ASTM research report.

10.2 *Bias*—The bias for Test Method A of this standard for measuring dry film thickness cannot be determined because each instrument has its own bias.

TEST METHOD B—ELECTRONIC GAGES

11. Summary of Test Method

11.1 Instruments complying with this test method measure thicknesses by placing a probe on the coated surface and use electronic circuitry to convert a reference signal into coating thickness.

11.2 Instruments of this type determine, within the probe or the instrument itself, changes in the magnetic flux caused by variations in the distance between the probe and the substrate.

12. Apparatus

12.1 The testing apparatus shall be an electrically operated instrument utilizing a probe that houses a permanent magnet or coil energized by alternating current that is placed directly on the surface. The coating thickness is shown on the instrument’s display.

12.2 Coating thickness standards with assigned values traceable to national standards are available.

13. Test Specimens

13.1 See Section 6.

14. Calibration of Apparatus

14.1 See Section 7.

15. Procedure

15.1 See Section 8. Exclude steps 8.5 and 8.7.

16. Report

16.1 See Section 9.

17. Precision and Bias

17.1 *Precision*—See Section 10.

17.2 *Bias*—The bias for Test Method B of this standard for measuring dry film thickness cannot be determined because each instrument has its own bias.

18. Keywords

18.1 coating thickness; dry film thickness; magnetic gages; nondestructive thickness; paint thickness
APPENDIX

X1. CHARACTERISTICS AFFECTING GAGE READINGS

X1.1 It is always good practice to ensure the reliability of gage readings by performing a verification test periodically, either before or after critical determinations. This practice ensures that, not only is the gage reading correctly, but also that it is correctly calibrated to provide maximum accuracy of readings on the sample. Not all applications require this level of certainty so, while suggested, the inclusion of this practice is up to the contacting individuals to decide on implementation.

X1.2 Certain characteristics of samples may affect the accuracy of the calibrations. These include, but may not be limited to:

X1.2.1 Surface profile of the substrate (roughness),
X1.2.2 Surface profile of the coating,
X1.2.3 Thickness of the substrate,
X1.2.4 Geography of the sample surface (curves with small radii, small diameters, complex curves, etc.), and
X1.2.5 Any characteristic that affects the magnetic or eddy current permeability of the substrate or coating, such as residual magnetism, or lack of homogeneity of magnetic characteristics.

X1.3 Calibration done on smooth, polished standards ensure that a gage can be properly calibrated, and that calibration is appropriate for any measurements on samples of the same characteristics, but it may not be the best for measurements of samples that differ from the calibration materials. When possible, verification should be done on samples of known thickness of coating applied to substrates as similar as possible to the sample to be tested.

X1.4 It is not practical to provide known thickness standards for all possible sample configurations. An alternative method is to verify calibration on a bare substrate as similar as possible to the sample, using a nonmagnetic metal foil, plastic shim or film of known thickness to simulate a coating.

X1.5 In using this verification of calibration method, it is necessary to be aware of additional characteristics that can affect the measured values. Plastic or brass shim stock typically has an inherent curve. This curve can act as a leaf spring and cause a magnetic pull-off gage to be “pushed” off the surface prematurely, resulting in an incorrect reading.

X1.6 With some materials and thickness, it is possible that the shim will not lie flat, which will also cause an erroneous reading. Various techniques exist to minimize this effect, such as mounting the shim in a holder that maintains tension on the shim to eliminate the tendency of the shim to curve.
X1.7 Other factors experienced with plastic shims, which are not usually present with painted or plated calibration standards include (but are not limited to):

X1.7.1 Permanent creases in the shim due to folding,

X1.7.2 Air entrapment between the shim and substrate,

X1.7.3 Distortion due to environmental conditions, such as temperature, and

X1.7.4 Shim thickness inconsistency due to the pressure of the probe tip. This may be a permanent “dimple” in the shim.

X1.8 Even with these factors affecting potential accuracy of plastic shims, in many applications, verification of calibration using plastic shims on the sample to be measured, can be a more appropriate (accurate) calibration than using plated or painted standards.

X1.9 No matter what standards are used, they should be periodically verified to ensure the assigned value is correct. Even metal coated on metal can wear or be damaged to an extent that readings are affected.
Performance Exam Checklist

*Nondestructive Measurement of Thickness of Nonmagnetic Coatings on a Ferrous Base*

*FOP For ASTM D 1186*

Participant Name  ___________________________  Exam Date  ____________

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<thead>
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<th>Procedure Element</th>
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<th>No</th>
</tr>
</thead>
<tbody>
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<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required,</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>has the current calibration/verification tags present?</td>
<td>☑</td>
<td>☐</td>
</tr>
<tr>
<td>3. Instrument calibrated in accordance with the manufacturer’s instructions before</td>
<td>☑</td>
<td>☐</td>
</tr>
<tr>
<td>use employing a suitable thickness standard?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>4. Several readings taken and recorded taking into account edge and curvature</td>
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<td>☐</td>
</tr>
<tr>
<td>effects?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>5. The average thickness converted to oz. ft² (g/m²) using appropriate conversion</td>
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<td>factor?</td>
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</table>

First attempt:  Pass ☐  Fail ☐  Second attempt:  Pass ☐  Fail ☐

Signature of Examiner  ___________________________

Comments:
1. Scope

1.1 This test method covers the determination of slump flow of self-consolidating concrete.

1.2 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.3 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. (WARNING - Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.)

1.4 The text of this standard references notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

2. Referenced Documents

2.1 ASTM Standards:

- C 143/C 143M Test Method for Slump of Hydraulic-Cement Concrete
- C 172 Practice for Sampling Freshly Mixed Concrete
- C 173/C 173M Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
- C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 halo, n—an observed cement paste or mortar ring that has clearly separated from the coarse aggregate, around the outside circumference of concrete after flowing from the slump cone.

3.1.2 spread, n—the distance of lateral flow of concrete during the slump-flow test.

3.1.3 stability, n—the ability of a concrete mixture to resist segregation of the paste from the aggregates.

3.1.4 viscosity, n—resistance of a material to flow under an applied shearing stress.

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This Test Method is based on ASTM C 1611/C 1611M and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
4. Summary of Test Method
   4.1 A sample of freshly mixed concrete is placed in a mold shaped as the frustum of a cone. The concrete is placed in one lift without tamping or vibration. The mold is raised, and the concrete allowed to spread. After spreading ceases, two diameters of the concrete mass are measured in approximately orthogonal directions, and slump flow is the average of the two diameters.

5. Significance and Use
   5.1 This test method provides a procedure to determine the slump flow of self-consolidating concrete in the laboratory or the field.
   5.2 This test method is used to monitor the consistency of fresh, unhardened self-consolidating concrete and its unconfined flow potential.
   5.3 It is difficult to produce self-consolidating concrete that is both flowable and nonsegregating using coarse aggregates larger than 1 in. (25 mm). Therefore, this test method is considered applicable to self-consolidating concrete having coarse aggregate up to 1 in. (25 mm) in size.

6. Apparatus
   6.1 Mold—The mold used in this test method shall conform to that described in FOP for AASHTO T 119.
   6.2 Base Plate—The base plate on which the mold rests shall be nonabsorbent, smooth, rigid, and have a minimum diameter of 36 in. (915 mm).

   NOTE 1: Field experience and results from the round robin test program have shown that base plates made from sealed/laminated plywood, acrylic plastic, or steel are suitable for performing this test.

   6.3 Strike-off Bar—As described in FOP for AASHTO T 152.

7. Sample
   7.1 The sample of concrete from which test specimens are made shall be representative of the entire batch. It shall be obtained in accordance with FOP for WAQTC TM 2.

8. Procedure
   8.1 The slump-flow test shall be performed on a flat, level, nonabsorbent base plate. Position and shim the base plate so it is fully supported, flat, and level.

   8.2 Filling the Mold: WSDOT requires the use of Procedure B.

   8.2.2 Filling Procedure B (Inverted Mold): Dampen and place the mold, with the smaller opening of the mold facing down, in the center of a flat, moistened base plate or concrete surface. From the sample of concrete obtained in accordance with Section 7, immediately fill the mold in one lift. Slightly overfill the concrete above the top of the mold.
8.3 Strike off the surface of the concrete level with the top of the mold by a sawing motion of the strike-off bar. Remove concrete from the area surrounding the base of the mold to preclude interference with the movement of the flowing concrete. Remove the mold from the concrete by raising it vertically. Raise the mold a distance of 9 ± 3 in. (225 ± 75 mm) in 3 ± 1 seconds by a steady upward lift with no lateral or torsional motion. Complete the entire test from start of the filling through removal of the mold without interruption within an elapsed time of 2½ minutes.

8.4 Wait for the concrete to stop flowing and then measure the largest diameter of the resulting circular spread of concrete to the nearest ¼ in. (5 mm). When a halo is observed in the resulting circular spread of concrete, it shall be included as part of the diameter of the concrete. Measure a second diameter of the circular spread at an angle approximately perpendicular to the original measured diameter.

8.5 If the measurement of the two diameters differs by more than 2 in. (50 mm), the test is invalid and shall be repeated.

9. Calculation

9.1 Calculate the slump flow using Eq 1:

\[
\text{Slump flow} = \frac{(d_1 + d_2)}{2}
\]

where:

\(d_1\) = the largest diameter of the circular spread of the concrete, and

\(d_2\) = the circular spread of the concrete at an angle approximately perpendicular to \(d_1\)

9.2 Record the average of the two diameters to the nearest ½ in. (10 mm).

10. Report

10.1 Report the slump flow to the nearest ½ in. (10 mm).

11. Precision and Bias

See ASTM C1611/C 1611M for precision and bias.
# Performance Exam Checklist

**WSDOT FOP for ASTM C 1611/C 1611M**  
*Standard Test Method for Slump Flow of Self-Consolidating Concrete*

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<tr>
<td>3. Sample was taken per TM 2?</td>
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<tr>
<td>4. Molds and base plate dampened and base plate is flat, level and fully supported?</td>
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<tr>
<td>5. Mold filled completely in one lift (slightly overfilled)?</td>
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<tr>
<td>6. Mold struck off level with top opening?</td>
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<tr>
<td>7. Excess material removed from base plate and mold raised 9 ± 3 inches, in 3 ± 1 seconds?</td>
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<tr>
<td>8. After flow stabilized, measured largest diameter (including halo if necessary)?</td>
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<tr>
<td>9. Second measurement taken approximately perpendicular to first measurement?</td>
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</tr>
<tr>
<td>10. First and second measurements agree within 2”?</td>
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<tr>
<td>11. Slump flow was reported as an average of the two measurements?</td>
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<tr>
<td>12. Slump flow reported to the nearest ½”?</td>
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First attempt: Pass ☐ Fail ☐  
Second attempt: Pass ☐ Fail ☐

Signature of Examiner ____________________________

Comments:
WSDOT FOP for ASTM C 1621/C 1621M

Standard Test Method for Passing Ability of Self-Consolidating Concrete by J-Ring

1. Scope

1.1 This test method covers determination of the passing ability of self-consolidating concrete by using the J-Ring in combination with a slump cone mold. The test method is limited to concrete with maximum size of aggregate of 1 in (25 mm).

1.2 The values stated in either inch-pounds or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.3 The text of this standard references notes that provide explanatory material. These notes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.4 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. (WARNING—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.)

2. Referenced Documents

2.1 ASTM Standards:

C 125 Terminology Relating to Concrete and Concrete Aggregates
C 143/C 143M Test Method for Slump of Hydraulic-Cement Concrete
C 172 Practice for Sampling Freshly Mixed Concrete
C 173/C 173M Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C 1611/C 1611M Test Method for Slump Flow of Self-Consolidating Concrete

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology C 125.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 halo—an observed cement paste or mortar ring that has clearly separated from the coarse aggregate, around the outside circumference of concrete after flowing from the slump cone.

---

1 This Test Method is based on ASTM C 1621/C 1621M and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
3.2.2 \textit{J-ring}—an apparatus consisting of a rigid ring supported on sixteen \( \frac{3}{8} \) in. (16 mm) diameter rods equally spaced on a 12 in. (300 mm) diameter circle 4 in. (100 mm) above a flat surface as shown in Figure 1.

3.2.3 \textit{J-ring flow}—the distance of lateral flow of concrete using the J-Ring in combination with a slump cone.

3.2.4 \textit{passing ability}—the ability of self-consolidating concrete to flow under its own weight (without vibration) and fill completely all spaces within intricate formwork, containing obstacles, such as reinforcement.

4. Summary of Test Method

4.1 A sample of freshly mixed concrete is placed in a slump mold (inverted position) that is concentric with the J-Ring (Figure 2). The concrete is placed in one lift without tamping or vibration. The mold is raised, and the concrete is allowed to pass through J-Ring and subside (Fig. 3).

The diameters of the concrete, in two directions approximately perpendicular to each other, are measured and averaged to obtain the J-Ring flow. The test is repeated without the J-Ring to obtain the slump flow.

The difference between the slump flow and J-Ring flow is an indicator of the passing ability of the concrete.

5. Significance and Use

5.1 This test method provides a procedure to determine the passing ability of self-consolidating concrete mixtures. The difference between the slump flow and J-Ring flow is an indication of the passing ability of the concrete. A difference less than 1 in. (25 mm) indicates good passing ability and a difference greater than 2 in. (50 mm) indicates poor passing ability. The orientation of the slump cone for the J-Ring test and for the slump flow test without the J-Ring shall be the same.

5.2 This test method is applicable for laboratory use in comparing the passing ability of different concrete mixtures. It is also applicable in the field as a quality control test.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>in.</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12.0 ± 0.13</td>
<td>300 ± 3.3</td>
</tr>
<tr>
<td>B</td>
<td>1.5 ± 0.06</td>
<td>38 ± 1.5</td>
</tr>
<tr>
<td>C</td>
<td>0.625 ± 0.13</td>
<td>16 ± 3.3</td>
</tr>
<tr>
<td>D</td>
<td>2.36 ± 0.06</td>
<td>58.9 ± 1.5</td>
</tr>
<tr>
<td>E</td>
<td>1.0 ± 0.06</td>
<td>25 ± 1.5</td>
</tr>
<tr>
<td>F</td>
<td>4.0 ± 0.06</td>
<td>200 ± 1.5</td>
</tr>
</tbody>
</table>
5.2 This test method is applicable for laboratory use in comparing the passing ability of different concrete mixtures. It is also applicable in the field as a quality control test.

6. Apparatus

6.1 J-Ring—The apparatus shall consist of a steel (or equivalent nonabsorbent, rigid material) ring measuring 12 in. (300 mm) in diameter at the center of the ring and 1 in. (25 mm) in thickness, and sixteen ⅝ in. (16 mm) diameter smooth steel rods spaced evenly around the ring measuring 4 in. (100 mm) in length (see Fig. 1).

6.2 Mold—The mold (slump cone) used in this test method is as described in FOP for AASHTO T 119.

6.3 Base Plate—A nonabsorbent, rigid plate having a diameter of at least 36 in. (915 mm).

Note 1: Field experience has shown that base plates made from sealed or laminated plywood, rigid plastic, or steel are suitable for performing this test.

6.4 Strike Off Bar—As described in FOP for AASHTO T 152.

6.5 Measuring Device—A ruler, metal roll-up measuring tape, or similar rigid or semi-rigid length measuring instrument marked in increments of ¼ in. (5 mm) or less.

7. Sample

7.1 The sample of concrete from which test specimens are made shall be representative of the entire batch. It shall be obtained in accordance with FOP for WAQTC TM 2.

8. Procedure

8.1 Perform the test on a flat, level, and nonabsorbent base plate. Position and shim the base plate so that it is fully supported and level. Pre-moisten base-plate with a damp towel, rag, or sponge. Rest the J-Ring at the center of the base plate.
8.2 WSDOT uses only Procedure B.

8.1.2 Filling Procedure B (Inverted Mold)—Dampen the mold, and place it on the base plate with the smaller opening facing down and concentric with the J-Ring. Support the mold and fill the mold in one lift. Heap the concrete above the top of the mold.

8.3 Strike off the surface of the concrete level with the top of the mold by a sawing motion of the strike off bar. Remove concrete from the area surrounding the mold to preclude interference with the movement of the flowing concrete. Raise the mold a distance of 9 ± 3 in. (230 ± 75 mm) in 3 ± 1 s by a steady vertical lift with no lateral or torsional motion. Complete the entire procedure from start of the filling through removal of the mold without interruption within an elapsed time of 2½ min.

8.4 Wait for the concrete to stop flowing and then measure the largest diameter ($d_1$) of the resulting circular flow of concrete. When a halo is observed in the resulting circular flow of concrete, it shall be included as part of the diameter of the concrete. Measure a second diameter ($d_2$) of the circular flow at approximately perpendicular to the first measured diameter ($d_1$). Measure the diameters to the nearest ¼ in. (5 mm). Determine the J-Ring flow in accordance with Section 9 of this test method.

8.5 Conduct a slump flow test without the J-Ring in accordance with Test Method C 1611/C 1611M. Use the same filling procedure as used with the J-Ring. Complete the tests with and without the J-Ring within 6 min.

9. Calculation

9.1 Calculate J-Ring flow according to the following equation:

$$\text{J-Ring flow} = \frac{d_1 + d_2}{2}$$

9.2 Calculate the slump flow according to the following equation:

$$\text{Slump flow} = \frac{d_1 + d_2}{2}$$

9.3 Calculate the difference between slump flow and J-Ring flow to the nearest ½ in. (10 mm). This number represents the passing ability of the concrete.

10. Blocking Assessment

10.1 Identify blocking assessment according to Table 1.

<table>
<thead>
<tr>
<th>Difference Between Slump Flow and J-Ring Flow</th>
<th>Blocking Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 1 in. (0 to 25 mm)</td>
<td>No visible blocking</td>
</tr>
<tr>
<td>&gt; 1 to 2 in. (&gt;25 to 50 mm)</td>
<td>Minimal to noticeable blocking</td>
</tr>
<tr>
<td>&gt; 2 in. (&gt;50 mm)</td>
<td>Noticeable to extreme blocking</td>
</tr>
</tbody>
</table>

Blocking Assessment

Table 1
11. Report

11.1 Report the filling procedure (A or B) that was used.

11.2 Report the J-Ring flow as the average of the two measured diameters to the nearest \( \frac{1}{2} \) in. (10 mm).

11.3 Report the slump flow (without the J-Ring) as the average of the two measured diameters to the nearest \( \frac{1}{2} \) in. (10 mm).

11.4 Report the passing ability as the difference between the slump flow and J-Ring flow to the nearest \( \frac{1}{2} \) in. (10 mm). Identify the blocking assessment.

12. Precision and Bias

See ASTM C 1621/C 1621M for Precision and bias.
### Performance Exam Checklist

**WSDOT FOP for ASTM C 1621/C 1621M**  
*Standard Test Method for Passing Ability of Self-Consolidating Concrete by J-Ring*

<table>
<thead>
<tr>
<th>Procedure Element</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The tester has a copy of the current procedure on hand?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>2. All equipment is functioning according to the test procedure, and if required.</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>Has the current calibration/verification tags present?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>3. Sample was taken per TM 2?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>4. Molds and base plate dampered and base plate is flat, level and fully supported?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>5. Mold is centered in J-Ring and centered on base plate?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>6. Mold filled completely in one lift (slightly overfilled)?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>7. Mold struck off level with top opening?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>8. Excess material removed from base plate and mold raised 9 ± 3 inches, in 3 ± 1 seconds?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>9. After flow has stabilized, measure largest diameter (including halo)?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>10. Second measurement taken approximately perpendicular to first measurement?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>11. Measurements made to nearest ¼”?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>12. Test performed within 6 minutes of FOP for ASTM C 1611?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>13. All calculations performed correctly?</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>14. Results reported to the nearest ½”?</td>
<td>☐</td>
<td>☑</td>
</tr>
</tbody>
</table>

First attempt:  Pass ☐  Fail ☐  
Second attempt: Pass ☐  Fail ☐

Signature of Examiner  ________________________________
Comments:
WSDOT FOP for ASTM D 4791

Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

1. Scope

1.1 This test method covers the determination of the percentages of flat particles, elongated particles, or flat and elongated particles in coarse aggregates.

1.2 The values stated in inch-pound units are to be regarded as the standard except in regard to sieve size and the size of aggregate, which are given in SI units in accordance with Specification E 11. The SI units in parentheses are for information purposes only.

1.3 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

Note: WSDOT will be determining flat and elongated particles in accordance with section 8.4.

2. Referenced Documents

2.1 WSDOT Standards:

T 2 WSDOT FOP for AASHTO for the Sampling of Aggregates

T 248 WSDOT FOP for AASHTO for Reducing Field Samples of Aggregates to Testing Size

T 27/11 WAQTC FOP for AASHTO for the Sieve Analysis of Fine & Coarse Aggregates & Materials Finer Than 75 mm (No. 200) in Mineral Aggregates by Washing

3. Terminology

3.1 Definitions:

3.1.1 flat or elongated particles of aggregate—those particles of aggregate having a ratio of width to thickness or length to width greater than a specified value (see Terminology C 125).

3.1.2 flat and elongated particles of aggregate—those particles having a ratio of length to thickness greater than a specified value.

3.1.3 length—maximum dimension of the particle.

3.1.4 width—maximum dimension in the plane perpendicular to the length

3.1.5 thickness—maximum dimension perpendicular to the length and width.

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1 This Test Method is Based on ASTM D 4791-99 and has been modified per WSDOT standards. To view the redline modifications, contact WSDOT Quality Systems Manager at (360) 709-5412.
4. Summary of Test Method
   4.1 Individual particles of aggregate of specific sieve sizes are measured to determine the ratios of width to thickness, length to width, or length to thickness.

5. Significance and Use
   5.1 Flat or elongated particles of aggregates, for some construction uses, may interfere with consolidation and result in harsh, difficult to place materials.
   5.2 This test method provides a means for checking compliance with specifications that limit such particles or to determine the relative shape characteristics of coarse aggregates.

6. Apparatus
   6.1 The apparatus used shall be equipment suitable for testing aggregate particles for compliance with the definitions in 3.1, at the dimensional ratios desired.

   6.1.1 Proportional Caliper Device—The proportional caliper devices illustrated in Fig. 1, Fig. 2, and Fig. 3 are examples of devices suitable for this test method. The device illustrated in Fig. 1 and Fig. 2 consists of a base plate with two fixed posts and a swinging arm mounted between them so that the openings between the arms and the posts maintain a constant ratio. The axis position can be adjusted to provide the desired ratio of opening dimensions. Figure 1 illustrates a device on which ratios of 1:2, 1:3, 1:4, and 1:5 may be set. The device illustrated in Fig. 3 contains several fixed posts and has the capability of measuring various ratios simultaneously.

   6.1.1.1 Verification of Ratio—The ratio settings on the proportional caliper device shall be verified by the use of a machined block, micrometer, or other appropriate device.

   6.1.2 Balance—The balance or scales used shall be accurate to 0.5 % of the mass of the sample.
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6.1.1.1 Verification of Ratio—The ratio settings on the proportional caliper device shall be verified by the use of a machined block, micrometer, or other appropriate device.

6.1.2 Balance—The balance or scales used shall be accurate to 0.5 % of the mass of the sample.

Proportional Caliper

Figure 1
7. Sampling

7.1 Sample the coarse aggregate in accordance with in FOP for AASHTO T 2. The mass of the field sample shall be the mass shown in FOP for AASHTO T 2.

7.2 Thoroughly mix the sample and reduce it to an amount suitable for testing using the applicable procedures described in FOP for AASHTO T 248. The sample for test shall be approximately the mass desired when dry and shall be the end result of the reduction. Reduction to an exact predetermined mass shall not be permitted. The mass of the test sample shall conform to the following:

<table>
<thead>
<tr>
<th>Nominal Maximum Size* Square Openings, in. (mm)</th>
<th>Minimum Mass of Test Sample, lb (kg.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>⅜ (9.5 )</td>
<td>2 (1)</td>
</tr>
<tr>
<td>½ (12.5)</td>
<td>4 (2)</td>
</tr>
<tr>
<td>¾ (19)</td>
<td>11 (5)</td>
</tr>
<tr>
<td>1 (25.0)</td>
<td>22 (10)</td>
</tr>
<tr>
<td>1½ (37.5)</td>
<td>33 (15)</td>
</tr>
<tr>
<td>2 (50)</td>
<td>44 (20)</td>
</tr>
<tr>
<td>2½ (63)</td>
<td>77 (35)</td>
</tr>
<tr>
<td>3 (75)</td>
<td>130 (60)</td>
</tr>
<tr>
<td>3½ (90)</td>
<td>220 (100)</td>
</tr>
<tr>
<td>4 (100)</td>
<td>330 (150)</td>
</tr>
<tr>
<td>4½ (112)</td>
<td>440 (200)</td>
</tr>
<tr>
<td>5 (125)</td>
<td>660 (300)</td>
</tr>
<tr>
<td>6 (150)</td>
<td>1100 (500)</td>
</tr>
</tbody>
</table>

* For aggregate, the nominal maximum size, (NMS) is the largest standard sieve opening listed in the applicable specification, upon which any material is permitted to be retained. For concrete aggregate, NMS is the smallest standard sieve opening through which the entire amount of aggregate is permitted to pass.

**Note:** For an aggregate specification having a generally unrestricted gradation (i.e. wide range of permissible upper sizes), where the source consistently fully passes a screen substantially smaller than the maximum specified size, the nominal maximum size, for the purpose of defining sampling and test specimen size requirements may be adjusted to the screen, found by experience to retain no more than 5% of the materials.

8. Procedure

8.1 If determination by mass is required, oven dry the sample in accordance with FOP for AASHTO T 255. If determination is by particle count, drying is not necessary.

8.2 Sieve the sample to be tested in accordance with FOP for AASHTO T 27/11. If the material retained on each required size (⅜ and larger) is more than 5% of the sample, reduce the material in accordance with FOP for AASHTO T 248 until approximately 100 particles are obtained for each required size.

8.3 Flat and Elongated Particle Test—Test each of the particles in each size fraction and place in one of two groups: (1) flat and elongated or (2) not flat and elongated.

8.3.1 Use the proportional caliper device, set at the desired ratio.
8.3.2 Measurement:

8.3.2.1 On proportional caliper devices similar to the devices shown in Fig. 1 and Fig. 2, set the larger opening equal to the length of the particle. The particle is flat and elongated if the particle, (biggest to smallest) when oriented to measure its thickness (biggest), can pass completely through the smaller opening of the caliper when it is rotated in any direction.

Use of Proportional Caliper

**Figure 2**

<table>
<thead>
<tr>
<th>in.</th>
<th>mm</th>
<th>in.</th>
<th>mm</th>
<th>in.</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>⅛</td>
<td>3.2</td>
<td>⅜</td>
<td>9.5</td>
<td>⅞</td>
<td>21.2</td>
</tr>
<tr>
<td>3/16</td>
<td>4.8</td>
<td>2⅜</td>
<td>64.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>⅛</td>
<td>6.3</td>
<td>1 1/16</td>
<td>25.4</td>
<td>⅝</td>
<td>25.4</td>
</tr>
<tr>
<td>5/16</td>
<td>7.9</td>
<td>1 ½</td>
<td>38.0</td>
<td>8</td>
<td>80.0</td>
</tr>
<tr>
<td>⅜</td>
<td>9.5</td>
<td>1⅝</td>
<td>41.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Metric Equivalents
8.3.2.2 On calipers similar to the one described in Fig. 3, set the minimum dimension of the proportional caliper device such that the particle, when oriented to measure its thickness, passes snugly between the post and swing arm. The particle is flat and elongated if the particle, when oriented to measure its length, fails to pass the desired large opening of the proportional caliper device.

8.3.3 After the particles have been classified into the groups described in 8.4, determine the proportion of the sample in each group by count or mass, as required.

*Note:* WSDOT performs this test by weight.

9. Calculation

9.1 Calculate the percentage of flat and elongated particles to the nearest 1% for each sieve size than \( \frac{3}{8} \) in. and larger (9.5 mm), as required.

10. Report

10.1 Include the following information in the report:

10.1.1 Identification of the coarse aggregate tested, and
10.1.2 Grading of the aggregate sample, showing percentage retained on each sieve.
10.1.3 For flat and elongated particle tests:

10.1.3.1 Percentages, calculated by number or by mass, or both, for flat and elongated particles for each sieve size tested,
10.1.3.2 The dimensional ratio used in the tests, and
10.1.4 When required, weighted average percentages based on the actual or assumed proportions of the various sieve sizes tested. Report the grading used for the weighted average if different from that in 10.1.2.

10.2 Report results using WSDOT form 350-161, or other report approved by the State Materials Engineer.

11. Precision and Bias

11.1 *Precision*—The precision of this test method is being determined.

11.2 *Bias*—Since there is no accepted reference material suitable for determining the bias for this test method, no statement on bias is being made.

12. Keywords

12.1 aggregates; coarse aggregates; particle shape
### Performance Exam Checklist

**FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE**

**FOP FOR ASTM D 4791**

<table>
<thead>
<tr>
<th>Participant Name</th>
<th>Exam Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Procedure Element

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. The tester has a copy of the current procedure on hand?
   - [ ] Yes
   - [ ] No

2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present?
   - [ ] Yes
   - [ ] No

3. Field sample obtained per AASHTO T-2?
   - [ ] Yes
   - [ ] No

4. Sample thoroughly mixed prior to reducing to testing size?
   - [ ] Yes
   - [ ] No

5. Sample reduced to testing size per AASHTO T-248?
   - [ ] Yes
   - [ ] No

6. Mass of the test sample conforms to the table in Section 7.2, ASTM D-4791?
   - [ ] Yes
   - [ ] No

#### PROCEDURE

1. If determination by mass, sample oven dried to a constant weight prior to mass determination?
   - [ ] Yes
   - [ ] No

2. Sample sieved per AASHTO T 27/T 11?
   - [ ] Yes
   - [ ] No

3. Proportional caliper device positioned at proper ratio?
   - [ ] Yes
   - [ ] No

4. Each size fraction 3/8 inch and larger retaining more than 5% of the original sample reduced per AASHTO T-248 until approximately 100 particles are obtained for each size fraction required?
   - [ ] Yes
   - [ ] No

5. Each particle of each size fraction tested for FLAT and ELONGATED using the proportional caliper device put in the appropriate group classification? (Flat & Elongated or Not flat & Elongated)
   - [ ] Yes
   - [ ] No

6. Proportion of the sample of each sieve size determined by Mass?
   - [ ] Yes
   - [ ] No

7. Percent of Flat and Elongated particles figured to the nearest 1% for each sieve size?
   - [ ] Yes
   - [ ] No

8. Record number of particles in each sieve size tested?
   - [ ] Yes
   - [ ] No

9. Record percentages calculated by Mass?
   - [ ] Yes
   - [ ] No

10. All calculations performed correctly?
    - [ ] Yes
    - [ ] No

First attempt:  Pass [ ] Fail [ ]

Second attempt: Pass [ ] Fail [ ]

Signature of Examiner ____________________________
Comments:
identifying them as original plan quantities which are shown as preliminary estimates of work. It should also be noted that final As-Built quantities for individual unit bid items can be obtained from the final CAPS ledger for the project.

In order to help identify significant changes in work location or significant changes in the work completed at a particular location, the Quantity Tabulation sheets must be updated to show the actual physical feature items or the locations of installations where significant changes were made. Types of significant changes may include revisions to guardrail, guardrail termini, post types, anchors or anchor types, revisions to monuments, etc. The intent is to show what significant changes to the planned work were made. Except for significant changes to quantities of items used or items added at a particular installation, it is not necessary to update item quantities for actual quantities used. Final As-Built quantities for the individual unit bid items can be more accurately obtained from the final CAPS ledger for the project.

In order to help identify significant changes in work location or the significant changes in the structure work completed at a particular location, the Structure Note sheets must be updated to show the actual physical feature items or the locations of installations where these significant changes were made. Types of significant changes may include structure notes that were added or revised, pipe size and types that were changed, revised locations for catch basins manholes, etc. The intent is to show what significant changes to the planned work were made. Except for significant changes to quantities of items used or items added at a particular installation, it is not necessary to update item quantities for actual quantities used. Final As-Built quantities for the individual unit bid items involved can be more accurately obtained from the final CAPS ledger for the project.

Correction tape may only be used to complete corrections or revisions made to the Quantity Tabulation and Structure Note sheets. Correction tape is not to be used for noting corrections on any other plan sheet of the As-Built plans. If electronic versions of these sheets are available, corrections noted electronically that clearly depict that a change has been made and plotted in a manner that produces these same results, is acceptable.

In addition to the requirements outlined above for As-Constructed or As-Built contract plans, the Standard Specifications also require that the Contractor furnish the Engineer with original reproducible tracings or drawings suitable for scanning or for use in correcting contract plans for; shop drawings, schematic circuit drawings etc. for Illumination, Traffic Signal Systems, and Electrical for shop drawings, including approved revisions for prestressed structural elements and all other structural steel components fabricated from shop plans. Specific requirements for these plans are outlined in Sections 6-02.3(26)A, 6-03.3(7), 8-03.3(10) and 8-20.3(17) of the Standard Specifications.

Upon project completion, all “As-Built” plans are to be arranged in numerical sequence, including a cover sheet using Form 722-025, and submitted to the Headquarters Engineering Records office, where they will become a part of the project Permanent Final Records. As-Built plans are being scanned to the Record Management Information System (RMIS). In order to achieve consistency, each Region shall:

- Submit as-built plan sheets with Form 722-025 EF attached
- Submit full sized plan sheets only
- Make corrections in red
- Attach photographs, when appropriate, in a .Jpg or .TIF format

Once the scanning process is completed, Engineering Records will recycle (shred) the submitted as-built plans.

10-3.12 Final Record Field Notebooks

Field notebooks are bound books of notes that are used for specific kinds of work such as alignment notes, grading notes, pile driving notes, etc. Field notebooks can also consist of loose leaf field notes that have been bound together into books as well. Records that appear in the field books should not be duplicated and placed in other final record books. The only exception to this rule are copies of Field Note Records with multiple item numbers which may be copied as described in Chapter 10-4.3, Structure Notes.

Field notebooks should be consecutively numbered and each should have the pages numbered beginning with number one. Typing information in the field book is not necessary as hand lettering is preferred. As with other project records, erasure corrections of any kind are not permitted.

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 should 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. 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 should 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 business practices provide for electronic calculation and storage of all types of detailed surveying data, quantity calculations, etc. Data forms for template input, calculation setup, forms for direct recording of field information, storage media for electronic files, as well as output for the calculated data shall all be treated as an original source documents. See Chapter 10-3.13 for further direction in regards to electronic data.
Remeasure cross section notes, where a deviation from the established roadway section or slopes has occurred, should 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 also 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 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.

For use as an example, Figures 10-6 and 10-7 show the front and back of a completed field note for the installation of a reinforced concrete sewer pipe.

10-3.13 Electronically 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 for determining structural quantities. In addition, there are many other “stand alone” applications created by individuals in each office for use on personal computers that are also recognized for these kinds of uses.

When electronic computations are used, the output generated must be bound together and identified with a title sheet for final record purposes. These documents are to be made a part of the three-year Temporary Final 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.

10-3.14 Photographs

A detailed photographic record is an important part of the project documents. A photographic record could consist of filmed photographs, digital photos, infrared photographs, video, etc. A photographic record should be taken of unusual equipment, construction methods, problem areas, areas of possible controversy, traffic control, and especially conditions in the area of an accident. In addition to these are “before” and “after” views taken from the same vantage point. These are particularly useful in documenting the progress of work. When photographs are to be maintained as a part of the project documents they must be fully identified. Photographs should clearly note when they were taken (date and time), where they were taken, and who took the picture. Although photographs are placed in the category of three-year Temporary Final Records, some Regions have extended the Region retention period for photographs or have even included them as a part of the project’s Permanent Final Records for permanent retention.

10-3.15 Pre-Estimate Reports

A Pre-Estimate report prepares the CAPS system to make an estimate payment. This report provides the opportunity for the project office to preview the estimate and is a means to allow for any corrections or deferments to be made before actual payment. The corrected Pre-Estimate Report used to make a progress payment must be signed by the Project Engineer in order to indicate authorization for payment. The signed Pre-Estimate Report must be retained in the project files, and become a part of the three-year Temporary Final Records. For additional information regarding progress payments and the CAPS system, see Chapter 1-3.1B of this manual.

10-3.16 Estimate Reports

When a payment is made to the Contractor for a progress or Final Estimate, the project office receives a copy of all the reports that are sent to the Contractor along with the warrant. The Contract Estimate Payment Advice report and the Contract Estimate Payment Totals report should be compared to the Pre-Estimate report verifying that the amount actually paid is the same as the amount authorized. These estimate reports should be kept with the completed Pre-Estimate reports in the project files, and become a part of the three-year Temporary Final Records. For additional information regarding progress payments and the CAPS system, see Chapter 1-3.1B of this manual.

10-4 Project Ledger System

10-4.1 General

The Contract Administration and Payment System (CAPS) provides both an accounting and payment system, while also acting as an information collection system. The CAPS program uses an electronic project ledger that is maintained current throughout the life of the project as the backbone of the system. All items of work on a project for which payment is made must be entered into the electronic project ledger. Items posted in the ledger become the basis for payment 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 are also used as the basis for final reports when the project is completed.

As work is completed on the project, the project office continuously enters those quantities into the ledger, those records then become eligible for payment when the next progress estimate is due. Processing of monthly progress and project final estimates is further detailed in Chapter 1-3 of this manual. With the ledger entries completed, the application compiles all those records eligible for payment and transfers the data to the payment portion of the CAPS system. Because of the system’s ability to store information it is also used as an extensive resource for corporate information regarding the construction program and is used extensively by many other groups throughout WSDOT.
### General Materials

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<td>Preliminary Sample Transmittal</td>
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<td>9/02</td>
<td>Sample Transmittal</td>
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<td>3/08</td>
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<td>As Built Cover Sheet</td>
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<td>WSP Field Check List</td>
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<td>3/08</td>
<td>Inspector’s Daily Report</td>
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<td>422-004A EF</td>
<td>3/08</td>
<td>Inspector’s Daily Report Diary Page</td>
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<td>422-004B EF</td>
<td>3/08*</td>
<td>(Street) Inspector’s Daily Report</td>
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<td>9/02</td>
<td>Scaleman’s Daily Report</td>
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<td>422-644 EF</td>
<td>12/95*</td>
<td>Daily Report of BST Operations</td>
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<td>3/02</td>
<td>Backflow Prevention Assembly Test Report</td>
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#### 11-2B Regional Office

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<td>Follow-Up Documentation Review</td>
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<td>272-061 EF</td>
<td>8/03</td>
<td>Federal-Aid Highway Construction Cumulative Training Report</td>
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<tr>
<td>420-012 EF</td>
<td>1/96</td>
<td>Recommended Changes to Specifications and Construction Manual</td>
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<td>421-014 EF</td>
<td>1/97</td>
<td>Examination Sheet for Contract Items</td>
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<td>422-100 EF</td>
<td>6/03</td>
<td>Interim Inspection of Federal-Aid Project</td>
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<tr>
<td>FHWA-1392</td>
<td>3/92</td>
<td>Federal-Aid Highway Construction Summary of Employment Data</td>
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#### 11-2C Fabrication Inspector

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#### 11-2D State Construction Office

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<td>3/92</td>
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#### 11-2E Materials Laboratory (State or Region)

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<td>Moisture – Density Relationship Report</td>
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<td>Gradation Chart – 0.45 Power</td>
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<tr>
<td>351-021 EF</td>
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<td>Statement of Receipt of Radioactive Material</td>
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### Forms Chapter 11

#### 11-2F Contractor

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<td>272-049 EF</td>
<td>9/07</td>
<td>Training Program</td>
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<td>9/07</td>
<td>Apprentice/Trainee Approval Request</td>
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<td>Contract Compliance Review Request for Additional Information</td>
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<td>3/08</td>
<td>Contractor’s Construction Process Evaluation</td>
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<td>420-004 EF</td>
<td>3/08*</td>
<td>Contractor and Subcontractor or Lower-Tier Subcontractor</td>
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<td>3/02</td>
<td>Commercial Pesticide Application Record</td>
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<td>FHWA-1391</td>
<td>3/92</td>
<td>Federal-Aid Highway Construction Contractor’s Annual EEO Report</td>
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#### Alphabetical Listing of Forms

**Forms Requiring an Original Hand Written Signature**

(X) = Contractor’s signature is desirable but not necessary to make payment.

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Forms Suitable for Printed Signature

(\(X\)) = Contractor’s signature is desirable but not necessary.

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