

- 610.01 General
- 610.02 References
- 610.03 Materials Sources
- 610.04 Geotechnical Investigation, Design, and Reporting
- 610.05 Use of Geotechnical Consultants
- 610.06 Geotechnical Work by Others
- 610.07 Surfacing Report
- 610.08 Documentation

610.01 General

It is the Washington State Department of Transportation's (WSDOT's) responsibility to understand the characteristics of the soil and rock materials that support or are adjacent to a transportation facility so that, when designed, constructed, and maintained, the facility will be adequate to safely carry the estimated traffic. It is also the responsibility of WSDOT to ensure the quality and quantity of all borrow, soils, rock, and surfacing materials used in the construction of transportation facilities. Specific requirements for geotechnical investigation, design, construction, and maintenance support are set forth in the WSDOT *Geotechnical Design Manual*.

The following information serves as guidance in the above areas. When a project consists of a surface overlay on an existing highway, the *WSDOT Pavement Policy* is used.

Before making project budget and schedule commitments to the Legislature, other agencies, and the public, it is necessary to identify the extent and estimated cost for a project. Contact the Region Materials Engineer (RME) and the Headquarters (HQ) Geotechnical Services Division as early as possible to obtain conceptual-level recommendations regarding how the project soil, rock, and groundwater conditions may affect the design of the project elements. The project soil, rock, and groundwater conditions, and the availability, quantity, and quality of borrow and surfacing materials, can affect the project scope, schedule, and budget.

The RME and the HQ Geotechnical Services Division will use existing subsurface information and their knowledge of the project area to assess the subsurface conditions within the project limits. If there is little information available or the information is poor, and the subsurface conditions have the potential to significantly affect the project budget or schedule, it may be necessary to obtain a limited number of geotechnical borings or test pits during Project Definition to assess soil, rock, and groundwater conditions within the project limits. Once the Project Definition has been developed and project funding secured, a more detailed geotechnical investigation follows during the design and Plans, Specifications, and Estimates (PS&E) phases.

It is essential to involve the RME and the HQ Geotechnical Services Division in the design as soon as possible once the need for geotechnical work is identified. (See 610.04(3) for time-estimate information.) If major changes occur as the project is developed, inform the RME and the HQ Geotechnical Services Division as soon as possible so that the geotechnical design can be adapted to the changes without significant delay to the project.

Coordinate early in your project for geotechnical reporting and design.

610.02 References

(1) Design Guidance

Construction Manual, M 41-01, WSDOT

Geotechnical Design Manual, M 46-03, WSDOT

Hydraulics Manual, M 23-03, WSDOT

Plans Preparation Manual, M 22-31, WSDOT

Standard Plans for Road, Bridge, and Municipal Construction (Standard Plans), M 21-01, WSDOT

Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications), M 41-10, WSDOT

WSDOT Pavement Policy

www.wsdot.wa.gov/biz/mats/pavement/WSDOT_Pavement_Policy.pdf

610.03 Materials Sources

(1) General

The region Project Development Engineer determines when a materials source is needed. The RME determines the best materials source for the project (see Exhibit 610-1). It is preferred that existing approved materials source sites be used when there are suitable sites available. When there are no approved sites available, the RME determines the locations for new materials sources. The RME contacts the HQ Geotechnical Services Division to provide a geotechnical investigation for the proposed site. The HQ Geotechnical Services Division provides geologic mapping of the site; develops a subsurface exploration plan and cost estimate; conducts the subsurface investigation; develops a subsurface geologic model including groundwater; evaluates slope stability issues; and makes recommendations. The HQ Geotechnical Services Division develops and provides a geotechnical report with materials source development recommendations to the RME. The RME uses this report and materials source recommendations to develop the Materials Source Report and to identify the quantity and quality of material that are intended for the life of the materials source.

Specific requirements for materials source investigations are set forth in the *Geotechnical Design Manual*.

(2) Materials Source Approval

The HQ Geotechnical Services Division must review and approve the Materials Source Report produced by the RME to ensure consistency with the geotechnical report produced by the HQ Geotechnical Services Division.

The HQ Materials Office and the HQ Design Office must approve each pit or quarry site before it is purchased, leased, or acquired on a royalty basis. Until the approval process is complete, the project cannot be advertised for bids. Local and state permits are required for materials sources. To avoid delay in advertising the project, begin the site investigations and permitting process in the early stages of the Project Definition phase.

610.04 Geotechnical Investigation, Design, and Reporting

(1) General

A geotechnical investigation is conducted on all projects that involve significant grading quantities (including state-owned materials source development), unstable ground, foundations for structures, and groundwater impacts (including infiltration). The goal of the geotechnical investigation is to preserve the safety of those who use the facility, as well as to preserve the economic investment by the state of Washington. Additional requirements regarding geotechnical investigations and who conducts these investigations are set forth in the *Geotechnical Design Manual*.

(2) Key Contacts for Initiating Geotechnical Work

For regions, the RME is the first person to contact for geotechnical work. Projects with structures designed by the HQ Bridge and Structures Office, Washington State Ferries (WSF) projects, and Urban Corridors projects generally require the involvement of the HQ Geotechnical Services Division. These particular WSDOT offices should contact the HQ Geotechnical Services Division directly for their geotechnical project needs. The specific roles and responsibilities of the RME and HQ Geotechnical Services Division, including application to the Project Management Process (PMP), are set forth in the *Geotechnical Design Manual*.

For information on retaining walls and noise walls, see *Design Manual* Chapters 730 and 740, respectively. For geosynthetic design, see Chapter 630.

(3) Scheduling Considerations for Geotechnical Work

The region Project Office, the HQ Bridge and Structures Office, the WSF, and the HQ Facilities Office are responsible for identifying the potential need for geotechnical work and requesting time and budget estimates from the RME or the HQ Geotechnical Services Division as early as possible to prevent delays to the project.

Once the geotechnical design request and the site data are received by the RME or the HQ Geotechnical Services Division, it can take from two to six months or more to complete the geotechnical design. Design completion depends on the complexity of the project, whether or not test holes are needed, current workload, the need to give the work to consultants, and how long it takes to obtain environmental permits and rights of entry.

If a consultant must be used, the minimum time required to complete a design (for even a simple project) is typically two and a half months.

In true emergency situations (such as a highway blocked by a landslide or a collapsed bridge), it is possible to get geotechnical design work completed (in-house or by consultants) more rapidly to at least provide a design for temporary mitigation.

Consider all of these factors when deciding how soon (in general, as early as possible) to initiate the geotechnical work for a project.

To incorporate geotechnical scheduling considerations into the overall project schedule, see the *Geotechnical Design Manual*, which provides a description and discussion of the Master Deliverables List (MDL) as it applies to geotechnical work.

(4) Site Data and Permits Needed to Initiate Geotechnical Work**(a) Geotechnical Work During Project Definition Phase**

To initiate geotechnical work on a project during the Project Definition phase, provide the following information:

1. Project description.
2. Plan view or description showing the proposed alignment or alignment alternative(s).
3. Description of project scope as it relates to geotechnical features such as major cuts and fills, walls, structures, and potential stormwater facilities.

(b) Geotechnical Work During Design and PS&E Phases

To initiate geotechnical work on a project during the design and PS&E phases, provide the following information:

1. Project description.
2. Plan sheets showing:
 - Station and location of cuts, fills, walls, bridges, retention/detention ponds, and other geotechnical features to be designed.
 - Existing utilities; as-built plans are acceptable.
 - Right of way limits.
 - Wetlands.
 - Drainage features.
 - Existing structures.
 - Other features or constraints that could affect the geotechnical design or investigation.
3. Electronic files, or cross sections every 50 feet or as appropriate, to define existing and new ground line above and below walls, cuts, fills, and other pertinent information.
 - Show stationing.
 - Show locations of existing utilities, right of way lines, wetlands, and other constraints.
 - Show locations of existing structures that might contribute load to the cut, fill, wall, or other structure.
4. Right of entry agreements and permits required for geotechnical investigation.
5. Due date and work order number.
6. Contact person.

When the alignment and any constraints (as noted above) are staked, the stationing on the plans and in the field must be in the same units. Physical surveys are preferred to photogrammetric surveys to ensure adequate accuracy of the site data.

Permits and agreements to be supplied by the region might include the following:

- HPA
- Shoreline permits
- Tribal lands and waters
- Railroad easement and right of way
- City, county, or local agency use permits
- Sensitive area ordinance permits

The region Project Office is also responsible for providing survey locations of test holes once the test holes have been drilled. The survey information includes the station, offset, elevation, and test hole coordinates. Coordinates are the latitude and longitude or state plane coordinates (north or south as appropriate), but not project coordinates.

(5) Overview of Geotechnical Design Objectives for the Various Project Stages

Geotechnical design objectives for the various design phases are described in the *Geotechnical Design Manual*.

(6) Earthwork

(a) Project Definition

The designer contacts and meets with the RME (and the HQ Geotechnical Services Division as needed) at the project site to conduct a field review to help identify the geotechnical issues for the project.

In general, if soil/rock conditions are poor and/or large cuts or fills are anticipated, the RME requests that the HQ Geotechnical Services Division participate in the field review and reporting efforts.

The designer provides a description and location of the proposed earthwork to the RME as follows:

- For widening of existing facilities, the anticipated width, length, and location of the widening, relative to the current facility, are provided.
- For realignments, the approximate new location proposed for the facility is provided.
- Locations in terms of length can be by milepost or stations.

A brief conceptual-level report that summarizes the results of the investigation is provided to the designer.

(b) Project Design

Geotechnical data necessary to allow completion of the PS&E-level design is compiled during the design phase. This includes soil borings, testing, and geotechnical design based on final geometric data. Detailed design of cut and fill slopes can be done once the roadway geometry is established and geotechnical data are available. The purpose of this design effort is to determine the maximum stable cut or fill slope and, for fills, the potential for short- and long-term settlement. Also, the usability of the cut materials and the type of borrow needed

for the project (if any) are evaluated. Evaluate the use of soil bioengineering as an option for building steeper slopes or to prevent surface erosion. (See Chapter 940, Soil Bioengineering, for more information.)

The designer requests a geotechnical report from the RME. The site data given in 610.04(4), as applicable, is provided. It is important that the request for the geotechnical report be made as early as possible in the design phase. Cost and schedule requirements to generate the report are project-specific and can vary widely. The time required to obtain permits and rights of entry must be considered when establishing schedule requirements.

The *Geotechnical Design Manual*, Chapter 24, summarizes the type of information and recommendations that are typically included in the geotechnical report for earthwork. The recommendations should include the background regarding analysis approach and any agreements with the region or other customers regarding the definition of acceptable level of risk.

The region Project Office uses the report to finalize design decisions for the project. To meet slope stability requirements, additional right of way might be required or a wall might be needed. Wall design is covered in Chapter 730. Construction timing might require importing material rather than using cut materials. The report is used to address this and other constructibility issues. The report is also used to proceed with completion of the PS&E.

(c) PS&E Development

Adequate geotechnical design information to complete the PS&E is typically received during the design phase. Additional geotechnical work might be needed when right of way cannot be acquired, restrictions are included in permits, or other requirements are added that result in changes to the design.

Special provisions and plan details, if not received as part of the report provided during design, are developed with the assistance of the RME or the HQ Geotechnical Services Division. The designer uses this information, as well as the design phase report, to complete the PS&E documents. Both the region Materials Laboratory and the HQ Geotechnical Services Division can review (if requested) the contract plans before the PS&E review process begins. Otherwise, they will review the contract plans during the normal PS&E review process.

(7) Hydraulic Structures, Ponds, and Environmental Mitigation

(a) Project Definition

The designer provides a description and location of the proposed hydraulic/environmental improvements and other pertinent site information and discusses the extent of the improvements with both the RME and the HQ Hydraulics Section to identify the geotechnical issues to be investigated. At this stage, only the identification and feasibility of the proposed hydraulic structures or environmental mitigation are investigated. The cost and schedule requirements for the geotechnical investigation are also determined at this time.

Examples of hydraulic structures include, but are not limited to, large culverts, pipe arches, underground detention vaults, and fish passage structures. Examples of environmental mitigation include, but are not limited to, detention/retention ponds, wetland creation, and environmental mitigation measures on fill slopes.

It is especially important to identify the potential to encounter high groundwater at the proposed hydraulic structure or pond location. In general, avoid high groundwater locations (see the *Highway Runoff Manual*) as groundwater can greatly affect design, constructibility, operations, performance, and maintenance.

(b) **Project Design**

The designer requests a geotechnical report from the RME. The site data given in 610.04(4), as applicable, is provided along with the following information:

- Pertinent field observations (such as unstable slopes, existing soft soils or boulders, evidence of high groundwater, or erosion around and damage to existing culverts or other drainage structures).
- Jurisdictional requirements for geotechnical design of berms/dams.

It is important that the request for the geotechnical report be made as early as possible in the design phase. Cost and schedule requirements to generate the report are project-specific and can vary widely. The time required to obtain permits and rights of entry must be considered when establishing schedule requirements. Furthermore, since the depth to groundwater can be critical to the feasibility of these types of facilities, and since seasonal variation of groundwater is typically important to know, it is essential to have adequate time to determine the effect of seasonal variations on groundwater.

The RME, with support from the HQ Geotechnical Services Division as needed, provides the following information in addition to the overall requirements specified in the *Geotechnical Design Manual*, when requested and where applicable, as part of the project geotechnical report:

- Soil boring logs.
- Soil pH and resistivity.
- Water table elevation.
- Soil infiltration rates (the highest rate for assessing spill containment/aquifer protection and the long-term rate for determining pond capacity).
- Bearing capacity and settlement for hydraulic structure foundations.
- Slope stability for ponds.
- Retention berm/dam design.
- Potential for and amount of differential settlement along culverts and pipe arches and the estimated time required for settlement to occur.
- Soil pressures and properties (primarily for underground detention vaults).
- Erosion potential.
- Geosynthetic design in accordance with Chapter 630.
- Recommendations for mitigation of the effects of soft or unstable soil on the hydraulic structures.
- Recommendations for construction.

Note that retaining walls that are part of a pond, fish passage, and so on, are designed in accordance with Chapter 730 and the *Geotechnical Design Manual*.

The designer uses the geotechnical information to:

- Finalize design decisions.
- Evaluate and mitigate environmental issues.
- Proceed with completion of the PS&E design. This includes determining the most cost-effective hydraulic structure/pond to meet the desired objectives; locating and sizing ponds and foundations for hydraulic structures; structural design; mitigating the effects of settlement; and satisfying local jurisdictional requirements for design.

(c) PS&E Development

During PS&E development, the designer uses the information provided in the geotechnical report to:

- Select pipe materials in accordance with corrosion, resistivity, and abrasion guidelines in the *Hydraulics Manual*.
- Consider and include construction recommendations.

Additional design and specification guidance and support from the RME or the HQ Geotechnical Services Division are sought as needed. Both sections provide careful review of the contract plans before the PS&E review process begins, if requested. Otherwise, they will review the contract plans during the normal PS&E review process.

(8) Signals, Sign Bridges, Cantilever Signs, and Luminaire Foundations

(a) Project Definition and Design

Geotechnical information is usually not required for signals, sign bridges, cantilever signs, and luminaires during Project Definition.

The region Traffic Design Office contacts the RME for conceptual foundation recommendations. The conceptual recommendations are based on existing information in the area and identify whether *Standard Plan* foundations are feasible or whether special-design foundations are required. If good soils are anticipated or the foundations will be placed in fill, *Standard Plan* foundations can be assumed. If special-design foundations are required, additional time and money can be included in the project to accommodate increased field exploration for foundation design, HQ Geotechnical Services Division involvement, and structural design by the HQ Bridge and Structures Office.

(b) PS&E Development

Foundation recommendations are made by either the RME or the HQ Geotechnical Services Division. The recommendations provide all necessary geotechnical information to complete the PS&E.

The region Traffic Design Office (or region Project Engineer in some cases) is responsible for delivering the following project information to the RME:

- Plan sheet showing the location of the structures (station and offset) and the planned structure type.
- Applicable values for: XYZ coordinates, strain pole class, sign bridge span length, luminaire height, variable message sign weight, wind load, CCTV pole height, and known utility information in the area.

The RME provides the following information to the requester if *Standard Plans* foundation types can be used:

- Allowable lateral bearing capacity of the soil
- Results of all field explorations
- Groundwater elevation
- Foundation constructibility

The region uses this information to complete the plan sheets and prepare any special provisions. If utilities are identified during the field investigation that could conflict with the foundations, the region pursues moving or accommodating the utility. Accommodation could require special foundation designs.

If special designs are required, the RME notifies the requester that special designs are required and forwards the information received from the region to the HQ Geotechnical Services Division. The HQ Geotechnical Services Division provides the HQ Bridge and Structures Office with the necessary geotechnical recommendations to complete the foundation designs. The region coordinates with the HQ Bridge and Structures Office to ensure they have all the information necessary to complete the design. Depending on the structure type and complexity, the HQ Bridge and Structures Office might produce the plan sheets and special provisions for the foundations, or they might provide the region with information so they can complete the plan sheets and special provisions.

Additional guidelines and requirements for design of foundations for these types of structures are contained in the *Geotechnical Design Manual*.

(9) Buildings, Park & Ride Lots, Communication Towers, and Rest Areas

In general, the RME functions as the clearinghouse for the geotechnical work to be conducted in each of the phases, for technical review of the work if it is performed by consultants, or for getting the work done in-house. For sites and designs that are more geotechnically complex, the RME contacts the HQ Geotechnical Services Division for assistance. (See the *Geotechnical Design Manual* for geotechnical investigation and design requirements for these types of facilities.)

Detailed geotechnical investigation guidance is provided in Facilities Operating Procedure 9.18, "Site Development": <http://wwwi.wsdot.wa.gov/MaintOps/facilities/newpdf/SiteDevelopmentProcedure.pdf>

In summary, this guidance addresses the following phases of design:

(a) Site Selection

Conceptual geotechnical investigation (based on historical data and minimal subsurface investigation) of several alternative sites is performed in which the geotechnical feasibility of each site for its intended use is evaluated, allowing the sites to be ranked. In this phase, geological hazards (such as landslides, rockfall, compressible soils, and liquefaction) are identified, and geotechnical data adequate to determine a preliminary cost to develop and build on the site is gathered.

(b) Schematic Design

For the selected site, the best locations for structures, utilities, and other elements of the project are determined based on site constraints and ground conditions. In this phase, the site is characterized more thoroughly than in the site selection phase, but subsurface exploration is not structure specific.

(c) Design and PS&E Development

The final locations of each of the project structures, utilities, and other project elements determined from the schematic design phase are identified. Once these final locations are available, a geotechnical investigation is conducted that is adequate to complete the final design of each of the project elements, such as structure foundations, detention/retention facilities, utilities, parking lots, roadways, and site grading. From this investigation and design, the final PS&E is developed.

(10) Retaining Walls, Reinforced Slopes, and Noise Walls**(a) Project Definition**

The designer provides the RME with a description and location of the proposed walls or reinforced slopes, including the potential size of the proposed structures and other pertinent site information. At this stage, only the identification and feasibility of the proposed walls or reinforced slopes are investigated. A field review may also be conducted as part of the investigation effort. In general, if soil/rock conditions are poor and/or large walls or reinforced slopes are anticipated, the RME requests that the HQ Geotechnical Services Division participate in the field review and reporting efforts. The cost and schedule requirements for the geotechnical investigation are also determined at this time.

A brief conceptual-level report that summarizes the results of the investigation may be provided to the designer at this time, depending on the complexity of the geotechnical issues.

(b) Project Design and PS&E Development

Geotechnical data necessary to allow completion of the PS&E-level design for walls and reinforced slopes are compiled during the design and PS&E development phases. These include soils borings, testing, and final geometric data. Detailed designs of walls and reinforced slopes can be done once the roadway geometry is established and geotechnical data are available. The purpose of this design effort is to determine the wall and slope geometry needed for stability; noise wall and retaining wall foundation requirements; and the potential for short- and long-term settlement.

The designer requests a geotechnical report from the RME for retaining walls, noise walls, and reinforced slopes that are not part of the bridge preliminary plan. For walls that are part of the bridge preliminary plan, the HQ Bridge and Structures Office requests the geotechnical report for the walls from the HQ Geotechnical Services Division. (See Chapter 730 for the detailed design process for retaining walls and reinforced slopes, Chapter 740 for the detailed design process for noise walls, and the *Geotechnical Design Manual* for design requirements for all walls.) It is important that requests for a geotechnical

report be made as early as possible in the design phase. The time required to obtain permits and rights of entry must be considered when establishing schedule requirements.

For retaining walls and reinforced slopes, the site data to be provided with the request for a geotechnical report are as given in Chapter 730. Supply right of entry agreements and permits required for the geotechnical investigation. The site data given in 610.04(4), as applicable, are provided for noise walls.

The RME or the HQ Geotechnical Services Division provides the information (see Chapter 730 or 740 for specific responsibilities for design) specified in the *Geotechnical Design Manual* as part of the project geotechnical report.

The recommendations may also include the background regarding the analysis approach and any agreements with the region or other customers regarding the definition of acceptable level of risk. Additional details and design issues to be considered in the geotechnical report are as provided in Chapter 1130 for retaining walls and reinforced slopes and in Chapter 740 for noise walls. The designer uses this information for final wall/reinforced slope selection and to complete the PS&E.

For final PS&E preparation, special provisions and plan details (if not received as part of the report provided during design) are developed with the assistance of the region Materials Laboratory or the HQ Geotechnical Services Division. Both the region Materials Laboratory and the HQ Geotechnical Services Division can review the contract plans before the PS&E review process begins, if requested. Otherwise, they will review the contract plans during the normal PS&E review process.

(11) Unstable Slopes

Unstable slope mitigation includes the stabilization of known landslides and rockfall that occur on slopes adjacent to the WSDOT transportation system and that have been programmed under the P3 Unstable Slope Program.

(a) Project Definition

The region Project Office provides the RME with a description and location of the proposed unstable slope mitigation work. Location of the proposed work can be milepost limits or stationing. The designer meets at the project site with the RME and HQ Geotechnical Services Division to conduct a field review, discuss project requirements, and identify geotechnical issues associated with the unstable slope project. The RME requests that the HQ Geotechnical Services Division participate in the field review and Project Definition reporting.

The level of work in the Project Definition phase for unstable slopes is conceptual in nature, not a final design. The geotechnical investigation generally consists of a field review, a more detailed assessment of the unstable slope, review of the conceptual mitigation developed during the programming phase of the project, and proposed modification (if any) to the original conceptual-level unstable slope mitigation. The design phase geotechnical services cost and schedule, including any required permits, are determined at this time. A brief conceptual-level report is provided to the designer that summarizes the results of the Project Definition investigation.

(b) Project Design

Geotechnical information and field data necessary to complete the unstable slope mitigation design is compiled during this design phase. This work includes, depending on the nature of the unstable slope problem, test borings, rock structure mapping, geotechnical field instrumentation, laboratory testing, and slope stability analysis. The purpose of this design effort is to provide design-level geotechnical recommendations to stabilize the known unstable slope.

The designer requests a geotechnical report from the HQ Geotechnical Services Division through the RME. The site data given in 610.04(4), as applicable, is provided along with the following information:

- A plan sheet showing the station and location of the proposed unstable slope mitigation project.
- If requested, the Digital Terrain Model (DTM) files necessary to define the on-ground topography of the project site (the limits of the DTM will have been defined during the Project Definition phase).

It is important that the request for the geotechnical report be made as early as possible in the design phase. Cost and schedule requirements to generate the report are project-specific and can vary widely. Unstable slope design investigations might require geotechnical monitoring of ground movement and groundwater over an extended period of time to develop the required field information for the unstable slope mitigation design. The time required to obtain rights of entry and other permits, as well as the long-term monitoring data, must be considered when establishing schedule requirements for the geotechnical report.

In addition to the geotechnical report requirements specified in the *Geotechnical Design Manual*, the HQ Geotechnical Services Division provides the following information as part of the project geotechnical report (as applicable):

- Unstable slope design analysis and mitigation recommendations.
- Constructibility issues associated with the unstable slope mitigation.
- Appropriate special provisions for inclusion in the contract plans.

The region Project Office uses the geotechnical report to finalize the design decisions for the project and the completion of the PS&E design.

(c) PS&E Development

Adequate geotechnical design information to complete the PS&E is typically obtained during the project design phase. Additional geotechnical work might be needed when right of way cannot be acquired, restrictions are included in permits, or other requirements are added that result in changes to the design.

Special provisions, special project elements, and design details, if not received as part of the design phase geotechnical report, are developed with the assistance of the RME and the HQ Geotechnical Services Division. The designer uses this information in conjunction with the design phase geotechnical report to complete the PS&E document. The RME and the HQ Geotechnical Services Division can review the contract plans before the PS&E review begins, if requested. Otherwise, they will review the contract plans during the normal PS&E review process.

(12) **Rockslope Design**

(a) **Project Definition**

The region Project Office provides the RME with a description and location of the proposed rock excavation work. For widening of existing rock cuts, the anticipated width and length of the proposed cut in relationship to the existing cut are provided. For new alignments, the approximate location and depth of the cut are provided. Location of the proposed cut(s) can be milepost limits or stationing. The designer meets at the project site with the RME and the HQ Geotechnical Services Division to conduct a field review, discuss project requirements, and identify any geotechnical issues associated with the proposed rock cuts. The RME requests that the HQ Geotechnical Services Division participate in the field review and Project Definition reporting.

The level of rockslope design work for the Project Definition phase is conceptual in nature. The geotechnical investigation generally consists of the field review, review of existing records, an assessment of existing rockslope stability, and preliminary geologic structure mapping. The focus of this investigation is to assess the feasibility of the rock cuts for the proposed widening or realignment, not final design. A brief conceptual-level report that summarizes the result of the Project Definition investigation is provided to the designer.

(b) **Project Design**

Detailed rockslope design is done once the roadway geometrics have been established. The rockslope design cannot be finalized until the roadway geometrics have been finalized. Geotechnical information and field data necessary to complete the rockslope design are compiled during this design phase. This work includes rock structure mapping, test borings, laboratory testing, and slope stability analysis. The purpose of this design effort is to determine the maximum stable cut slope angle and any additional rockslope stabilization measures that could be required.

The designer requests a geotechnical report from the HQ Geotechnical Services Division through the RME. The site data given in 610.04(4), as applicable, is provided.

It is important that the request for the geotechnical report be made as early as possible in the design phase. Cost and schedule requirements to generate the report are project-specific and can vary widely. The time required to obtain permits and rights of entry must be considered when establishing schedule requirements.

In addition to the geotechnical report requirements specified in the *Geotechnical Design Manual*, the HQ Geotechnical Services Division provides the following information as part of the project geotechnical report pertaining to rockslope design analysis and recommendations:

- Type of rockslope design analysis conducted and limitation of the analysis. Also included will be any agreements with the region and other customers regarding the definition of “acceptable risk.”
- The slope(s) required for stability.

- Additional slope stabilization requirements (such as rock bolts or rock dowels).
- Rockslope ditch criteria (see Chapter 1230).
- Assessment of rippability.
- Blasting requirements, including limitations on peak ground vibrations and air blast over-pressure if required.
- Usability of the excavated material, including estimates of shrink and swell.
- Constructibility issues associated with the rock excavation.

The region Project Office uses the geotechnical report to finalize the design decisions for the project and the completion of the PS&E design for the rockslope elements of the project.

(c) **PS&E Development**

Adequate geotechnical design information to complete the PS&E is typically obtained during the design phase. Additional geotechnical work might be needed when right of way cannot be acquired, restrictions are included in permits, or other requirements are added that result in change to the design.

Special provisions, special blasting requirements, and plan details, if not received as part of the design phase geotechnical report, are developed with the assistance of the RME or the HQ Geotechnical Services Division. The designer uses this information in conjunction with the design phase geotechnical report to complete the PS&E documents. The RME and the HQ Geotechnical Services Division can review (if requested) the contract plans before the PS&E review begins. Otherwise, they will review the contract plans during the normal PS&E review process.

(13) Bridge Foundations

(a) **Project Definition**

The HQ Geotechnical Services Division supports the development of reasonably accurate estimates of bridge substructure costs beginning with the Project Definition phase. A field review is recommended for major projects and projects that are located in areas with little or no existing geotechnical information. The region office responsible for Project Definition coordinates field reviews. Subsurface exploration (drilling) is usually not required at this time, but might be needed if cost estimates cannot be prepared within an acceptable range of certainty.

Once it has received the necessary site data from the region Project Office, the HQ Bridge and Structures Office is responsible for delivering the following project information to the HQ Geotechnical Services Division:

- Alternative alignments and/or locations of bridge structures.
- A preliminary estimate of channelization (structure width).
- Known environmental constraints.

The HQ Geotechnical Services Division provides the following to the HQ Bridge and Structures and region offices:

- Summary of existing geotechnical information.
- Identification of geotechnical hazards (such as slides, liquefiable soils, and soft-soil deposits).
- Identification of permits that might be required for subsurface exploration (drilling).
- Conceptual foundation types and depths.
- If requested, an estimated cost and time to complete a geotechnical foundation report.

The HQ Bridge and Structures Office uses this information to refine preliminary bridge costs. The region Project Office uses the estimated cost and time to complete a geotechnical foundation report to develop the project delivery cost and schedule.

(b) Project Design

The HQ Geotechnical Services Division assists the HQ Bridge and Structures Office with preparation of the bridge preliminary plan. Geotechnical information gathered for Project Definition will normally be adequate for this phase, as test holes for the final bridge design cannot be drilled until accurate pier location information is available. For selected major projects, a type, size, and location (TS&L) report might be prepared, which usually requires some subsurface exploration to provide a more detailed, though not final, estimate of foundation requirements.

The HQ Bridge and Structures Office is responsible for delivering the following project information, based on bridge site data received from the region Project Office, to the HQ Geotechnical Services Division:

- Anticipated pier locations.
- Approach fill heights.
- For TS&L, alternate locations/alignments/structure types.

The HQ Bridge and Structures Office can expect to receive the following:

- Conceptual foundation types, depths, and capacities.
- Permissible slopes for bridge approaches.
- For TS&L, a summary of site geology and subsurface conditions, and more detailed preliminary foundation design parameters and needs.
- If applicable or requested, the potential impact of erosion or scour potential (determined by the HQ Hydraulics Section) on foundation requirements.

The HQ Bridge and Structures Office uses this information to complete the bridge preliminary plan. The region Project Office confirms right of way needs for approach embankments. For TS&L, the geotechnical information provided is used for cost estimating and preferred alternate selection. The preliminary plans are used by the HQ Geotechnical Services Division to develop the site subsurface exploration plan.

(c) PS&E Development

During this phase, or as soon as a 95% preliminary plan is available, subsurface exploration (drilling) is performed and a geotechnical foundation report is prepared to provide all necessary geotechnical recommendations needed to complete the bridge PS&E.

The HQ Bridge and Structures Office is responsible for delivering the following project information to the HQ Geotechnical Services Division:

- 95% preliminary plans, concurrent with distribution for region approval.
- Estimated foundation loads and allowable settlement criteria for the structure when requested.

The HQ Bridge and Structures Office can expect to receive:

- The bridge geotechnical foundation report.

The HQ Bridge and Structures Office uses this information to complete the bridge PS&E. The region Project Office reviews the geotechnical foundation report for construction considerations and recommendations that might affect region items, estimates, staging, construction schedule, or other items.

Upon receipt of the structure PS&E review set, the HQ Geotechnical Services Division provides the HQ Bridge and Structures Office with a Summary of Geotechnical Conditions for inclusion in Appendix B of the contract.

(14) Geosynthetics

For design guidance on geosynthetics, refer to Chapter 630.

(15) Washington State Ferries Projects**(a) Project Design**

The HQ Geotechnical Services Division assists the Washington State Ferries (WSF) with determining the geotechnical feasibility of all offshore facilities, terminal facility foundations, and bulkhead walls. For upland retaining walls and grading, utility trenches, and pavement design, the RME assists WSF with determining geotechnical feasibility.

In addition to the site data provided in Section 610.04(4), as applicable, the following information is supplied by WSF to the HQ Geotechnical Services Division or the RME, as appropriate, with the request for the project geotechnical report:

- A plan showing anticipated structure locations as well as existing structures.
- Relevant historical data for the site.
- A plan showing utility trench locations.
- Anticipated utility trench depths.
- Proposed roadway profiles.

WSF can expect to receive the following:

- Results of any borings or laboratory tests conducted.
- A description of geotechnical site conditions.
- Conceptual foundation types, depths, and capacities.

- Conceptual wall types.
- Assessment of constructibility issues that affect feasibility.
- Surfacing depths and/or pavement repair and drainage schemes.
- If applicable or requested, potential impact of erosion or scour potential (determined by the HQ Hydraulics Section) on foundation requirements.

WSF uses this information to complete the design report, design decisions, and estimated budget and schedule.

WSF is responsible for obtaining any necessary permits or right of entry agreements needed to access structure locations for the purpose of subsurface exploration (such as test hole drilling). The time required for obtaining permits and rights of entry must be considered when developing project schedules.

Possible permits and agreements might include, but are not limited to:

- City, county, or local agency use permits.
- Sensitive area ordinance permits.

(b) **PS&E Development**

Subsurface exploration (drilling) is performed and a geotechnical foundation report is prepared to provide all necessary geotechnical recommendations needed to complete the PS&E.

The designer requests a geotechnical report from the HQ Geotechnical Services Division or the RME, as appropriate. The site data given in 610.04(4), as applicable, is provided along with the following information:

- A plan showing final structure locations as well as existing structures.
- Proposed structure loadings.

WSF can expect to receive the following:

- Results of any borings or laboratory tests conducted.
- A description of geotechnical site conditions.
- Final foundation types, depths, and capacities.
- Final wall types and geotechnical designs/parameters for each wall.
- Assessment of constructibility issues to be considered in foundation selection and when assembling the PS&E.
- Pile driving information: driving resistance and estimated overdrive.
- Surfacing depths and/or pavement repair and drainage schemes.

WSF uses this information to complete the PS&E.

Upon receipt of the WSF PS&E review set, the HQ Geotechnical Services Division provides WSF with a Summary of Geotechnical Conditions for inclusion in Appendix B of the Contract. A Final Geotechnical Project Documentation package is assembled by the HQ Geotechnical Services Division and sent to WSF or the Plans Branch, as appropriate, for reproduction and sale to prospective bidders.

610.05 Use of Geotechnical Consultants

Prior to authorizing a consultant to conduct the geotechnical investigation for a project, the region Project Office, the HQ Geotechnical Services Division, and the RME determine the scope of work and schedule for the project and whether or not the project will go to a geotechnical consultant.

Once the decision has been made to have a consultant conduct the geotechnical investigation for a project, the HQ Geotechnical Services Division or the RME assists in developing the geotechnical scope and estimate for the project (WSDOT Consultant Services assists in this process). A team meeting between the consultant team, the region or Washington State Ferries (depending on whose project it is), and the HQ Geotechnical Services Division/RME is conducted early in the project to develop technical communication lines and relationships. Good proactive communication between all members of the project team is crucial to the success of the project due to the complex supplier-client relationships.

Additional guidelines on the use of geotechnical consultants and the development of a scope of work for the consultant are provided in the *Geotechnical Design Manual*.

610.06 Geotechnical Work by Others

Geotechnical design work conducted for the design of structures, or other engineering works by other agencies or private developers within the right of way, is subject to the same geotechnical engineering requirements as for engineering works performed by WSDOT. Therefore, the provisions contained within this chapter also apply in principle to such work. All geotechnical work conducted for engineering works within the WSDOT right of way or that otherwise directly impacts WSDOT facilities must be reviewed and approved by the HQ Geotechnical Services Division or the RME, depending on the nature of the work.

Additional requirements for geotechnical work by others that impacts WSDOT facilities and land within the WSDOT right of way are set forth in the *Geotechnical Design Manual*.


610.07 Surfacing Report

Detailed criteria and methods that govern pavement rehabilitation can be found in *WSDOT Pavement Policy*. The RME provides the surfacing report to the region Project Office. This report provides recommended pavement types, surfacing depths, pavement drainage recommendations, and pavement repair recommendations.

610.08 Documentation

(1) Design Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:

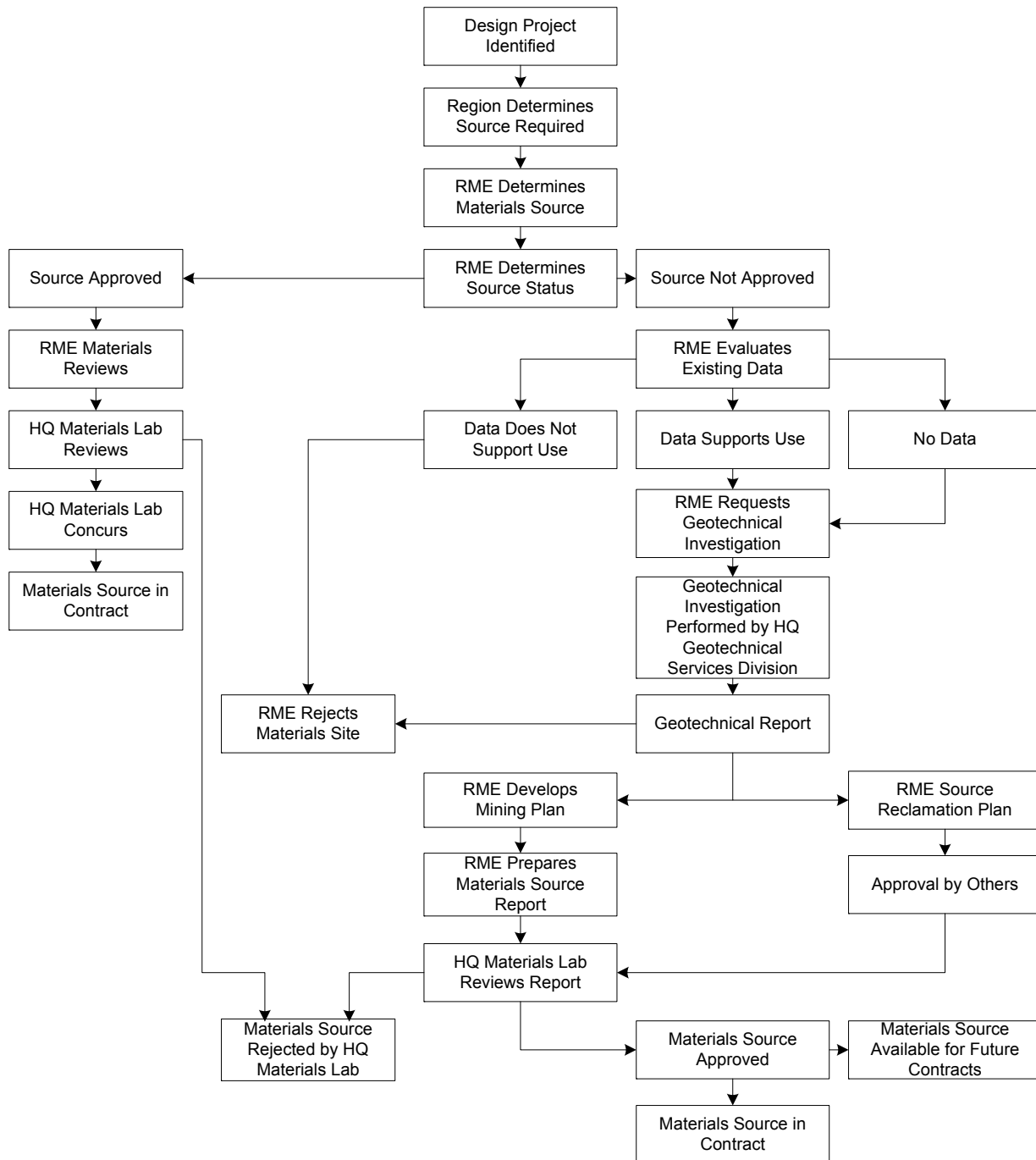
 www.wsdot.wa.gov/design/projectdev/

(2) Final Geotechnical Project Documentation and Geotechnical Information for the Construction Contract

Once a project PS&E is near completion, all of the geotechnical design memorandums and reports are compiled together to form the Final Geotechnical Project Documentation, to be published for the use of prospective bidders. The detailed process for this is located in the *Plans Preparation Manual*.

Geotechnical information included in the contract consists of the final project boring logs and, as appropriate for the project, a Summary of Geotechnical Conditions. The boring logs from the geotechnical reports are incorporated into the contract by the region, WSF, or Urban Corridors Office (UCO) staff. The Summary of Geotechnical Conditions is provided to the region, WSF, or UCO by the HQ Geotechnical Services Division and/or RME.

Additional geotechnical project documentation requirements are set forth in the *Geotechnical Design Manual*.



Materials Source Development
Exhibit 610-1