

22-1 Overview

This chapter describes the geotechnical support needed for projects where WSDOT intends to use the Design-Build (DB) method of contract delivery and the geotechnical policies that govern that support.

DB differs from traditional Design-Bid-Build (DBB) projects in that the DB team is responsible for the final design, and the means and methods needed to successfully construct the project compatible with the design. In the DBB contract method of delivery there can be a reasonable anticipation of potential means and methods that may be selected by a contractor. Hence, given a 100% design, establishing a geotechnical baseline with respect to the subsurface and site conditions that may be encountered can be more objectively established. Of significance to the preparation of geotechnical documents for DB is that foundation types and how they are constructed may change, retaining walls may move affecting both height and wall types considered during the development of the project concept, size and location of cuts and fills may change, and any effects on adjacent sensitive structures and utilities may be significantly different than anticipated in the Conceptual Design. Right of way (ROW) lines may also be affected as well as temporary construction easements (TCE).

In DB, the Design-Build team is the responsible Engineer of Record (EOR) and has the latitude in completing the majority of the project design such that it meets the performance requirements and is in compliance with the contract documents. While the WSDOT will always retain primary ownership of the project and its long-term operations and maintenance, the DB contract delivery method allocates the majority of the responsibility and risk for project design and construction to the Design-Builder to foster innovation and creativity.

These differences relative to DBB have a fundamental effect on the type of geotechnical support needed and how it is carried out. The geotechnical support provided by the Headquarters Geotechnical Office or the department's geotechnical consultants includes:

- A geotechnical investigation to identify site geotechnical conditions and to gather the geotechnical information needed to provide a common and consistent basis for bidding.
- Verification of the feasibility of the project Conceptual Design and identification of areas of geotechnical risk.
- The development of geotechnical Technical Requirements to be included in the Request for Proposals (RFP) as well as the Geotechnical Data Report (GDR) and Geotechnical Baseline Report (GBR) to be included as part of the contract.
- The development of Geotechnical Reference and other reference documents.
- Once the contract advertisement begins, a review of proposals, if requested by the project management; this will depend on the importance and complexity of the project geotechnical issues.

- A review of geotechnical Alternative Technical Concepts (ATCs) for consistency with the contract design requirements and WSDOT design policy.
- Review of geotechnical designs, plans, and other geotechnical submittals after award and execution.
- Project office assistance when geotechnical problems occur during the life of the project.

The chapter sections that follow address each of these areas to provide the guidance needed by the Headquarters Geotechnical Office staff and department geotechnical consultant staff to successfully develop and support department DB projects. Since this chapter is for internal geotechnical staff and internal consultant staff, and the department offices who interact with these staff, to develop and carry out DB projects, this chapter should be excluded from the Mandatory Standards that are included in the contract documents.

22-2 Definitions

Geotechnical documents provided as part of or in support of a DB project include the Geotechnical Data Report (GDR), the Geotechnical Baseline Report (GBR), Geotechnical Reference documents, and other related Reference Documents. A GDR only presents factual geotechnical and geological information obtained through site and subsurface investigation, and laboratory testing, for the project, and should not include interpretive information. The GDR is a contract document. The Geotechnical Baseline Report (GBR) is a contract document and a risk allocation document provided to Proposers of DB projects that provides the primary contractual interpretation of geotechnical conditions, in addition to the factual data provided in the GDR, for Proposers to use as the basis for their proposals. The GBR interpretation of geotechnical conditions is based on the factual information in the GDR plus interpretation of the geotechnical conditions that is not strictly based on the available factual information in the GDR. The GBR is also used after contract award for evaluating differing site conditions claims.

This GBR should not refer to any part of a reference document, as doing so will make the reference document contractual and negate its reference document status. Geotechnical Memoranda and other reference documents include other geotechnical information, interpretations, and conceptual designs that were used as the basis for evaluating the feasibility of the project Conceptual Design, and possibly alternatives to the final project Conceptual Design, and to assess areas of geotechnical risk for the project. The Geotechnical Reference documents are not included as Contract Documents, but are made available to Proposers in an appendix of the RFP for information only, not to be used as the basis for their proposal.

The geotechnical information to be included in RFP is project-specific and can include all or only some of the documents identified above. For example, during concept development for the project, it may be determined that the overall geotechnical risks are minimal, warranting only the inclusion of a GDR as a contract document and incorporating a financial allowance to manage any unforeseen risks. The level of the potential financial allowance is a decision made by the project management with input from the HQ Geotechnical and Construction Offices and the project geotechnical team.

22-2.1 Field Investigation Requirements for Pre-Advertisement Design-Build Project Documents

Past experience has demonstrated that an inadequate project geotechnical investigation can lead to excessive risk both in terms of schedule and cost. Therefore, it is important to do the right amount of geotechnical investigation to provide the subsurface information needed to help mitigate those risks. These data can then be used to develop contract information that will provide potential Proposers with a consistent understanding of the site geotechnical conditions and the impact those conditions may have on the project design and the constructability of that design. This section summarizes the level of geotechnical investigation and analysis that should be considered prior to contract advertisement for DB projects. Decisions regarding the level of geotechnical investigation needed should be developed as early in the project as possible with region project office input, including the development of a geotechnical risk profile for the project that is mutually agreed upon by both region and headquarters offices. These early efforts will also be useful to develop a strategy for establishing geotechnical baselines.

The level of geotechnical field investigation necessary for assessment of potential geotechnical risks, with consideration to the baseline configuration for the project, and for preparation of the GDR and GBR should be conducted as early in the project as possible. The goal is to leave enough time in the project development schedule for the Geotechnical Office, the region project office, and possibly others such as the HQ Construction Office and region management, to identify and come to agreement on the level of geotechnical risk WSDOT should be taking and how to allocate that risk. The project baseline configuration geotechnical investigation shall be approved by the State Geotechnical Engineer, or an approved designee. The State Geotechnical Engineer, Region/Headquarters management, and the region project team will review and agree upon the short-term (i.e., during the contract) and long-term (i.e., after the contract is completed to the end of the design life of the facility) project performance risks when determining the initial level of investigation required. During the execution of the field exploration program, field findings may significantly alter those risks and require changes to the field investigation program. The level of geotechnical investigation shall consider the amount of information necessary to develop the Conceptual Design for the DB project and also to provide the appropriate level of confidence in baseline statements and thereby reduce the risk of differing site condition claims. If there is a disagreement regarding the level of geotechnical investigation required, the issue(s) may be escalated to the next higher management level to resolve the disagreement.

The amount of geotechnical investigation needed is project specific, and shall be determined based on the guidelines provided herein.

The goals of the typical geotechnical investigation for DB projects are to:

1. Identify the distribution of soil and rock types for the Conceptual Design, and assess how the material properties will affect the design and construction of the project elements.
2. Define the ground water and surface water regimes for the project concept design. It is especially important to determine the depth, and seasonal and spatial variability, of groundwater or surface water. The locations of confined water bearing zones, artesian pressures, and seasonal or tidal variations should also be identified. The geotechnical investigation will not be sufficient to fully define these groundwater issues, but should be enough to identify potential groundwater problems and risks.
3. Identify and consider any impacts to adjacent facilities that could be caused by the construction of the Conceptual Design.
4. Identify and characterize any geologic hazards that are present within or adjacent to the project limits (e.g., landslides, rockfall, debris flows, liquefaction, soft ground or otherwise unstable soils, seismic hazards) that are already known or discovered during the baseline configuration geotechnical investigation that could affect the Conceptual Design as well as adjacent facilities that could be impacted by the construction of the Conceptual Design.
5. Assess the feasibility of the proposed alignments, including the feasibility and conceptual evaluation of retaining walls and slope angles for cuts and fills, and the effect the construction of the Conceptual Design could have on adjacent facilities.
6. Assess potential project stormwater infiltration or detention sites with regard to their feasibility, and to gather at least one year of ground water data in accordance with storm water regulations if possible within the project development schedule.
7. Identify potential suitability of on-site materials as fill, and/or the usability of nearby materials sources.
8. For structures including, but not limited to, bridges and cut-and-cover tunnels, large culverts, walls, bored tunnels, trenchless technology, provide adequate subsurface information to assess feasibility of the Conceptual Design and to help quantify risks.
9. For projects that may include ground improvement to achieve the project Concept Design, provide adequate information to assess feasibility and to assess the potential impacts to adjacent facilities due to the ground improvement.
10. For projects that may include landslides, rockfall areas, and debris flows, provide adequate information to evaluate the feasibility of various stabilization or containment techniques.

To accomplish these goals, the typical geotechnical investigation should consist of the following:

- A review of historical records of previous investigations and construction of existing facilities.
- A geological site reconnaissance of the proposed alignment, focusing on all key project features, and identification of potential hazards within and adjacent to the alignment.
- A subsurface investigation consisting of an appropriate combination of borings, cone probes, field testing, field instrumentation (such as piezometers or inclinometers), geophysical surveys, and laboratory testing.

As a starting point, utilize existing subsurface information from records and augment that information with additional borings, cone probes and/or geophysical surveys to fill in gaps in the existing information.

Typically, to produce a GDR and GBR to support a 15 to 30% project design, a 50 percent or greater level geotechnical subsurface field investigation (including any existing (historical) borings that can be relied upon) is typically needed relative to a full PS&E level geotechnical investigation for final design as defined elsewhere in the GDM and referenced documents. The actual subsurface investigation conducted for a specific project may vary significantly from this target, however, depending on the uncertainty in the details of the Conceptual Design, the potential for variations in alignments and structure locations, the complexity of the site and project, the availability of preexisting subsurface information, and the potential for risk. As stated above, the level of geotechnical investigation undertaken should be developed collaboratively with the Region Project Office, as well as managers in the Region and in Headquarters as needed, based on the level of risk WSDOT should be taking.

Any new boring logs produced shall be consistent with the requirements in [Chapter 4](#).

The geotechnical investigation may also include an assessment of the potential to encounter hazardous waste, since that potential and its location may be strongly tied to the subsurface stratigraphy and ground water regime. However, Environmental Services, and/or the region, or their consultants, have the lead in such investigations, working as a team with the Headquarters Geotechnical Office to complete that work. From a contract standpoint, it is desirable to “baseline” the hazardous/ contaminated materials/water in the same manner that the geotechnical project attributes are baselined. It is also desirable from a contract standpoint that this hazardous/contaminated materials/water information be consolidated in one place in the contract. The decision of whether this is captured in the GBR or an Environmental hazardous/contaminated materials/water baseline report should be coordinated with Environmental Services.

Regarding historical and subsurface investigations to assess the potential to encounter archeological artifacts, such investigations are conducted through environmental Services, the region, or their consultants. In general, the results of archeological investigations will not be included in the GDR, GBR, and Geotechnical Memoranda for WSDOT DB projects, but are contained in a separate report.

It should be recognized that at the time of the field exploration many of the project Conceptual Design features investigated may not be defined. The geotechnical engineer developing the GBR will have to utilize professional judgment in addition to assistance from the WSDOT project team to assess what project elements for the Conceptual Design are to be investigated and where they will likely be located in order to perform an adequate field investigation. When developing the exploration plan to investigate the project Conceptual Design, or other specific concept alternatives requested by the WSDOT project office, ensure that the plan is sufficient to develop an overall characterization of the project corridor, and also sufficient as a basis for pricing the final Conceptual Design portrayed in the RFP.

Risks to be considered that could require a more detailed investigation than what may be considered typical shall include, but not be limited to, the following:

- Liquefaction and other seismic hazards.
- Very soft soils.
- Areas of previous or potential instability (e.g., Landslides, rockfall, severe erosion).
- Site and soil conditions that may affect constructability.
- High groundwater, or complex groundwater regime.
- Shallow bedrock surface that is highly variable either in depth from the surface or in quality/strength.

The degree of investigation necessary to properly define and allocate these risks depends on the nature of the risk, the amount of detailed geotechnical information needed to mitigate that risk, and the impact such risks have on the potential project costs. To determine the amount of geotechnical investigation required, consider the impact of such conditions on the ability of Proposers to adequately estimate project costs and project staging/scheduling. It will remain up to the Design-Builder to assess the limitations in the exploration program provided in the RFP and perform the requisite explorations to be compliant with the GDM and AASHTO requirements during final design.

22-3 Purpose and Content of the Geotechnical Reports Included in the Contract Documents

In general, this section follows the guidelines provided in Essex, et al. (2007) as published by the American Society of Civil Engineers. As specifically applied to WSDOT DB projects, the geotechnical reports included in the contract documents shall be as described in this section.

Geotechnical Data Report (GDR) – The GDR contains all the factual geotechnical data gathered for the project, and shall be included as part of the project contract. The GDR should contain the following information:

- A description of the geotechnical site exploration program, including any explanatory information needed to understand the boring logs and in-situ field test logs.
- The logs of all borings, logs of other subsurface investigation techniques such as cone or geophysical, test pits, and other site investigations, including any existing subsurface geotechnical data.
- Ground water measurements.

- A description of the geologic and seismic setting for the project corridor (at a regional level).
- Results of all field tests conducted, including description and results.
- Installation details, logs, and measurements results of all geotechnical field instrumentation installed for the project or existing geotechnical instrumentation and measurement results usable for the project.
- A description of all laboratory tests conducted and the test results, as well as any previous geotechnical laboratory test results that are relevant for the project.

Existing boring and other subsurface data that are available within the project corridor should not be included in the GDR unless their level of accuracy is consistent with the new subsurface data obtained for the project. This older data should be included in a separate appendix to the RFP as an historical geotechnical reference document that is available to proposers as background information only, not part of the contract, and not be used to determine differing site conditions.

The GDR may also include subsurface profiles and cross-sections at key locations within the project limits, provided that subsurface data interpretations such as interpolation between borings to develop stratigraphy, as well as the geologic interpretation of the strata, are not done. In this case, boring logs are presented in a way that shows spatial relationships between the borings, but no stratigraphic interpretation of the factual data (i.e., the boring logs) is done. This also applies to the boring logs themselves – the boring logs should not contain geological interpretations of the soil and rock units encountered, but should only present the factual observations and test data.

Alternatively, these subsurface profiles and cross-sections that include the stratigraphic and geological interpretations could be included in a separate geotechnical interpretive report (a Geotechnical Reference document) included in an Appendix to the RFP for information only.

Regarding geotechnical field tests reports for exploration methodologies such as pressuremeter testing or geophysical testing, even though the test report will likely contain an interpretation of the raw test data, such test reports should still be included with the GDR. These test interpretations are fairly standardized and are customarily considered to be factual design data in geotechnical practice.

If there is historical information about past construction, the information should be summarized and included in the GDR, especially, for example, if there were geotechnical impacts such as boulders, high groundwater, soft soils, or documented changed conditions.

Geotechnical Baseline Report (GBR) – The GBR is an interpretive geotechnical document used to establish a common understanding between the contractor and the owner (WSDOT) of the subsurface conditions and their potential impact and effect of risk on the design and construction of the project Conceptual Design.

The primary focus of the GBR is to establish baselines regarding geotechnical subsurface conditions present within the project, but specifically focused on the project Conceptual Design as portrayed in the RFP. These baselines should clearly define the specific geotechnical conditions the DB contractor should consider as the basis for developing their price proposal. These baselines are also used to allocate risk between the owner (WSDOT) and the contractor. The GBR baselines are not intended to be used for final design. The GDR and geotechnical data generated by the Design-Builder are used as the basis for final design. The GBR should not contain design or construction requirements; instead, design and construction requirements belong in the RFP and associated mandatory standards.

When establishing baselines in the GBR, it must be recognized that subsurface conditions are inherently variable, and that variability can translate to design and construction risk. The baseline, however, must be as clear, concise, and measurable as possible, conveying to potential Proposers what to assume about the condition being baselined (i.e., essentially, a “line in the sand”) in a way that all Proposers will understand and interpret consistently. Baselines do not necessarily need to be supported by the available technical data. Baselines are engineering interpretations or assumptions about geotechnical conditions that can affect the design of a project feature or its constructability, expressed as contractual representations of anticipated geotechnical conditions (Essex, et al., 2007). The baseline is intended to resolve, at least contractually, the uncertainty in the geotechnical data or its interpretation. Baseline statements are not required to be factual but should address specific risk elements that WSDOT requires the Design-Builder to address or consider. However, baseline statements should not be overly broad or unrepresentative of the conditions such that the risk allocation is excessively shifted to the Design-Builder. It is important that baselines be as realistic as possible.

WSDOT DB contracts allow changes to occur. These changes could occur during the procurement process by the use and approval of an Alternative Technical Concept, or during contract administration by the use of the project changes to the specifications. Both of these options are administered based on the contract documents and each process may or may not include impacts or changes related to baseline assumptions.

Baseline statements should not be considered applicable to alternate locations of the project features that may be proposed by the Design-Builder, or Work that is not in conformance with the anticipated Work. To define the locations for which the baselines are applicable, contractual baseline boundaries should be established to define the area for which the baselines are applicable. This could either be done based on the project Conceptual Design plan feature locations and maximum offsets from those feature locations, or based on a maximum offset from each boring plus an anticipated variance of strata boundaries relative to each boring, or possibly some combination of the two.

Baselines do not need to be provided for every feature in a project that could require geotechnical considerations (e.g., fills or foundations placed on very dense moist or dry soils, small walls, cuts and fills for which the risk and impact of failure is low). Only the higher risk geotechnical features and issues in a project require baselines. What specifically is to be baselined should be determined collaboratively with the project office, and others as needed. The RFP should be clear that for items not baselined, the Design-Builder assumes the risk for bid and design assumptions as well as constructed means, methods, and sequences.

Where possible, baselines should be location and, as much as possible, stratigraphic unit specific, and applicable to the type(s) of construction anticipated with consideration to the Conceptual Design for the project. However, baselines should also avoid getting into specific means and methods. For example, where the need for deep bridge foundations exists in the Conceptual Design for the project, and loose wet sand is present, the baseline should alert proposers that caving conditions are present that may need to be considered. However, the baseline should not tell the proposers to assume that full depth casing will be required to get through the caving soil. An exception to this is possibly to baseline types of construction that are likely to not be successful given the soil/rock conditions. For example, use of sheet piles that must be driven into a soil unit that is very dense or hard, or bouldery, or use of sump pumps in excavations where very permeable water bearing strata will be intersected.

In order to have baselines tied to specific subsurface conditions, a description and depth of soil and rock strata encountered in the borings should be provided. Typically, soil and rock strata locations in each boring can be summarized in a table of specific, interpreted, strata boundary locations in each of the borings. It must be clear that these strata locations are to be used only with respect to the baselines (i.e., these are Baseline Stratigraphic Units, or BSUs), and the proposers should expect the potential for those specific soil and rock strata and their depths will need adjustment for final design once the selected proposer conducts the final geotechnical explorations for the project. Stratigraphic units should not be identified in the boring logs themselves, as the additional subsurface explorations conducted by the Design-Builder for final design could require some adjustments to the stratigraphy.

Stratigraphic profiles or cross-sections in which the boring log specific BSUs discussed above are connected together to provide an overall two-dimensional stratigraphy should not be provided in the GBR. However, if the location, depth, or thickness of a high risk soil stratum in the vicinity of a specific Conceptual Design project feature such as a bridge is highly variable, the geotechnical engineer developing the GBR may need to consider including an assumed depth/location/thickness of the stratum in the baseline. This will be a risk allocation decision and as such, agreement between the Geotechnical Office, the region project design office, and possibly other offices such as Headquarters Construction and the Bridge Office should be sought before including this type of baseline in the GBR.

For project features such as walls and major cuts or fills that are not well defined and subject to significant changes relative to the project Conceptual Design, it may not be feasible to establish locations of BSUs that are specific enough to establish BSU specific baselines. In such cases, it may not even be possible to establish specific baselines, other than for known unstable areas such as landslides, or known locations of obstructions.

The baselines may draw upon data in the GDR as well as in geotechnical reference documents (see [Section 22-5](#)). However, the GBR should not specifically reference Geotechnical and other related Reference Documents that are not contractual.

Specific subject areas where baselines may be developed typically include the following, depending on the Conceptual Design and the nature of the project:

- Bridge foundation issues
- Bridge abutment and approach fill issues
- Retaining wall issues

- Seismic design issues, including liquefaction and its effects
- Embankment stability and settlement
- Cut stability
- Stormwater infiltration facilities
- Unstable slope issues and potential mitigation issues
- Ground improvement issues
- Utility impacts
- Noise wall foundation issues
- Groundwater issues
- Excavation and shoring issues, including potential dewatering issues
- Use of excavated materials
- Impact of poor ground, other than as specifically addressed above
- Known and potential obstructions
- Contaminated soils, though this is usually handled separately

In general, geotechnical design parameters (e.g., soil friction angles, earth pressures, permeability values) should not be baselined. If there is a significant risk issue associated with the selection of a geotechnical design parameter that WSDOT cannot afford to be determined by the Design-Builder as the Engineer of Record, the specification of such design parameters shall be approved by the State Geotechnical Engineer and the WSDOT project managers. These geotechnical design parameters should be described or defined in the RFP Section 2.6, and not in the GBR. Examples of this include the seismic ground response parameters for a given site, what soils are to be considered liquefiable, high risk troublesome soils such as glacialacustrine soils as described in GDM [Section 5-13.3](#), high risk landslide deposits, etc. This may be especially important for situations where the geotechnical designer has to use considerable judgment in establishing the design parameters, or where the design procedures and standards of practice are poorly defined.

For extremely large, complex projects, or for specific features that are long and/or uncertain as to their specific location, size, and extent of the geotechnical work needed, it may be too unwieldy to develop specific baselines for everything in the project that have significant geotechnical risks. In that case, the effort and costs expended to develop the GBR need to be strategic so that the most costly risks are addressed in enough detail to clearly apportion those risks. This strategy should be developed in collaboration with the project office and program managers. If it appears necessary to “scale down” the GBR baselines to accommodate these situations, this shall be done in consultation with the State Geotechnical Engineer and the Deputy State Construction Engineer as early as possible in the project, so that there is adequate time to make the course corrections needed for approval of the GBR baseline approach by the State Geotechnical Engineer and the Deputy State Construction Engineer to be obtained so that project development delays are avoided.

See Essex, et al. (2007) for additional guidance on developing GBRs, and their contents.

22-4 Geotechnical and Other Reference Documents

Geotechnical reference documents include interpretive or informational documents that should be made available to bidders, but that should not be considered part of the contract documents. Such documents include, but are not limited to, the following:

- Geotechnical interpretive reports containing results of preliminary geotechnical design used to establish the feasibility of the project design concept and to help quantify geotechnical risks.
- Interpretive geotechnical background information that was used to assess the feasibility of the project Conceptual Design or which could be used by Design-Builders as background information in support of their geotechnical design activities (e.g., geologic stratigraphy).
- As-built information for existing facilities within or adjacent to the project corridor that may or may not be directly affected by the project.
- Detailed construction records for existing facilities within the project corridor.
- Historical information about the project corridor.

The RFP could include as-built information and detailed construction records for existing facilities within the project corridor. In general it has been WSDOT policy to place the risk for the accuracy of as-built documents on the Design-Builder. Therefore, it is important from a contract interpretation standpoint where the as-built information is included in the RFP (e.g., in an appendix), and how it is identified in the RFP. In general, as-built information should not be included in the GBR or GDR, because doing so would place the risk of their accuracy and completeness on WSDOT.

Preliminary geotechnical engineering to develop the Conceptual Design and evaluate its feasibility during the contract development phase should be conducted. Since this is interpretive information developed for the purpose of developing the DB project documents, this information should not be included as part of the contract, but should be made available to Proposers as informational via a reference document.

The focus of any geotechnical analysis or design conducted to develop a DB project should be to evaluate feasibility, and to assess the risk of bidders having wide swings in their bids due to geotechnical issues that have not been adequately defined. For example, if shafts or piles are proposed as foundations for a bridge, the specific foundation loads will not be known accurately enough during GBR and RFP development to determine foundation depths and sizes. Therefore, detailed analysis of foundation skin friction and end bearing resistance would be of little use. The Design-Builder would have to redo such calculations during final design anyway. What is of more use is whether or not shaft or pile foundations are feasible to install, considering impacts to adjacent facilities, ability for equipment of sufficient size to access potential pier locations, etc.

Typically, preliminary geotechnical design to assess feasibility and risk associated with the project Conceptual Design will consist of one or more of the following preliminary geotechnical design activities:

- Feasibility of proposed alignments with consideration to feasible slopes or need for walls, and the potential impact of those fill or cut slopes and walls on adjacent facilities.
- Structure foundation feasibility and risk, and potential impacts to adjacent facilities.
- Conceptual seismic hazard assessment, including site specific ground motion studies (if appropriate for the site and project scope) and the potential for liquefaction and associated seismic hazards caused by liquefaction.
- Preliminary assessment of other existing or potential geologic hazards such as landslides, rockfall, debris flows, etc., as well as the conceptual feasibility of mitigation strategies.
- Potential need for ground improvement to stabilize unstable ground, liquefaction, and excessive settlement, including the feasibility of various ground improvement techniques and their potential impact on adjacent facilities.
- Whether or not on-site materials will be usable as construction materials.
- Feasibility of site conditions present to infiltrate runoff water.
- Need for dewatering, its feasibility, and its potential impact to adjacent facilities.
- Any other preliminary geotechnical design activities needed to assess risks, to help establish baselines that will be included in the GBR, to ensure feasibility of the project Conceptual design, and to assist the WSDOT project office to develop an engineer's estimate for the project.

If there is potential for soil liquefaction at the site, a preliminary assessment of the depth and extent of the liquefiable soils should be considered. A preliminary assessment of the feasibility of potential mitigation schemes may also be considered, as well as an assessment of the impact of liquefaction on the proposed project features, depending on the impact to project feasibility. A more detailed liquefaction investigation and hazard assessment may need to be included in the contract documents to ensure bidding consistency if one or more of the following is true:

- The liquefaction hazard could affect the decision on whether to widen or replace an existing bridge or similar structure.
- The design assumptions and parameters needed to make that liquefaction assessment could vary significantly between proposers such that the project scope could vary significantly (e.g., some proposers feel no stabilization is needed, while others feel that stabilization is necessary or the bridge must be replaced rather than widened).

Similarly, for complex site conditions and large, important structures, it may be necessary to include the results of site specific seismic ground motion or seismic hazard studies in the contract documents rather than just as informational geotechnical reference documents (see [Section 22-6](#)).

22-5 Geotechnical RFP Development

The geotechnical portions of the RFP should rely heavily upon the GDM and the AASHTO Bridge Design Specifications. Since the GDM must function as both a practice manual for in-house staff and WSDOT's geotechnical consultants and as a contract document for DB projects, the RFP should clarify how to interpret the GDM for the purposes of the DB contract, to fit the GDM within the context of the project specific contract. Furthermore, the GDM may not cover every geotechnical design situation needed in the DB project, and the RFP may need to include additional design provisions not covered by the GDM, AASHTO, or other available design specifications or manuals. The RFP essentially is contractually establishing the geotechnical engineering design requirements for the DB project.

Table 1-2, defines words used in the GDM to convey design policy (e.g., "should," "shall," "may"). These words also have important contractual implications in the RFP for conveying whether or not the Design-Builder has any options with regard to the specific design requirement. The GDM also identifies design policy issues and options that require specific approval from the State Geotechnical Engineer and/ or Bridge Design Engineer. In such cases, as it applies to DB contracts, the Design-Builder should assume that design provisions requiring approval from the State Geotechnical Engineer and/or the Bridge Design Engineer are not approved, but can only be considered through the Alternative Technical Concepts (ATC) process. Since these address design policy issues, the State Geotechnical Engineer and/or Bridge Design Engineer in this context are not to be considered equivalent to the designer of record for the DB contractor, as decisions on these policy issues are not within the authority of the Engineer of Record.

The GDM is written to augment or supersede the AASHTO Bridge Design Specifications; therefore, if there is an apparent conflict between the GDM and the AASHTO specifications or other referenced documents, the GDM should be considered to be higher in the order of precedence than the AASHTO specifications or other referenced design documents.

With regard to the geotechnical conditions (not design and construction requirements), the GBR should be considered to be highest in the order of precedence in the RFP.

22-6 Geotechnical Investigation During RFP Advertisement

Often with DB, specific project elements cannot be reasonably defined at the time the contract documents are produced. To help minimize contingency costs in the bids and limit risk, it may be desirable to perform supplemental geotechnical investigations after the RFP has been advertised (while the bidders are preparing proposals) to augment the GDR and GBR. Whether or not supplemental geotechnical investigations should be completed during the RFP process is determined by mutual agreement between the State Geotechnical Engineer and Region/Headquarters management prior to advertisement of the RFP. The defined term for this in the RFP is as follows: Supplemental Geotechnical Data Report (SGDR). The Contract Document developed pursuant to ITP Section X.X.X, that contains factual subsurface data collected prior to the Proposal Date, and which is included in Appendix XX. Should supplemental investigation occur, the short-listed Proposers should submit requests for additional information including locations and depths of borings. The State will evaluate the requests and develop an exploration program that eliminates duplication of borings in specific locations. Doing

this will eliminate potential conflicts between Proposers, unwanted congestion due to the presence of multiple sets of drilling rigs and multiple crews, and to excessive costs through elimination of duplicated efforts. An example of Instructions to Proposers (ITP) language for a supplementary boring program is provided in [Appendix 22-A](#).

Once the supplemental boring program is completed, the new subsurface data should be included in the GDR through a contract addendum. If the supplemental borings conflict with the GBR, an amendment to the GBR should be developed by the Headquarters Geotechnical Office or the WSDOT Geotechnical Consultant who developed the GBR and included as an addendum to the contract.

22-7 Geotechnical Support for Design-Build Projects During RFP Advertisement and Post-Award

Regarding the geotechnical review of proposals, the focus of this geotechnical support is to evaluate geotechnical aspects of the Proposal in terms of the scoring criteria spelled out in the Instructions to Proposers. Whether or not geotechnical review of bidder proposals is required will depend on the importance and complexity of the geotechnical issues in the project, and if there are any scoring criteria focused on geotechnical issues. Alternative Technical Concepts (ATCs) may also be proposed during the bidding phase. Similarly, the geotechnical support needed includes the assessment of the technical adequacy of the ATC relative to the contract design documents, or that at least the ATC will provide a level of quality that is equal to or better than the contract Conceptual Design and that is consistent with accepted design practice which in general is defined by the RFP.

Once the contract is awarded, geotechnical oversight by the owner (WSDOT) is required to ensure that the final design and its construction meet the contract requirements. This geotechnical oversight is also needed to address unanticipated site conditions (see Differing Site Conditions clause in 1-04.7 of the RFP, i.e., Request for Proposals, in WSDOT projects) and potential ambiguities in the contract specifications, if such problems occur.

From this point forward, owner (WSDOT) geotechnical support is focused on review of contractor design and construction submittals and assisting the project office with oversight to verify that the Design-Builder is appropriately addressing geotechnical design or construction problems as they come up, in accordance with the contract. The geotechnical support person must become intimately familiar with the RFP and referenced contractual documents, as those documents dictate the focus of the geotechnical submittal reviews. The geotechnical support person must consider themselves to be a member of the WSDOT project team, and the findings of their review activities are therefore provided to the WSDOT project managers for implementation. The goal is to provide the WSDOT project management with a technical assessment as to whether or not the Design-Builder met the contract technical requirements, verifying that their Quality Control/Quality Assurance (QC/QA) program with regard to geotechnical issues is being properly implemented and is effective in producing a geotechnical design that meets the contract requirements. The purpose of the geotechnical review is not to provide the DB contractor with QC/QA of their design, as the contractor is responsible for their design QC/QA.

Ordinarily, the DB Contract Technical Requirements will require the Design-Builder to define a process in their Quality Management Plan for recording, logging, tracking, responding to, and resolving WSDOT design review comments. This process is managed by the Design-Builder. Geotechnical comments should be incorporated into this process.

Designer preferences, or differences in opinion between the reviewer's and the Design-Builder's judgments/assumptions, etc., are generally not relevant to these reviews. The focus must be on compliance of the geotechnical design/construction with the contract requirements.

This does not mean that the geotechnical support person is conducting these reviews only at the "30,000 foot level." There may be times when the geotechnical support person must do a comparative design to figure out if the contractor's submittal does meet the contract intent. But in other cases, an evaluation based on the reviewer's geotechnical engineering experience may be sufficient. If problems in the design start to repeat themselves, this may be an indication that either the contractor is not interpreting the contract in a way that is consistent with how WSDOT is interpreting it, or the contractor's design QC/QA is not fully functional. In such cases an oversight review (i.e., a Quality Verification, or QV, review) of the Design-Builder's QA/QC process should be conducted, documenting the review in the Construction Audit Tracking System (CATS), and issuing Non-conforming Issue Reports (NCIs) as appropriate so that the problem can be properly addressed within the provisions of the contract.

The geotechnical support person may also be involved in over-the-shoulder reviews and design task forces of the Design-Builder's work as it progresses. The purpose of such reviews and involvement in the task forces is to not provide design QC/QA or technical direction to the Design-Builder, but simply to work in a cooperative manner with the Design-Builder to head off problems in the design before they get too far along, keeping in mind that the focus is on meeting the contract requirements.

There may be cases where the site conditions encountered by the contractor through additional subsurface explorations or during construction appear to differ from those in the contract documents. Just like any other potential differing site conditions situation, the geotechnical support person should be working with the project management team and Headquarters Construction Office to provide a technical assessment of the claim.

22-8 References

Essex, R. J., 2007, *Geotechnical Baseline Reports for Construction – Suggested Guidelines*, ASCE, Reston, Virginia, 62 pp., <http://cedb.asce.org/cgi/wwwdisplay.cgi?0710539>.

22-9 Appendices

[Appendix 22-A](#) Example Supplemental Geotechnical Boring Program ITP Language

Appendix 22-A Example Supplemental Geotechnical Boring Program ITP Language

Language that may be used in the ITP regarding the availability of a supplemental boring program is provided below. Note that in the first paragraph, this example language allows up to 5 borings to be selected by each of the proposers (typically, three proposers), though for proposed borings that are in close proximity of one another, borings may be combined. This number of supplemental borings (up to $3 \times 5 = 15$ borings) would typically apply to larger, more complex projects. A smaller number of borings could be used for smaller less complex projects. Ultimately, the number of supplemental borings is a project-specific decision that is made jointly between the Geotechnical Division and the project team.

22-A-1 Supplemental Geotechnical Data Report

Each Proposer is entitled to obtain certain additional geotechnical information by means of a Supplemental Geotechnical Data Report that WSDOT will conduct at WSDOT's own expense. Under the Supplemental Geotechnical Data Report, Proposers may request WSDOT to perform up to five additional test borings and to provide an analysis of the resultant samples.

A request under the Supplemental Geotechnical Data Report must be submitted no later than the Request for Supplemental Boring Deadline set forth in this ITP. Each request shall set forth the location (by station and offset) and highest bottom elevation of the requested borings. Each request shall also include specific requests regarding the frequency and depth of field vane tests; the locations of split-spoon samples and Standard Penetration Tests; the length and diameter of rock cores; the depth of disturbed samples, undisturbed samples, and rock cores sought by the Proposer; and the tests the Proposer desires WSDOT to conduct in relation to the sample gathered.

WSDOT will make reasonable efforts to comply with Proposers' requests under the Supplemental Geotechnical Data Report, but is not obligated to conduct borings at the precise locations requested. To the extent boring locations requested by one or more Proposers are within 20 feet of each other, the locations will be averaged and only one test boring will be conducted. If a Proposer's boring is averaged with another Proposer's boring, neither Proposer will be allowed an additional boring for this supplemental boring program. Survey personnel provided by WSDOT will establish the boring locations and elevations. A qualified inspector working for WSDOT will inspect the borings. WSDOT staff or an independent, qualified drilling contractor will perform the borings. At the option of the Proposers, each Proposer may dispatch a maximum of one person to observe the drilling, sampling, testing, and coring, and shall coordinate transportation of the chosen observer to the drilling site with WSDOT. The Proposers' on-site observers shall not interfere with the operation of the surveyor, driller, or inspector.

The WSDOT drill crew or drilling contractor will conduct the following sampling and testing:

- Split-spoon samples and Standard Penetration Tests at 5-foot intervals and every change in stratum.
- Minimum NQ-size rock cores.
- Minimum 10-foot rock cores with RQD.
- Field vane shear tests in soft clays.
- Electronic cone penetrometer testing.
- Conventional laboratory classification testing on disturbed soil samples.
- Conventional laboratory tests on rock samples.
- Such other tests requested by a Proposer and agreed to by WSDOT at WSDOT's sole discretion.

WSDOT will perform the test borings in whatever manner or sequence it deems appropriate at WSDOT's sole discretion. The Supplemental Geotechnical Data Report, including the final boring logs and laboratory test results, will be provided to all Proposers according to Section 1 of this ITP and is included as Appendix G9 of the RFP. To the extent not consumed by testing, the samples resulting from the Supplemental Geotechnical Data Report will be turned over to the Design-Builder immediately after the Contract is awarded.

WSDOT makes no representation as to whether the Supplemental Geotechnical Data Report will be sufficient for the Proposer to prepare its Proposal. Each Proposer must make this determination independently based upon its own independent judgment and experience. Failure by a Proposer to submit a request for test borings under the Supplemental Geotechnical Data Report constitutes a conclusive presumption that the Proposer has determined that it does not require any additional geotechnical data to properly design, construct, and price the Work, or that it will obtain any necessary geotechnical data at its own expense using its own forces. If permits are required for supplemental borings (in addition to those permits already required for the Project), WSDOT may not be able to permit the borings within the deadline.