

INSPECTION TECHNICAL PROCEDURE

I-112

GEOTECHNICAL/FOUNDATIONS INSPECTION

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Table of Contents

1.0 PURPOSE..... 1

2.0 OBJECTIVES..... 1

3.0 INSPECTION REQUIREMENTS 2

 3.1 Adequacy and Effectiveness of Programs and Procedures..... 2

 3.2 Adequacy and Effectiveness of Construction Activities 2

 3.3 Adequacy and Effectiveness of the Training and Qualifications of Personnel 3

 3.4 Adequacy and Effectiveness of the System of Records..... 3

4.0 INSPECTION GUIDANCE 3

 4.1 Adequacy and Effectiveness of Programs and Procedures..... 3

 4.2 Adequacy and Effectiveness of Construction Activities 5

 4.3 Adequacy and Effectiveness of the Training and Qualification of Personnel 6

 4.4 Adequacy and Effectiveness of the System of Records..... 6

5.0 REFERENCES 6

6.0 LIST OF TERMS..... 7

INSPECTION TECHNICAL PROCEDURE I-112, REV. 1 GEOTECHNICAL/FOUNDATIONS INSPECTION

1.0 PURPOSE

The development of engineered foundations for safety-related structures ensures that the structures will function as the designer intended during all anticipated transient and normal loading situations. There are requirements and related documents that are incorporated into the Contractor's limited construction and construction plans for ensuring that engineered foundations are constructed in accordance with committed standards. These requirements are found in the Safety Requirements Document (SRD), the Quality Assurance Manual (QAM), and other related documents. The design is translated into drawings and construction specifications that describe the details of foundation construction and verification.

This inspection procedure assesses the adequacy and effectiveness of:

- Construction implementing procedures
- Construction activities
- Training and qualification of personnel
- System of records.

2.0 OBJECTIVES

This procedure verifies the Contractor's development and implementation of effective programs for: (1) implementing commitments regarding foundation construction; (2) managing and providing oversight to ensure that foundation construction and quality control (QC) have been adequately addressed by specifications, drawings, and procedures; and (3) managing and providing oversight to ensure that the "as-constructed" condition of the foundation structure is in accordance with the design.

This inspection procedure is a component of a complete construction inspection program. This and other inspection procedures will be used as necessary to provide assurance that construction activities are conducted as required by authorization basis commitments and Contractor procedures. Although it is expected a significant portion of this procedure will be accomplished at least once for each major Contractor/subcontractor involved with the activities addressed by this procedure, it is not expected the entire procedure will be completed during any one inspection and/or every time the inspection procedure is used.

3.0 INSPECTION REQUIREMENTS

3.1 Adequacy and Effectiveness of Programs and Procedures

- 3.1.1 The inspector should verify all Contractor/subcontractors with responsibilities in the area of safety-related foundation construction have approved implementing procedures that describe administrative controls, work processes, and inspection requirements implementing the design requirements. The procedure review should include verifying that the implementing procedures contain the major aspects of foundation construction as set forth in steps 3.2.1 through 3.2.6 below. (QAM, Policy Q-05, Sections 3.1.1 and 3.3; ISMP, Table 1-3, item 5; and SRD, Safety Criterion (SC) 4.1-2 and 7.3-5)
- 3.1.2 The inspector should verify that: (1) the procedures prescribe adequate methods of QC inspection to ensure that the “as-built” condition of the foundations meets specified engineering requirements and drawings, (2) the documents include or reference appropriate quantitative or qualitative acceptance criteria for determining that the prescribed activities have been accomplished satisfactorily, and (3) the equipment used for process monitoring or data collection is calibrated and maintained as part of the procedure requirement. (QAM, Policy Q-05.1, Section 3.5.1, and Policy Q-12.1, Sections 3.1.2 and 3.2; ISMP, Table 1-3, items 5 and 8; and SRD SC 4.1-2, and 7.3-7)
- 3.1.3 The inspector should verify that the Contractor has established procedures for ensuring that craft and QC inspection personnel performing quality-related foundation installation and testing activities are qualified to perform their assigned work. (QAM, Policy Q-02.2, Section 3.3.2; and ISMP, Table 1-3, item 2)

3.2 Adequacy and Effectiveness of Construction Activities

The inspector should verify that foundation construction work is accomplished under controlled conditions using approved instructions, procedures, and checklists prepared at a level of detail appropriate to the circumstances. (QAM, Policy Q-05.1, Section 3.1.1; SRD, SC 4.1-2 and 7.3-5; and ISMP, Table 1-3, item 5)

The major aspects of foundation construction work that should be verified are as follows:

- 3.2.1 Excavation activities.
- 3.2.2 Preparing the excavation for placement of backfill.
- 3.2.3 Placing backfill into the excavation.
- 3.2.4 Compacting the backfill.
- 3.2.5 Testing compacted backfill material.
- 3.2.6 Controlling excavation drainage to preclude degradation of compacted backfill.

3.3 Adequacy and Effectiveness of the Training and Qualifications of Personnel

The inspector should verify that the craft, testing, and quality assurance (QA)/QC personnel involved in foundation construction and inspection activities are qualified to perform their job functions. (QAM, Policy Q-02.2, Sections 3.3.1, 3.2.2, and 3.3.3; and SRD, SC 7.3-3)

3.4 Adequacy and Effectiveness of the System of Records

The inspector should verify that the records of foundation excavation, backfill, and testing are as specified, and reviewed by the Contractor for accuracy and assurance that the recorded information meets project requirements, are approved, and sufficiently stored and maintained to support technical and contractual regulatory requirements. (QAM, Policy Q-17.1, Sections 3.1.2, 3.3.1 and 3.6.1; SRD, SC 4.0-3, 4.1-2, and 7.3-4; ISMP, Section 8 and Table 1-3, item 4)

4.0 INSPECTION GUIDANCE

For each inspection element, the inspector should: (1) obtain a copy of the Contractor's procedures and the related industry codes and standards committed to by the Contractor, (2) become familiar with the contents of the procedures and standards, and (3) assess whether the procedures and implementation of the procedures adequately conform to the applicable commitments. The inspector should use judgement in determining sample selection, focusing on examination of the most important aspects of the particular activity being inspected. The intent is to establish a high level of assurance that the end product meets requirements.

4.1 Adequacy and Effectiveness of Programs and Procedures

4.1.1 The inspector should review the implementing procedures for safety-related foundation construction to ensure that approved procedures specify the work processes, inspection requirements, and management controls for the various construction activities described in Sections 3.2.1 through 3.2.6 above. Specific areas of importance for each of these sections is described below.

In the area of excavation, assess if there are provisions to establish whether excavated material is acceptable for backfill, and to segregate acceptable material from unacceptable material. If the provisions for material acceptability determination require compaction testing, the inspector should determine whether the testing is specified and accomplished as required by industry standards (e.g., American Society for Testing and Materials [ASTM] Standard D 3740, D 2922, and D 3017 (SC 4.1-2)) The inspector should determine whether provisions are included to ensure that the area and depth of excavation, specified by the design drawings, are accomplished in the field.

In the area of preparation of the excavation for placement of backfill, the inspector should determine whether the design requires any special surface preparation prior to backfill placement and whether the procedure addresses the design requirements.

In the area of placement of backfill into the excavation, determine whether the procedure establishes measures to ensure that only acceptable backfill will be placed and, if compaction is required, the inspector should specify the maximum thickness of each lift prior to compaction activity. The procedure should provide acceptance criteria for the slope of the edges of the compacted backfill.

In the area of backfill compaction, the inspector should determine whether the procedure specifies criteria for the conduct of compaction activities (e.g., the type of equipment to be used as compactors, how many passes of compaction should be used by the operator, and/or speed of travel for the compactors). The inspector should determine whether the procedure specifies those actions to be taken and verified prior to placing the next lift (e.g., testing the compacted backfill to ensure that the surface is sufficiently compacted and the applicable acceptance criteria were met).

In the area of testing of compacted backfill material, the inspector should determine whether the procedure specifies the soil attributes to be tested and whether the testing is required to be conducted in accordance with established industry standards (e.g., ASTM Standard D 3740, D 2922, and D 3017 (SC 4.1-2))

In the area of drainage control, the inspector should determine whether measures are established to ensure that the compacted surface will not be degraded by water accumulation.

- 4.1.2 The inspector should determine: (1) whether the procedures provide for adequate QC inspections and inspection methods to ensure that the activities of Sections 3.2.1 through 3.2.6 are completed in accordance with drawing and procedure requirements, (2) whether the procedures provide planned QC inspections for in-process activities and define acceptance and performance criteria, and (3) whether the procedures require that test equipment or instruments used for inspection performance are calibrated to standards traceable to industry-recognized criteria (e.g., the National Bureau of Standards, **Not Committed**).

In the area of excavation, the inspector should determine whether measures are provided to verify that stockpiled material for backfill use conforms to acceptance criteria.

In the area of preparation of the excavation for placement of backfill, the inspector should determine whether measures are established to verify acceptable subsurface preparation completion, as required by design drawings.

In the area of placement of backfill, the inspector should determine whether measures are established to verify that acceptable backfill material is used, the conformance to lift thickness acceptance criteria, and that the slope of the backfill edges conforms to acceptance criteria.

In the area of backfill compaction, the inspector should determine whether measures are established to verify conformance to compaction equipment requirements, the number of compaction passes, and compactor speed criteria. Also, the inspector should determine

whether measures are established to verify the readiness of the next backfill lift and the acceptability of compaction verification test data.

In the area of testing of compacted backfill material, the inspector should determine whether measures are provided to verify that the required testing was completed in accordance with referenced ASTM specifications and that the test data conform to specified acceptance criteria.

In the area of drainage control, the inspector should determine whether measures are provided to verify the acceptable implementation of drainage control provisions.

- 4.1.3 The inspector should review the procedures establishing the requirements for the qualification of craft and inspection personnel, and determine whether the procedures conform to the authorization basis requirements.

4.2 Adequacy and Effectiveness of Construction Activities

Before performing work observation inspections in the field, the inspector should review the procedures and industry standards applicable to the work that will be observed. This will ensure familiarity with the requirements and acceptance criteria pertinent to the planned observations. During the field observations, the inspector should carry a copy of the sections of the procedure and industry standards pertinent to the planned observations and verify that work is being accomplished using the proper revision of the respective procedure.

During the field observations, the inspector should interview and obtain the names of a sample of craft and QC personnel performing the observed activities to assess whether job and procedure knowledge is satisfactory. Information on these same personnel will be used pursuant to Section 4.3 below to determine the adequacy of their experience and training.

- 4.2.1 The inspector should observe portions of the excavation activities to verify conformance to procedure requirements. In particular, the inspector should ascertain that material acceptable for subsequent backfill is segregated from unacceptable material, the specified testing activities are used to determine whether the excavated material is acceptable for backfill, and the dimensions of the excavation conform to design drawings. The inspector should observe in-process testing activities to determine whether these are conducted in accordance with procedure requirements.
- 4.2.2 Following excavation activity and to verify conformance with procedure requirements, the inspector should observe the activities to prepare the bottom surface of the excavation for the placement of backfill and the QC inspections to verify subsurface acceptance criteria.
- 4.2.3 The inspector should observe portions of backfill placement activities to ascertain that acceptable backfill is used, and that lift thickness requirements are accomplished and verified. The inspector should ascertain that the slope of the backfill surface edges conforms to specified requirements and should observe Contractor verification activities.

- 4.2.4 The inspector should observe portions of backfill compaction to ascertain whether the equipment used, the number of passes, and the speed of travel conform to specified requirements. In addition, the inspector should verify that the actions required by the procedure are accomplished, as required, before the next lift.
- 4.2.5 The inspector should observe in-process testing activities, used to verify acceptable compaction prior to placement of the next lift, to ascertain whether the testing activities conform to procedure requirements. In-process testing to control fill placement is usually via density and moisture tests. Acceptance usually will be in terms of some percentage of the maximum dry density (usually 95%) and a moisture content within some percentage of optimum (usually 2%).
- 4.2.6 The inspector should ascertain that drainage control measures are executed and verified to conform to drawing and procedure requirements.

4.3 Adequacy and Effectiveness of the Training and Qualification of Personnel

During the observation of work activities (Section 4.2 above), the inspector should carry a copy of the procedures that specify the Contractor's requirements for education and experience levels, training, and certification. The inspector should interview four craft and four QA/QC personnel involved in the performance of foundation-related activities, and record which jobs they were performing. The inspector should verify that the personnel are sufficiently knowledgeable of procedure requirements. The inspector also should review the training and qualification records for those individuals to determine if they meet requirements.

4.4 Adequacy and Effectiveness of the System of Records

The inspector should select a sample of the records that were generated during the conduct of excavation, backfill, compaction, and testing activities, and the records of qualification for those craft and QA/QC personnel selected during the performance of Section 4.3 above. The inspector should verify that the records selected for examination were approved by the proper authority, and were stored and maintained in such a manner to demonstrate conformance with procedure requirements.

5.0 REFERENCES

ASTM Standard D 3740, *Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.*

ASTM Standard D 2922, *Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).*

ASTM Standard D 3017, *Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods.*

Integrated Safety Management Plan, BNFL-5193-ISP-01, Bechtel National, Inc., Richland, Washington, 2001.

Quality Assurance Manual, 24590-WTP-QAM-QA-01-001, Revision A, Bechtel National, Inc., Richland, Washington, 2001.

Safety Requirements Document, BNFL-5193-SRD-01-02, Bechtel National, Inc., Richland, Washington, 2001.

Uniform Building Code, International Conference of Building Officials, Pasadena, California, 1997.

6.0 LIST OF TERMS

ASTM	American Society for Testing and Materials
QA	quality assurance
QAM	Quality Assurance Manual
QC	quality control
SC	Safety Criterion
SRD	Safety Requirements Document

Attachments: None

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