SECTION 02254

SHEETING AND SHORED EXCAVATIONS

PART 1 - GENERAL

1.1 Summary

A. Work under this Section consists of furnishing, placing, maintaining and subsequently removing, to the extent required, a positive system of temporary supports for cut and cover, open cut, and trench excavations, including bracing, dewatering, and associated items to support the sides and ends of the excavations. The support system shall prevent lateral and vertical ground movements which will cause damage to buildings, structures, pavements, utilities, and any other adjacent improvements.

B. The excavations for the structures shall be made vertical and shored according to this Section. The Contractor shall construct sheeting and shoring to construct all structures and protect all existing structures, improvements, aboveground utilities, and below-ground utilities.

C. Contractor shall make his own assessment of existing conditions including adjacent property, the possible effects of his proposed temporary works and construction methods, and shall select and design such support systems, methods, and details as will assure safety to the public, adjacent property, and the completed Work.

D. The positive system of support may consist of soldier piles and lagging, sheet piling, or other methods as may be approved by Engineer; secured in place by means of bracing members which may include wales, struts, tieback anchors, or similar members. A trench box is not considered a positive means of support and will not be permitted.

E. Utility modification or relocation shall be performed by Contractor at no additional cost to Owner or Engineer, if existing utilities interfere with Contractor's proposed method of support.

F. Related Work Specified Elsewhere:

Earthwork .....Section 2200
Trench Excavation and Backfill .....Section 2300
Excavation, Filling, and Backfilling for Structures .....Section 2321

1.2 Quality Assurance

A. Reference Standards and Specifications:

1. American Society for Testing and Materials (ASTM):

ASTM A36/A36M - Carbon Structural Steel.

ASTM A328/A328M - Steel Sheet Piling.

2. American Welding Society (AWS):

D1.1 - Structural Welding Code, Steel.

3. American Institute of Steel Construction (AISC):

Manual of Steel Construction.

1.3 Submittals and Construction Records

A. Submittals:

1. Submit as specified in Section 1330.

2. Preliminary Shoring Report:

a. A Preliminary Shoring Report outlining the entire scope of the Contract shoring to the specified requirements shall be prepared by or under supervision of Contractor's shoring engineer. The Preliminary Shoring Report shall be submitted for Owner and Engineer review in accordance with Section 1330 prior to the commencement of any shoring work.

3. Working Drawings:

a. Working drawings, by a licensed professional engineer, shall be submitted for Owner and Engineer review in accordance with Section 1330 prior to the commencement of work on each individual item of shoring.

b. The following shall be included on the working drawings:

(1) Details, arrangement, and method of assembly of the proposed system.

(2) The method of bracing and preloading.

(3) The full excavation depth.

(4) Loads for various stages of bracing removal during concrete placement and backfilling.

(5) The anticipated lateral earth pressure, hydrostatic pressure, utility, rail, traffic, and equipment loads.

(6) The maximum design load to be carried by the various members of the support system and a tabulation of the required preloads.

(7) The depth to which the support system will be installed.

(8) The proposed sequence of strut and shore removal as applicable and as related to concrete placement and backfilling operations.

(9) Proposed monitoring plan, including location of monitoring points, inclinometers, and seismographs.

c. Complete design calculations and the maximum theoretical deflections of the support members shall be included.

d. Existing utility facilities shall be included and, after checking their locations by field investigations, the working drawings shall be revised to show the actual locations of facilities, location of excavation supports, interference with the proposed Work, and how Contractor proposes to overcome these interferences.

e. Documents provided with evidence of an Arizona State registered Professional Engineer's seal, signature, and date.

f. Welder certificates signed by Contractor certifying that welders comply with requirements under "Quality Assurance" Article.

g. Qualifications of vibration monitoring firm.

B. Construction Records:

1. The summary of monitoring data prepared by Contractor's shoring engineer shall be submitted for Owner and Engineer review on a weekly basis.

2. Results of pre-excavation survey prior to any excavation.

1.4 Qualifications

A. Contractor and his subcontracted shoring engineer shall furnish evidence of having successfully completed one project that meets the following criteria:

1. Equal or larger total linear footage of sheeting or shoring for one project of similar scope and conditions.

2. Complete within the specified contract time.

1.5 Dewatering

A. Dewatering plan shall be based on the criteria specified in Section 2300.

1.6 Protection

A. Sheeting and Shoring: Provide shoring, sheeting, and bracing as indicated or required. Meet the following requirements:

1. Prevent undermining of pavements and slabs. Remove and replace all undermined pavements, either concrete or asphalt, at Contractor's expense.

2. Excavations shall be accomplished with vertical banks wherever possible. All excavations shall remain within the property lines of the pump station as shown on the Drawings.

3. Except as otherwise specified herein, shoring and sheeting materials may be extracted and reused at Contractor's option; however, Contractor shall remove and replace any existing structure or utility damaged during shoring and sheeting. Where shoring and sheeting materials must be left in place in the completed Work to prevent settlements or damage to adjacent structures or as directed, backfill the excavation to 1 meter (3 feet) below the finished grade and remove the remaining exposed portion of the shoring before completing the backfill. If H-piles and wood lagging are used for shoring, remove wood lagging to within 1 meter (3 feet) of finished grade in incremental steps of approximately 150 mm (6 inches) as the backfill is constructed. The location of all shoring and sheeting left in place shall be documented on drawings and given to Engineer and Owner.

1.7 Quality Assurance

A. Design Criteria:

1. The design and construction of the support system, and the adequacy thereof, shall be the responsibility of Contractor. Contractor's shoring engineer shall be a professional engineer, legally authorized to practice in the jurisdiction where the Project is located, experienced in the design of earth support systems, and required to visit the Site prior to development of any sheeting and shoring system designs in order to become familiar with existing Site conditions.

2. During installation and removal of the any shoring, Contractor's shoring engineer shall visit the Site to observe the Work and to verify the compatibility of the Work with design assumptions. Contractor's shoring engineer shall prepare a status report with each visit to the Site. This report shall be submitted to Engineer within three days of each Site visit. This status report shall contain certification that the Work is in concurrence with design assumptions. If deficiencies are observed, these must be noted and the corrective action outlined in the report. In the event that deficiencies are noted in Contractor's shoring engineer's report, Contractor's shoring engineer shall return to the Site within three days after the corrective action has begun to verify that the deficiencies are adequately being corrected. A corrective action status report shall be prepared by the

Contractor's shoring engineer. The above outlined procedures shall be repeated until the corrective action status report confirms that all deficiencies have adequately been corrected.

3. Design the excavation support in accordance with the design criteria specified herein and in the Contract Documents. The criteria are intended for guidance and are the minimum acceptable.

4. Where applicable, the design and construction of the support system shall conform to the requirements of the AISC Manual of Steel Construction, unless otherwise stated.

5. Design the excavation support system and components to support lateral earth pressures, unrelieved hydrostatic pressures, utility loads, rail loads, traffic and construction loads, and building and other surcharge loads to allow the safe and expeditious construction of the permanent structures without movement or settlement of the ground, and to prevent damage to or movement of adjacent buildings, structures, utilities, and other improvements. The minimum lateral design earth pressure in all cases shall be determined by the Contractor's Shoring Engineer. All of the other above loadings shall be determined by Contractor's shoring engineer and added to the minimum design criteria. The design shall account for staged removal of bracing to suit the sequence of concrete placement for permanent structures and of backfill.

6. Design members to support the maximum loads that can occur during construction. For the purpose of this Section, the design load is the maximum load the support member will have to carry in actual practice, and the proof load is a specified test load greater than the design load.

7. Employ wales, struts, rakers, and tieback anchors for horizontal support for excavation faces retained by soldier piles and lagging, sheet piling, or other methods as may be approved by Engineer. Provide struts with intermediate vertical and horizontal supports if necessary to prevent buckling. Bracing members shall be structural steel. Tiebacks shall be high strength tendons or rods.

8. Take into account stresses due to temperature variations in the design of the struts. Make provisions to protect struts against deformations and stress variations induced by temperature fluctuations.

9. The splicing of an element of the support system will not be permitted.

10. Analyze elements supporting vertical loads and lateral pressures for combined axial load and bending.

11. Lateral loads due to soil and surcharges shall not be transmitted to the permanent structures, or portions thereof, until the concrete has reached sufficient strength to resist said loads, and then, not until the section to be loaded has been checked for strength and deflection and the method of load transmittal accepted by Engineer. The removal of struts shall not increase the design loading on the permanent structures.

12. In a bracing system where wales are not used and a direct strut to soldier pile connection is used, consider an additional provision for bending stress due to the eccentricity of lateral loading of 10% of the depth of the member in each direction in the design of the strut member.

13. Design compression member connections for their compressive loads and for a tensile and shearing load equal to 10% of the design compressive load unless tensile or shearing loads are greater.

14. Driven soldier piles may be assumed as fully braced against buckling in the plane of lagging. In the plane perpendicular to the lagging, the column length shall be taken as the distance between braced points.

15. Backfill soldier piles installed in predrilled holes with lean concrete and allow to set up prior to the start of excavation.

16. Vertical members of flexible wall systems may be designed under the assumption that they are hinged at the bottom of the pile supported excavation and at all bracing levels except the topmost level.

17. In order to satisfy a hinge condition at the bottom of excavation in soil, the vertical wall members shall have at least the minimum penetration necessary to develop the passive resistance of ground material in which piles are embedded, or cantilever action shall be assumed about the lowest installed brace.

18. The calculated deflection of any element of the support system shall not exceed 13 mm (1/2-inch) during excavation or brace removal.

19. Apply active pressure above the pile subgrade elevation to the full panel width between soldier pile centers and to the width of the soldier pile or encasement below pile subgrade. Passive pressure for calculation of embedment required shall be taken as acting on 1.5 times diameter for soldier piles circular in plan and 2.0 times width for soldier piles rectangular in plan.

20. To account for the concentration of soil pressures at struts and tieback locations, the bending moments taken from pressure diagrams (hydrostatic and surcharge pressures excluded) may be reduced by 20 percent when calculating flexure requirements for vertical members and wales of flexible wall systems.

21. Where the loading conditions on opposite sides of an excavation are not equal, analyze the stability of the temporary retaining structure and design structural members so as to take this condition into account.

22. In design of vertical members and wales of flexible wall systems, basic allowable unit stresses may be increased 20%. Design bracing members and connections using basic allowable unit stresses.

23. For calculation of brace loads, vertical wall members may be assumed as several independent simple beams supported at brace levels and their continuity effects ignored. The sum of reactions at each support is used as the design brace load. The full loading on cantilevered portions shall be considered as acting directly upon the supporting brace level. An assumed strut shall be considered to exist at the bottom of the excavation when the minimum pile penetration below subgrade, or deeper, is satisfied. Where wales are a part of the support system, they shall be designed according to the principles of statics.

B. Tieback Analysis and Design:

1. Investigate loading and use the most critical case for design.

2. Make a check of the overall stability (sliding, rotational, etc.) of the zone forming the anchoring mass of earth. The width of resisting surface shall be taken not greater than the distance from the support wall back to the vertical plane passing through the end of the shortest anchor. For a rotational analysis using the slip circle method the design shall yield a factor of safety of at least 1.5, based on loading and the physical properties tabulated.

3. For purposes of determining the effective length of anchors, take the failure plane of the soil mass behind the wall at a minimum angle of 45 degrees measured from the vertical. Anchors shall be considered as receiving resistance from only the soil mass acting beyond the indicated failure plane. Consideration shall be given to increased extent of the failure zone due to high surcharge loads.

4. For loading combinations found, determine the allowable value of adhesion between the soil and the anchor for design of effective embedded length of each individual anchor in various strata. The effective length thus found shall be increased by at least 10% to make allowance for unforeseen field variables.

5. The angle between the direction of the anchor and the horizontal line perpendicular to the support of excavation wall shall be chosen by the Contractor within a range of 0 degrees to 30 degrees. Account shall be taken of the effects of resulting vertical components and associated structural implications arising therefrom, particularly regarding toe penetration requirements.

6. Install anchors in predrilled holes and pressure grout to ensure firm contact with the surrounding soil.

7. For drilled-in anchors, the total anchor load shall be developed in bond between steel and grout acting within effective length of the anchorage.

8. The final working stress shall not exceed 60% of the ultimate tensile strength of the steel nor 70% of its yield strength loads where high-strength tie rod steel is used.

9. For tieback anchors of high strength steel, a pretest load of at least 140% of working load shall be applied. The load shall then be relaxed to not less than 100% of the working load. Final pretest stress in the steel is not to exceed 80% of the ultimate strength nor the manufacturer's recommendations as shown in his catalog or otherwise stated by him in writing.

10. Spacing of the tiebacks shall ensure no overlap of resisting soil stress bulbs in assuming full value of anchorage for each tieback. In the event of overlap, then a reduction factor shall be used for ties effected. In any one plane the anchors shall have a minimum clear distance between them of 1.5 meters (5 feet). Tiebacks having overlapping soil stress bulbs shall be pretested simultaneously.

11. Use good engineering practice, a knowledge of the local or regional subsurface conditions, available geotechnical or subsurface information, and studies performed by the Contractor to investigate the subsurface conditions at the Site in the analysis and design of tieback systems.

12. The value of overburden pressure, if used for adhesion calculations, shall not include surcharge loads.

13. Tiebacks shall not be placed closer than 3 meters (10 feet) to foundation structures of existing buildings.

C. Monitoring:

1. Pre-excavation Survey:

a. Contractor shall document all existing damage to adjacent facilities and submit the information to the Owner prior to performing any excavation. Documentation shall include a written description, diagrams, measurements, and photographs as appropriate.

b. Establish lines of monitoring points, perpendicular to the excavation face, for at least two sides of each excavation where monitoring is required. Space the lines of monitoring points no more than 6 meters (20 feet) apart, and a minimum of three lines shall be established for each

excavation side to be monitored. Each monitoring line shall consist of a minimum of four monitoring points spaced no more than 3 meters (10 feet) apart. Locate the first monitoring point in each line at the top of the braced excavation. The monitoring lines shall extend from the excavation face to a distance equivalent to twice the total excavation depth. The base of each monitoring point monument shall extend to a depth of at least 1.5 meters (5 feet) below the ground surface. Establish surface monitoring points prior to beginning an excavation.

c. Each survey reading shall consist of measuring the vertical and horizontal location of each monitoring point. Make the initial set of readings prior to the start of the excavation. Make each additional set of readings at each 1.5-meter (5-foot) increment of vertical excavation depth, immediately before and immediately after internal bracing or tiebacks are installed. After the excavation has been completed, take readings at 7-day intervals thereafter and until movements have been determined by Contractor's shoring engineer to have ceased. If portions of the bracing system are removed at any time, make readings immediately prior to removal and immediately after removal.

d. Contractor's shoring engineer shall reduce and review the monitoring data and submit a summary of the data to Engineer on a weekly basis. As a minimum, this summary shall include graphical plots of the monitoring data and Contractor's shoring engineer's interpretation thereof.

D. Work Site Conditions:

1. Provision for Contingencies:

a. Monitor the performance of the components of the support system for both vertical and horizontal movement at regular intervals not to exceed three days.

b. Provide a contingency plan or alternative procedure for implementation if unfavorable performance is evident.

c. Keep the materials and equipment necessary to implement the contingency plan on hand.

2. Employ caution in the areas of utility facilities, which shall be exposed by hand or other excavation methods acceptable to Owner.

E. Welding Standards:

1. Comply with applicable provisions of AWS D1.1.

2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved, and if pertinent, has undergone recertification.

PART 2 - MATERIALS

2.1 Structural Steel: Steel H-piles, WF shapes, bracing members, fabricated connections, and all other accessories shall conform to the requirements of ASTM A36.

2.2 Structural Steel Sheet Piles

A. Steel sheet piling shall conform to the requirements of ASTM A328.

B. Steel sheet piling and interlocks shall not have excessive kinks, camber, or twists that would prevent the pile from free sliding.

2.3 Reinforcing Steel: Shall conform to the requirements of Section 3200.

2.4 Field Welding: Shall be performed by certified welders and be in accordance with AWS D1.1.

2.5 Tiebacks: Shall be high strength steel tendons or rods encased in concrete grout. Use of helical screw anchors is strictly prohibited.

2.6 Concrete

A. Lean grout shall be a mixture of Type V cement, sand, and fly ash in the proportions of one bag cement, 5 cubic feet fly ash, and sufficient aggregate and mix water to yield 27 cubic feet and shall be placed in such a manner as to present a firm, stable mass capable of retaining shape and position during excavation operations, yet allow relative ease in chipping out for placement of lagging.

B. All other concrete shall conform to the requirements of Section 03300.

2.7 Timber Lagging: Shall be of a structural grade providing a minimum allowable working stress of 7.6 MPa (1,100 psi) where a system of timber lagging is to be used to support earth excavation.

2.8 Other Materials: Shall be of the size, shape and properties best fitted for their intended use.

2.9 Materials: Whether new or used, shall be sound and free of defects that might impair strength or function.

PART 3 - EXECUTION

3.1 Soldier Piles Installation

A. In the initial positioning of soldier piles at the ground surface, make allowances for installation deviations, and the probable inward movements of the support wall during excavation. Intrusion of wall members into the neat lines of the structures will not be permitted. Where sheeting systems are located contiguous to the neat lines of the structure, provide a reasonable percentage of the depth of excavation to subgrade for initial installation offset.

B. Install soldier piles by preboring or other preexcavating methods to tip elevation shown on the approved working drawings.

C. Case or fill the prebored holes with drill mud, as required, to prevent caving of the sides of the hole prior to placement of the soldier pile and encasement.

D. Pile Embedment:

1. Carry the bottom of the support system to a depth below the main excavation to provide sufficient lateral support to limit the maximum pile deflection to 13 mm (0.5-inch).

E. After seating the soldier piles, encase the piles with lean grout, completely encasing the pile.

F. Design of soldier piles shall conform to the criteria specified in PART 1 - QUALITY ASSURANCE, this Section.

G. Vertical Support System with Tiebacks:

1. Install piles or other vertical support system members incorporated in a system using tieback anchors so that

vertical support members are capable of resisting vertical components of tieback loads without significant settlement during excavation and construction.

2. Install the vertical support members so that settlements will not be caused by construction. In general, install the members to be end bearing in a stratum below the maximum depth of excavation and capable of carrying the total vertical loads without assistance of skin friction in the depth of the excavation.

3.2 Lagging and Sheeting Installation:

A. Use timber lagging or contact sheeting, steel sheeting, or precast reinforced concrete members secured in place for sheeting of excavations.

B. Install sheeting and lagging with no gap between the boards. Carefully perform excavation for the installation of sheeting and lagging to minimize or eliminate the formation of voids behind the lagging. As installation progresses, backfill voids between the excavation face and the lagging or sheeting with sand or soil compacted in place. Pack gaps in lagging with materials such as hay or burlap to allow drainage of groundwater without substantial loss of soil.

C. If unstable material is encountered, take measures to retain the material in place or to otherwise prevent soil displacement.

D. Sheeting and lagging placement shall follow the excavation. The maximum height of the unsheeted or unlagged face of excavation shall be determined by the job conditions, but in no case shall it exceed at anytime 1.2 meters (4 feet) in predominately clayey soils or 1 meter (3 feet) in sandy soils. If water flows from the face of the excavation, or soil in the face moves toward the excavated area, the maximum height of the unlagged face shall not exceed 375 mm (15 inches), or as directed by Resident Project Representative.

E. Sheet piling not cut to length shall be cut off after driving at elevations as indicated, if applicable.

F. Drive sheet piling by recognized methods of good practice in soil conditions present using a hammer with sufficient energy to penetrate overburden material without damaging the sheet piling or adjacent existing facilities. Avoid splicing of sheet piling when

possible. Z-pile sections shall be driven with ball edge "ahead."

G. Provide protection to sheet pile ends, as required, to ease driving, assure penetration and prevent tearing or splitting in hard driving conditions.

H. In running sand or silt, provide a positive means of securing the lagging to the soldier piles to avoid shifting or falling off of the lagging. Also provide a positive means of securing the material behind the lagging or sheeting.

I. A sufficient quantity of material shall be on hand at all times (for sheeting, shoring, bracing and other purposes) for the safe execution of the work and for use in case of accident or other emergency.

J. Place wales, when used, on the inside face of the support wall. Make provisions to wedge, pack, shim, or otherwise assure tight bearing between wales and soldier piles, with ample bearing area to assure transfer of the load.

K. Remove lean grout only to the extent that is required for installation of the lagging.

3.3 Internal Bracing Support Systems Installation

A. The internal bracing support system includes lagging and sheeting, soldier piles, wales, struts, and shores.

B. Brace as soon as possible after reaching prescribed excavation levels.

C. Provide struts with intermediate bracing if necessary, to enable them to carry the maximum design load without distortion or buckling.

D. Provide diagonal bracing where needed to maintain the stability of the system.

E. Include web stiffeners, plates, or angles to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members. Allow for eccentricities due to field fabrication and assembly.

F. Install bracing support members and maintain in tight contact with

each other and with the surface being supported. Install support system instrumentation if directed by Owner or Engineer.

G. Coordinate excavation work with installation of bracing and preloading.

H. Design primary support members to support the maximum loads occurring during the excavation or removal stages, and as required by design criteria specified under PART 1 - QUALITY ASSURANCE, this Section, and on the Contract Drawings.

I. Preloading:

1. Primary bracing members including struts, shores, and similar members shall be preloaded at installation. The amount of the preload shall be determined by Contractor's shoring engineer. Tiebacks shall be preloaded as specified for those installations.

2. Use procedures that produce uniform loading of the bracing member without appreciable eccentricities, or overstressing and distortion of the members of the wall system.

3. Make provisions for permanently fixing the required load in the member using steel shims or wedges welded into place.

4. Wooden wedges shall not be used to preload a bracing member.

5. The preloading system shall include a means to determine within 5% the amount of preload induced into the bracing members.

J. Excavation shall not go deeper than 1 meter (3 feet) below the point of support about to be placed. Install the support and preload immediately after installation of bracing and prior to continuing excavation.

3.4 Tieback Support Systems Installation

A. If Contractor elects to use a support system which includes tieback anchors, he shall submit full details of his proposed system to the Engineer for review prior to commencement of the work. The submittal shall be in accordance with instructions specified under PART 1 - SUBMITTALS, this Section. Design shall be in accordance with tieback criteria specified under PART 1 - QUALITY

ASSURANCE, this Section.

B. Install tieback systems in accordance with the working drawings. Install the anchorage in soil no closer than a plane extending upward at an angle of 45 degrees to the horizontal from the limit of the lowest depth of excavation.

C. Stress all the tiebacks to proof loads equal to 120% of the maximum design load. Maintain the proof load for 30 minutes prior to reducing it to the design load. Anchors which lose more than 5% of the proof load during the 30-minute period will not be acceptable.

D. During proof testing, load in increments of 4.5 metric tons (5 tons) at one-minute intervals providing means to measure the load application within an accuracy of plus or minus 5%. Record axial movement corresponding to incremental applications of load to an accuracy of 0.25 mm (0.01-inch).

E. After reducing the tieback load to the design load, encase tiebacks in grout. Maintain the design load until the tiebacks are fixed in place.

F. Use a method of fixation which will limit the load loss to no more than 5% of the design load in the transfer of the loads from the jacks to the support system.

G. Provide and maintain convenient access and appropriate means so that these observations may be made.

H. Grease and wrap drilled-in anchors or otherwise treat to ensure the absence of bond on the portion of the tieback between the face of wall and the anchorage.

I. Performance Tests on Tiebacks:

1. Conduct performance tests on at least three selected tiebacks prior to installing any of the remaining tiebacks, which will all be proof loaded. Test tiebacks at each level of support in the excavation. A minimum of 10% of the tiebacks installed shall be performance tested. All performance tests shall be measured with a load cell accurate to within 1% of the design load.

2. Performance tests for tiebacks in cohesionless soils shall consist of the following cyclic loadings: 0 tons to 0.25 DL

(Design Load); 0.25 DL to 2 tons; 2 tons to 0.50 DL; 0.50 DL to 2 tons; 2 tons to 0.75 DL; 0.75 DL to 2 tons; 2 tons to 1.0 DL; 1.0 DL to 2 tons; 2 tons to 1.2 DL; 1.2 DL to 2 tons; 2 tons to 1.33 DL. The load shall then be reduced to 100% of the design load and locked off. Record axial movement corresponding to incremental applications of 25% of the design load for each individual cycle of loading to an accuracy of 0.025 mm (0.001-inch).

3. Performance tests for tiebacks in cohesive soils shall consist of the following cyclic loadings: 0 tons to 0.25 DL (Design Load); 0.25 DL to 1.8 m tons (2 tons); 1.8 m tons (2 tons) to 0.50 DL; 0.50 DL to 1.8 m tons (2 tons); 1.8 m tons (2 tons) to 0.75 DL; 0.75 DL to 1.8 m tons (2 tons); 1.8 m tons (2 tons) to 1.0 DL; 1.0 DL to 1.8 m tons (2 tons); 1.8 m tons (2 tons) to 1.2 DL; 1.2 DL to 1.8 m tons (2 tons); 1.8 m tons (2 tons) to 1.33 DL. The load shall then be reduced to 100% of the design load and maintained continuously for a minimum of 10 hours. Measure axial movements to an accuracy of 0.025 mm (0.001 inch) and record on 5-minute intervals for the first 100 minutes and 10-minute intervals thereafter.

4. The data from all performance tests shall be interpreted by Contractor's shoring engineer. This interpretation will constitute an evaluation of anchor allowable load-carrying capacities and shall be used by Contractor's shoring engineer to set a criteria for allowable movement of the proof tests.

3.5 Trench Excavation

A. Perform sheeting, shoring, and bracing for trench excavation for utility facilities and other purposes in accordance with the safety requirements of the General Conditions.

B. Provide sheeting, shoring, and bracing for trench excavation in the subgrade of the excavation to prevent movement of the main excavation support system.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

No measurement will be made for this item.

4.2 Payment

A. Sheeting and Shored Excavations

Payment for Sheeting and Shored Excavations is included in the lump sum price for the appropriate precast concrete structure(s) included in this project.

**** END OF SECTION 2254 ****