§644-5

<table>
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<tr>
<td>644.11 M</td>
<td>Anchor Bolts</td>
<td>Kilogram</td>
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Note: nn denotes serialized pay item. See §101-02 Definitions of Terms under "Specifications" and the Standard Drawings.

SECTION 645 - SIGNS

645-1 DESCRIPTION. This work shall consist of fabricating, furnishing, installing and covering traffic signs, sign support systems, sign posts, sign panels, and illuminated sign panels in accordance with the plans, these specifications, standard sheets, the MUTCD and directions of the Engineer.

645-2 MATERIALS. Materials shall meet the requirements of the following subsections:

- Weathered Brown Guide Rail Paint 708-24
- Stainless Steel Connecting Products 715-16
- Aluminum Sign Panels 730-01
- Reflective Sheeting (Class A) 730-05.01
- Reflective Sheeting (Class B) 730-05.02
- Reflectorized Sheeting Sign Characters (Type IV) 730-12
- Reflectorized Sheeting Sign Characters (Type V) 730-13
- Stiffeners, Overhead Brackets, and Miscellaneous Hardware 730-22
- Fiberglass Reinforced Plastic Sign Panels 730-23
- Type A Sign Supports 730-24
- Type B Sign Posts 730-25
- Breakaway Bases and Hinge Assemblies 730-26

Additional requirements are indicated below.

645-2.01 SIGN PANELS

A. Ground Mounted (MUTCD §201.1) Codes G&I Signs and All Overhead Mounted Sign Panels. Sign Panels for Ground Mounted MUTCD Codes G&I Signs and all Overhead Mounted Sign Panels shall be aluminum alloy 3 mm thick meeting the requirements of §730-01, Aluminum Sign Panels.

B. Ground Mounted (MUTCD §201.1) Codes R, P, W & M Signs. Panels for Ground Mounted MUTCD Codes R, P, W & M signs shall be aluminum alloy 2.5 mm thick meeting the requirements of §730-01, Aluminum Sign Panels. Fiberglass Reinforced Plastic Sign Panels, 3.5 mm thick, meeting the requirements of §730-23, may be used for sign panels up to 1.2 m X 1.2 m.

C. Illuminated Sign Panels. Illuminated Sign Panels shall be aluminum alloy 3 mm thick meeting the requirements of §730-01, Aluminum Sign Panels. All materials necessary to illuminate the sign panels shall be as shown in the contract documents.

D. Reflective Sheeting. The reflective sheeting materials used on sign panels shall conform to the class (type) and usage requirements described in Table 1 of §730-05. In general, Class A Sheeting, also known as AASHTO Type I or Engineer Grade Sheeting, may be used on tourist and motorist services signs; and Class B Sheeting, also known as AASHTO Type III or High Intensity Sheeting, shall be used on guide, regulatory, and warning signs.
All sign panels shall be clearly identified to show the Contract Number and the date (month/day/year) of sheeting application.

Approved methods of identification shall be permanent and include, but not be limited to, engraving, labels attached with pressure sensitive adhesive, or marking with an indelible ink or paint.

645-2.02 Sign Covering Material. Material used to cover sign panels shall be of a high quality opaque, porous, windproof fabric as approved by the Engineer. More than one layer of fabric may be required to prevent legibility of the sign legend to be covered. Plastic, mesh, translucent or transparent materials will not be allowed. The covering material shall be a single neutral color, except orange or yellow, and shall not contain any wording or images.

645-2.03 Concrete for Foundations. Cast-in-place concrete shall meet the requirements of Class A Concrete in Section 501, Portland Cement Concrete-General. Precast concrete shall meet the requirements of §704-06 Precast Concrete Cribbing. The batching, mixing and curing methods, and the inspection facilities shall meet the approval of the Department or its representative. The Contractor may submit, for approval by the Director, Materials Bureau, a mix at least equivalent to the specified Class A Concrete.

645-2.04 Rustic Type B Sign Posts, With or Without Breakaway Bases and Hinge Assemblies. All of the provisions of §730-25 and §730-26 shall apply as described for Rustic Type B Sign Posts with or without Breakaway Bases and Hinge Assemblies.

645-2.05 Pole Mounted Sign Support Systems. Brackets, hardware, and fasteners necessary to mount signs on traffic signal poles, street lighting poles or other poles shall be stainless steel. Bands shall be as a minimum 20 mm X 0.5 mm stainless steel. Other methods of attachment may be substituted with prior permission of the Engineer.

645-2.06 Yellow and Brown Signs. Whenever brown reflective sheeting is specified it shall conform to the Standard Specification requirements for §730-05 Reflective Sheeting under Class A (Materials Designation 730-05.01). Brown reflective sheeting (Class A) may be processed by a sign fabricator in his/her shop. The legend for a sign with brown background must be made by applying cut-out letters or symbols of yellow sheeting meeting the material requirements of §730-05 under Class A.

645-2.07 Type A Sign Posts. Type A Sign Posts shall be selected from the Department's Approved List of Type A Sign Supports. The standard strength (i.e. moment capacity) of a Type A Sign Post shall be 2800 N•m, although weaker or stronger posts may be substituted as described in §645-3.11. Type A Sign Posts With Extra Embedment (more than 1 m), and Soil Plates for Type A Sign Posts, shall meet the requirements of the Material Details for Type A Sign Supports.

645-2.08 High Capacity Type A Sign Posts. High Capacity Type A Sign Posts are defined as any Type A Sign Post system shown in the Material Details for Type A Sign Supports that has a total combined capacity for the entire two or three post system higher than 10,600 N•m when used as shown in the Material Details. The contractor shall calculate the design moment of the sign panel to be installed at the required location, and select an appropriate High Capacity Type A Sign Post system from the Material Details for Type A Sign Supports, subject to the Engineer’s approval, capable of resisting that moment.

645-3 CONSTRUCTION DETAILS

645-3.01 General. Sign panels, overhead panels, overhead vertical brackets, vertical and horizontal Z bars, sign support systems, sign posts, breakaway bases and hinge assemblies, and foundations for Type B Sign Posts shall be constructed in accordance with these specifications, plans, standard sheets, MUTCD, materials details and the directions of the Engineer.
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645-3.02 Wind Loads. The wind pressures given on the standard sheets have been calculated according to the procedure in AASHTO's "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (1994)", Section 1.2.5 - Application of Wind Loads.

A. Unless otherwise stated in the contract documents, ground mounted signs on Type A Sign Posts shall be constructed with sign and structure able to withstand a 97 km/h wind loading in Regions 1, 2, 6, 8 and 9. This corresponds to a wind pressure of 690 N/m² when the panel centroid is 4.27 m or less above the surrounding terrain. When the panel centroid is more than 4.27 m above the surrounding terrain, the corresponding wind pressure is 919 N/m². In Regions 3, 4, 5, 7, 10 and 11, ground mounted signs on Type A Sign Posts shall be constructed with sign and structure able to withstand a 113 km/h wind loading. This corresponds to a wind pressure of 977 N/m² when the panel centroid is 4.27 m or less above the surrounding terrain. When the panel centroid is more than 4.27 m above the surrounding terrain, the corresponding wind pressure is 1207 N/m².

Where ground mounted signs are to be mounted on traffic signal or street lighting poles, they and their mountings shall be designed to withstand the above wind loadings. Each horizontal Z-Bar stiffener (stringer) shall be firmly attached to the pole.

B. Sign panels on overhead structures and ground mounted signs on Type B sign posts shall be constructed with sign and structure able to withstand the following wind loadings:

129 km/h (1609 N/m² at 4.27 m to 8.84 m height of centroid) Regions 3, 4, 5, 7, 10 and 11.
113 km/h (1207 N/m² at 4.27 m to 8.84 m height of centroid) All other regions unless otherwise noted.

All wind loading shall be adjusted for height, drag, and gusting in accordance with AASHTO's "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (1985)."

645-3.03 Fabrication. Fabrication of all components of the completed sign shall produce a finished sign installation to the satisfaction of the Engineer. Holes may be punched or drilled. Edges shall be smooth and true and free from burrs or ragged breaks.

The sign fabricator shall clearly identify and date each completed sign in accordance with §645-2.02. The Contract Number and fabrication date shall be located on the back of the sign panel substrate, at either lower corner.

645-3.04 Sign Face Construction.

A. Sign face shape, color, dimensions, characters, symbols, wording, lettering and reflectorization shall be in accordance with:

1. Contract Documents
2. Standard Sheets
3. New York State Manual of Uniform Traffic Control Devices (MUTCD)

B. Layout, size, lighting equipment, and arrangement of sign panels and sign assemblies shall be as shown in the contract documents.

C. Standard sign face layouts for MUTCD Code R, P, W & M signs are shown in the New York State MUTCD. Detailed sign face layouts for MUTCD Codes G&I, normally not included in the contract documents, will be available at the Regional Office for inspection by the Bidders. At the time the contract is awarded, two copies of the sign face layout will be given to the Contractor.
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D. Sign face characters and background shall be reflective, but black portions of a sign face shall not be reflective.

E. Characters shall include letters, numerals, route shields, symbols and borders. Characters shall be the size, series and color specified in the MUTCD and as specified in the plans. Only Type IV or Type V Characters, as appropriate, shall be used. All white legend and border shall be formed with directly applied Type IV Characters. Interstate shields for signs shall be either demountable panels or directly applied panels with Type V reverse-screened characters.

F. Corner radii and border widths shall be as designated in the MUTCD. In the event corner radii are not otherwise designated, they shall be approximately one eighth of the height of the sign; but, shall not exceed 300 mm. In the event border width is not designated, it shall be the same as the stroke width of the major lettering on the sign.

645-3.05 Sign Drawings. Sign drawings which are part of the contract documents are designated as “Contract Drawings” and are not intended to be used as shop or working drawings. Shop drawings are not required; however, it shall be the Contractor’s responsibility to compile all necessary dimensions located throughout the Contract Documents, in compliance with the requirements of §645-3.04 Sign Face Construction which are required in conjunction with layout for construction.

645-3.06 Work Sequence. The Contractor shall erect new signs and remove existing signs in such a manner that the traveling public is provided all necessary regulatory, warning, and guidance information at all times. It may also be required that certain items, designated in the contract documents or by the Engineer, be preformed prior to other items of work.

645-3.07 Sign Locations. Sign locations shown in the contract documents are approximate and the exact location for each sign will be determined by the Engineer in the field.

645-3.08 Erection. Sign panels, sign support systems, sign posts and breakaway bases and hinge assemblies, shall be erected in accordance with details shown on the plans, standard sheets, materials details and as directed by the Engineer.

645-3.09 Transportation, Handling and Storage. All material shall be transported and handled in a manner that will cause no permanent deformation, injury or damage. Material to be stored shall be stored above ground in a manner and at a location approved by the Engineer. Any part of the entire sign or structure damaged during transportation, storage, handling or erection shall be repaired, or, if determined by the Engineer as unfit for use in the finished work, shall be removed from the site and replaced at the contractor’s expense.

645-3.10 Foundations. Foundations shall be constructed in accordance with details shown on the plans, standard sheets and as directed by the Engineer. Upon completion of the sign installation the Contractor shall restore the area to its original state.

645-3.11 Type A and Type B Sign Posts

A. Type A Sign Posts. Subject to the conditions indicated below, Type A Sign Posts shall be used individually or in groups such that the number of posts acting together can resist the moment required. They shall be installed in accordance with the Materials Details. Type A Sign Posts With Extra Embedment, and Soil Plates for Type A Sign Post, shall be installed in accordance with the installation requirements of the Material Details for Type A Sign Supports wherever extra embedment depth and/or soil plates are required by the Materials Details. High Capacity Type A Sign Posts shall also be installed in accordance with the installation requirements of the Material Details for Type A Sign Supports wherever indicated in the contract documents or where extra moment capacity is required.

The number of Type A Sign Posts indicated on the plans is based on the information available prior to the time of letting. The actual number and strength of Type A Sign Posts to be installed.
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shall be based on conditions at the final sign location which shall be determined or approved by the Engineer. The Contractor shall either compute the bending moment to be resisted by the Type A Sign Post(s) due to the wind loads indicated in §645-3.02, or use the design tables given on the Materials Details, to propose an appropriate number and strength of Type A Sign Posts subject to the criteria given below and the approval of the Engineer. The Contractor shall submit the approved Materials Details, and any computations, to the Engineer, and supply and install the required number of Type A sign posts subject to the following criteria:

1. For signs wider than 762 mm, at least two posts are required, except the nominal 750 X 750 mm diamond panel and the nominal 900 mm wide "YIELD" panel require only one post.

2. The maximum number of posts installed within a 2.13 m path, as described on the approved Materials Details, must be complied with.

3. For single flanged channel post installations only, the calculated bending moment to be resisted by the post shall be augmented by 25% to adjust for torsional shear. The Materials Details includes this adjustment.

B. Type B Sign Posts. Type B Sign Posts, hinge assemblies, slip-bases and footings shall be fabricated and installed in accordance with the details shown on the standard sheets. Sign posts other than those shown on the standard sheets shall be fabricated and installed in accordance with the manufacturer’s approved materials details. Type B Sign Post type, size and number shown on the plans are based on the best information available at the time they were selected. The final sign post type, size and number to be installed by the Contractor shall be based on the final location determined or approved by the Engineer in the field. The Contractor shall compute the bending moment to be resisted by the sign post due to the pressures indicated in §645-3.02 Wind Loads and the conditions of the actual field location to verify the assumed design moment and post selection. The Contractor shall also check the hinge capacity and 2.1 m wheel path criteria shown on the Standard Sheets.

The Contractor shall make the computations available to the Engineer for verification. The Contractor shall install Type B sign posts which satisfy the actual bending moment, the hinge capacity and the 2.1 m path criteria.

The Contractor is permitted to install breakaway type posts under the pay item for non-breakaway type posts provided that non-slotted hinge plates are used on both flanges and the installation is outside the clear zone or otherwise protected.

C. Rustic Type B Sign Posts. All of the above provisions of §645-3.11,B Type B Sign Posts shall apply except the posts shall be ungalvanized weathering steel.

When used with a breakaway base and hinge assembly, the installation shall be as described in §645-3.12 Breakaway Bases and Hinge Assemblies.

D. Pole Mounted Sign Support Systems. Pole Mounted Sign Support Systems shall consist of stainless steel bands and brackets which shall be firmly attached to the pole in accordance with the standard sheets and/or manufacturer’s instructions. Each horizontal Z-Bar stiffener shall be banded to the pole. Sign panels without Z-Bars shall be attached to the pole with two bands.

645-3.12 Breakaway Bases and Hinge Assemblies. Standard breakaway bases and hinge assemblies shall be fabricated and installed as shown on the standard sheets. Breakaway bases and hinge assemblies other than those shown on standard sheets shall be fabricated and installed in accordance with the manufacturer’s approved materials details.

When breakaway bases and hinge assemblies are used with Rustic Type B Sign Posts, the breakaway bases and hinge assemblies shall be modified as per §730-26 and installed as follows:

1. The upper slip base plate and attached post shall be ungalvanized weathering steel, ASTM A588M or A242M. The lower slip base plate, and the attached stub portion of the post, shall be galvanized steel. The remainder of the slip base shall be installed as shown on the contract drawings.

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2. When used on one-way, divided roadways, the back (trailing) flange hinge plate of Rustic Type B Sign Posts shall be ungalvanized A588M or A242M steel installed as shown on the contract drawings. When the possibility exists of being impacted from two opposite directions, as on two-way undivided roadways, the back (trailing) flange hinge plate shall meet the requirements, below, of the front (approach) flange hinge plate.

3. The front (approach) flange hinge plate of Rustic Type B Sign Posts shall be galvanized steel installed as shown on the contract drawings, except that an additional galvanized steel flat washer shall be installed on all four bolts between each post and the slotted hinge plate to assure proper slippage.

4. Weathered Brown Guide Rail Paint shall be used to paint all miscellaneous visible galvanized steel hardware except the vicinity of the hinge plate slots.

645-3.13 Sign Panels. Sign panels with M.U.T.C.D. codes R, P, W, and M shall be fabricated and installed as shown on the “Standard Sign Blank Details” and “Sign Panel Details for Guide, Information and Other Signs” standard sheets, or as shown on the plans. Details for intermediate signs that are not shown on “Standard Sign Blank Details” shall be similar to the closest shown sign blank size. Details for larger size panels shall be as shown on the “Sign Panel Details for Guide, Information and Other Signs” standard sheets. The illumination equipment for illuminated sign panels shall be installed as shown in the contract documents.

645-3.14 Date Marking. Each sign panel shall be marked in the lower right corner of the back of the panel with the month and year of installation. Markings shall be a minimum of 25 mm high and with either a permanent paint or ink or stamped into the material.

645-3.15 Field Inspection. All materials and labor will be inspected in the field.

All work of erection shall be subject to the inspection of the Engineer, who shall be given all facilities for a thorough inspection of the work.

An inspection of the completely erected sign will be made in the daylight for proper location, line and grade of signs, vertical post alignment, appearance and visibility. The completely erected signs will also be inspected at night by the Engineer for orientation, specular reflection and defects which will be more conspicuous at night. Each sign will be inspected day and night for acceptable color and reflectivity.

All apparent defects disclosed after day and night inspection shall be corrected by the Contractor to the satisfaction of the Engineer at no additional expense to the State.

645-3.16 Illuminated Signs. Sign panels designated to be illuminated shall be illuminated as detailed in the plans. All work on the illumination system shall be performed by competent electricians and in accordance with the National Electrical Code, rules of the local electrical company, and the directions of the Engineer. The electrical circuits shall be tested by the Contractor for resistance to ground, insulation resistance, and functionality, in accordance with the following requirements:

A. Insulation Test. Each circuit with associated ballasts and protective devices shall be insulation tested using an insulation tester connected according to manufacturer's instructions. A polarization index shall be computed by dividing a ten minute reading by a one minute reading. The polarization index shall be greater than four (4) for acceptance of new circuits, and greater than two (2) for acceptance of existing circuits. The lighting system shall be properly grounded and disconnected while this test is taking place.

B. Ground Test. A ground test shall be performed by the Contractor using an earth tester with resolution to at least a tenth of an ohm. The test shall be performed, and the results interpreted, according to manufacturer's instructions. Readings of five ohms or less will be required for acceptance. Additional grounding methods satisfactory to the Engineer may be necessary until the installation can pass the ground test.

C. Functional Test. After satisfactory completion of all other tests, a functional test shall be
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performed consisting of not less than ten consecutive days of satisfactory operation. If unsatisfactory performance of any component of the lighting system is discovered during this time, the condition shall be corrected and the Engineer may require the test repeated until ten days of continuous satisfactory operation is obtained.

Temporary shut downs caused by power interruption or vehicle impact shall not constitute discontinuity of the functional test.

All testing equipment shall be supplied by the Contractor and the tests shall be performed in the presence of the Engineer. All shortcomings detected during the testing shall be remedied and the installation shall be retested.

645-3.17 Covering of Signs. Signs shall be covered where indicated on the plans and/or directed by the Engineer to eliminate noncurrent, conflicting, or unneeded information. The opaque porous fabric shall be held in place and positioned so that none of the sign face to be covered is showing at any time. More than one layer of fabric may be required to prevent legibility of the sign legend to be covered.

The porous fabric shall be folded over the top and bottom of panel edges, but not on the sides, and secured to the back of the sign panel with weather-proof tape or by some other method approved by the Engineer. Under no circumstances will tape be permitted on the face of the sign panel nor will holes be permitted to be drilled in the sign panel or posts. Coverings that work loose shall be re-secured by the Contractor at no additional expense to the State. The cover shall remain in place until the time directed by the Engineer.

645-4 METHOD OF MEASUREMENT

645-4.01 Sign Panels, Illuminated Sign Panels, and Covering Sign Panels. The quantity to be measured under this work shall be the number of square meters of sign panel covered or fabricated and installed in accordance with the plans, specifications, standard sheets or as directed by the Engineer. The measured area shall be the sum of the areas of each individual sign panel fabricated and erected in accordance with the plans, specifications, standard sheets or as directed by the Engineer except that panels that are to become part of larger background panels (e.g. route shields on large guide signs, etc.) shall not be measured for payment.

The area of each panel shall be measured as the area shown on the standard sheets. For sign panels not shown on the standard sheets, the product of length and width, computed to the nearest 0.01 square meter with no reduction for rounded corners, shall be used to measure payment area. When sign panels are mounted back-to-back, each panel face will be measured separately. Illuminated sign panels shall be measured the same way as non-illuminated sign panels.

645-4.02 Type A Sign Posts. The quantity of Type A Sign Posts will be measured as the number of posts required, which is the greater of either:

1) the number of posts required based on the width of the sign; or,

2) the number of posts of standard strength (2800 N\text{m} moment capacity) required to resist the moment due to wind load.

The quantity of Type A Sign Posts With Extra Embedment will be measured as the number of posts satisfactorily installed with these modified bases where indicated on the plans or where directed by the Engineer. Soil Plates for Type A Sign Posts will be measured as the number of soil plates satisfactorily installed on either standard Type A Sign Posts, or on Type A Sign Posts With Extra Embedment where indicated on the plans or where directed by the Engineer.

645-4.03 Type B Sign Posts and Rustic Type B Sign Posts. The quantity of Type B Sign Posts, or Rustic Type B Sign Posts, will be measured as the number of completed posts of the size and type indicated, fabricated and erected in accordance with the plans, specifications, standard sheets, or as directed by the Engineer. When the Engineer directs that a different size Type B sign post be installed at a location that is called for on the plans and there is no pay item in the contract for the directed post, the original quantity shall be multiplied by the following factor: kg/m of directed post divided by kg/m
of original post.

645-4.04 Pole Mounted Sign Support System. The quantity of Pole Mounted Sign Support Systems shall be measured as the number of completed pole mounted sign support systems fabricated and installed in accordance with the plans, specifications or as directed by the Engineer. A pole mounted sign support system is defined as the hardware necessary to mount a single sign panel on an existing pole, regardless of the number of bands used.

645-4.05 High Capacity Type A Sign Posts. The quantity of High Capacity Type A Sign Posts will be measured as the number of posts installed in accordance with the plans, specifications, standard sheets, MATERIALS DETAILS, and as directed by the Engineer. Post systems in which two posts are combined to function as a single post, such as the back-to-back flanged channel or the telescoping square tube, are measured as one post.

645-5 BASIS OF PAYMENT

645-5.01 General. The unit price bid for all items shall include the cost of furnishing all labor, equipment and materials necessary to complete the work.

645-5.02 Ground Mounted Sign Panels, Tourist and Motorist Service Sign Panels, and Overhead Mounted Sign Panels. The unit prices bid for ground mounted and overhead mounted panels shall include the cost of all labor, material and equipment necessary for fabricating, furnishing, erecting and adjusting the sign panels complete as shown in the contract documents or as directed by the Engineer. The work shall include the necessary panels, reflectorized background, characters, horizontal and vertical stiffeners (Z Bars), vertical overhead brackets to mount sign panels to overhead structures, miscellaneous hardware, fasteners and all other necessary material, equipment and labor to complete the work. The cost of sign panels that are to become part of larger signs (e.g. route shields on large guide signs) shall be included in the unit price bid for the main panel.

645-5.03 Illuminated Sign Panels. All the requirements of §645-5.02 Ground Mounted and Overhead Mounted Sign Panels shall apply to this work. In addition, the unit bid price shall include the cost of all labor, materials, and equipment necessary to furnish, install, energize, test, and repair luminaires, bulbs, ballasts, wiring, conduit and fittings from a point just outside the footing to the most extreme luminaire, until six months after acceptance of the contract. The cost of energy necessary to illuminate sign panels before contract acceptance shall be borne by the Contractor. The cost of energy after contract acceptance shall not be borne by the Contractor. The cost of controllers shall be separately paid.

645-5.04 Covering Sign Panels. The unit price bid for covering sign panels shall include the cost of all labor, equipment and materials necessary to complete the work. Covering construction signs will be paid under the item for Construction Signs.

645-5.05 Type A and Type B Sign Posts. The unit price bid for each Type A Sign Post and each Type B Sign Post and each Type A Sign Post With Extra Embedment, and each Soil Plate for Type A Sign Post, and each High Capacity Type A Sign post shall include the cost of furnishing all labor, materials, and equipment necessary to install the sign posts, including the posts, breakaway base and hinge assemblies, and footings installed in place. Breakaway posts provided in lieu of non-breakaway posts at the Contractor's option shall be paid for at the bid price for non-breakaway posts.

645-5.06 Pole Mounted Sign Support Systems. The unit price bid for each pole mounted sign support system shall include the cost of furnishing all labor, materials and equipment necessary to install the sign panel on an existing pole, regardless of the number of bands used.

Payment will be made under:

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<td>07</td>
<td>W310X39</td>
<td>03</td>
<td>Omni-directional Breakaway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>08</td>
<td>W360X51</td>
<td>03</td>
<td>Omni-directional Breakaway</td>
</tr>
</tbody>
</table>

645.85 M  Pole Mounted Sign Support System (Band Mounting)  Each

SECTION 646 - DELINEATORS, REFERENCE MARKERS AND SNOWPLOWING MARKERS

646-1 DESCRIPTION. This work shall consist of furnishing and installing delineators, reference markers and snowplowing markers in accordance with the N.Y.S.M.U.T.C.D., Reference Marker Manual, standard sheets, plans or as ordered by the Engineer.

646-1.01 Delineators. Delineators are reflective units placed on supports along the highway to serve as driving aids.

646-1.02 Reference Markers. Reference markers are panels with a legend, placed at approximately 161 meter intervals along the highway, to provide a numerical location reference.

646-1.03 Snowplowing Markers. Snowplowing markers are reflective units installed along the highway to identify guardrail sections for snowplow operators.

646-2 MATERIALS. Materials for delineators, reference markers and snowplowing markers shall meet the requirements of the following subsection of §700 Materials except as provided for below:

- Galvanized Coating and Repair Methods 719-01
- Aluminum Sign Panels 730-01
- Reflective Sheeting 730-05
  (Materials Designations 730-05.02 and 730-05.03)
- Acrylic Plastic Reflex Reflectors for Delineators 730-10
- Sign Posts and Footings 730-20
§646-3

Flexible Delineator Posts
Stiffeners, Overhead Brackets
and Miscellaneous Hardware
730-21
730-22.

646-2.01 Posts. Posts shall be fabricated from galvanized steel as shown on the standard sheets and/or plans, or an approved flexible post meeting the requirements of §730-21 Flexible Delineator Posts.

646-2.02 Reflective Material. Delineators and snowplowing markers shall be fabricated from either Reflective Sheeting, Material Designations 730-05.02 (Class B) or 730-05.03 (Class C), or from Acrylic Plastic Reflex Reflectors. On any one contract all of the delineators must be fabricated from the same material and all of the snowplowing markers must be fabricated from the same material, but the material may differ between the delineators and the snowplowing markers.

Reference markers shall be fabricated from Reflective Sheeting, Materials Designation 730-05.02 (Class B).

646-2.03 Aluminum Panels. Aluminum panels for delineators, reference markers and snowplowing markers shall be of aluminum alloy 6061-T6 in accordance with the standard sheets.

646-2.04 Fasteners. Fasteners shall be fabricated from stainless steel, galvanized steel or aluminum as shown on the standard sheets.

646-2.05 Brackets. Mounting brackets shall be fabricated from either aluminum alloy 6061-T6 or galvanized steel or polycarbonate (0.080) as shown on the standard sheets.

646-2.06 Corrosion Protection. All steel surfaces shall be prevented from coming in direct contact with the aluminum brackets by means of either an approved mastic or 3 mm thick pad placed between the dissimilar metals.

646-3 CONSTRUCTION DETAILS

646-3.01 Fabrication. Delineators and snowplowing markers shall be fabricated as shown on the standard sheets. Reference markers shall be fabricated as shown on the standard sheets from reflective sheeting with the legends applied by reverse silk screening and/or directly applied reflective characters using green background and white letters. Legend content shall be as shown on the plans.

646-3.02 Location. Delineators shall be installed at the locations and spacing as shown on the plans or as ordered by the Engineer. Directional orientation, arrangement, number and color of reflector units, at any given location shall be as shown on the plans.

Reference markers shall be installed at approximately 161 meter intervals along the highway. The Contractor will be given the location of each marker.

Snowplowing markers and supplementary snowplowing markers shall be installed at the locations shown on the plans or as ordered by the Engineer.

646-3.03 Erection. Delineators, reference markers and snowplowing markers are to be erected on posts, brackets, existing posts and structures in the manner shown on the standard sheets.

646-3.04 Inspection. After the installation of delineators, reference markers and snowplowing markers, an inspection by the Engineer shall be made in the day time for proper location, line and grade, vertical post alignment and visibility. They shall also be inspected at night for improper orientation, specular reflection and other defects more conspicuous at night. All apparent defects disclosed after the day and night inspections shall be corrected by the Contractor to the satisfaction of the Engineer and the cost thereof shall be included in the Contractor's unit price bid.

646-3.05 Damage. When delineators and markers are installed on walls, bridges, existing posts, poles or structures, care shall be taken so as not to damage the appearance or structural features of the existing facilities. All damaged features shall be repaired or replaced, at no additional cost, to the satisfaction of
§646-3

the Engineer.

646-3.06 Marker Relocation. The existing markers shall be carefully removed and stockpiled above ground in a neat and skilled manner, to the satisfaction of the Engineer, by the Contractor at the site or sites within the R.O.W. limits as designated by the Engineer. Care shall be exercised in removing the markers to prevent damage to any part of the reflectorized panels. All markers so damaged shall be replaced at the Contractor's expense.

The contractor shall remove and dispose of all existing posts or hardware used only for the support of the existing markers.

Markers removed shall be re-erected on new posts, brackets, or bands at the locations called for on the plans or specified by the Engineer.

646-4 METHOD OF MEASUREMENT. Delineators, reference markers and snowplowing markers shall be measured as the number of complete markers and/or delineators furnished and installed. In the event a section of highway is under construction by others and reference markers cannot be installed, they will be measured as the number of marker panels furnished only.

Relocated markers shall be measured as the number of markers relocated in accordance with these specifications and in a manner approved by the Engineer.

646-5 BASIS OF PAYMENT. The unit price bid shall include the cost of all materials, equipment and labor necessary to satisfactorily complete the work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>646.0601 M</td>
<td>Delineator, Single Unit, One Way on Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0602 M</td>
<td>Delineator, Single Unit, Back to Back on Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0603 M</td>
<td>Delineator, Single Unit, Two Way on Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0604 M</td>
<td>Delineator, Single Unit, Three Way on Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0605 M</td>
<td>Delineator, Single Unit, Four Way on Post</td>
<td>Each</td>
</tr>
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<td>646.0606 M</td>
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<td>Delineator, Single Unit, Band or Bracket Mounted</td>
<td>Each</td>
</tr>
<tr>
<td>646.0608 M</td>
<td>Delineator, Double Unit, Band or Bracket Mounted</td>
<td>Each</td>
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<td>646.0609 M</td>
<td>Delineator, Single Unit, Back to Back, Band or Bracket Mounted</td>
<td>Each</td>
</tr>
<tr>
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<td>646.0611 M</td>
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<td>Each</td>
</tr>
<tr>
<td>646.0612 M</td>
<td>Delineator, Single Unit, Four Way, Band or Bracket Mounted</td>
<td>Each</td>
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<tr>
<td>646.0623 M</td>
<td>Delineator, White, Single Unit, One Way on Flexible Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0624 M</td>
<td>Delineator, White, Single Unit, Back to Back, on Flexible Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0625 M</td>
<td>Delineator, White, Double Unit on Flexible Post</td>
<td>Each</td>
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<td>646.0633 M</td>
<td>Delineator, Yellow, Single Unit, One Way on Flexible Post</td>
<td>Each</td>
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<td>Each</td>
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<td>646.0635 M</td>
<td>Delineator, Yellow, Double Unit on Flexible Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0701 M</td>
<td>Reference Marker, 1.2 m Mounting Height</td>
<td>Each</td>
</tr>
<tr>
<td>646.0702 M</td>
<td>Reference Marker, 2.1 m Mounting Height</td>
<td>Each</td>
</tr>
<tr>
<td>646.0703 M</td>
<td>Reference Marker, Band or Bracket Mounted</td>
<td>Each</td>
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<tr>
<td>646.0704 M</td>
<td>Reference Marker, On Existing Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0705 M</td>
<td>Reference Marker, Furnish Panel Only</td>
<td>Each</td>
</tr>
<tr>
<td>646.0801 M</td>
<td>Snowplowing Marker, Single Unit</td>
<td>Each</td>
</tr>
<tr>
<td>646.0802 M</td>
<td>Snowplowing Marker, Double Unit</td>
<td>Each</td>
</tr>
<tr>
<td>646.0803 M</td>
<td>Supplementary Snowplowing Marker</td>
<td>Each</td>
</tr>
<tr>
<td>646.09 M</td>
<td>Marker-Relocation</td>
<td>Each</td>
</tr>
</tbody>
</table>
SECTION 647 - REMOVING, STORING AND RELOCATING SIGNS

647-1 DESCRIPTION. This work shall include the removal, or removal and storage, or relocation of existing State signs and/or sign structures designated on the plans or specified by the Engineer. The sign components shall include sign panels, stringers, vertical brackets, miscellaneous hardware used solely for the support of the designated sign panels, upright supports, bracing and structures.

647-2 MATERIALS. All materials used in this work shall meet the requirements of §645-2.

647-3 CONSTRUCTION DETAILS

647-3.01 Removal of Signs. Existing traffic signs requiring removal, but not storage, shall become the property of the Contractor and shall be removed from the work site in a neat and skillful manner to the satisfaction of the Engineer.

647-3.02 Removal and Storage of Signs. Existing traffic signs shall be removed and stockpiled off the ground in a neat and skillful manner, to the satisfaction of the Engineer, by the Contractor at the site or sites within the R.O.W. limits as approved by the Engineer.

647-3.03 Removal of Concrete Sign Footings. All concrete sign footings shall be completely removed, or if allowed by the Engineer, shall be cut to a depth of 0.3 meters below existing ground and be replaced with suitable material as specified by the Engineer.

647-3.04 Relocation of Signs. Existing sign panels shall be removed and stockpiled off the ground in a neat and skillful manner by the Contractor to the satisfaction of the Engineer, at the site or sites within the R.O.W. limits as designated by the Engineer. Care shall be exercised in removing the sign panels to prevent damage to any part of the reflectorized sign face or characters, or the existing stringers or stiffeners. Any damage shall be repaired or the damaged part replaced to the satisfaction of the Engineer at the Contractor's expense.

Existing sign posts shall become the property of the Contractor and shall be removed from the work site in a neat and skillful manner.

The Contractor shall erect new sign posts and mount the existing sign panels at the locations shown on the plans or specified by the Engineer. The requirements of §645-3, Construction Details, shall apply to this work.

647-4 METHOD OF MEASUREMENT. The quantity to be paid for will be the number of completely removed or relocated installations having sign areas of the following sizes:

- Size A: 0.0 to 1.0 Square Meters
- Size B: 1.1 to 2.0 Square Meters
- Size C: 2.1 to 4.0 Square Meters
- Size D: 4.1 to 10.0 Square Meters
- Size E: Over 10.0 Square Meters
- All Overhead Sign Panels (Any Size)

647-5 BASIS OF PAYMENT. The unit price bid for removing or removing and storing or relocating an existing installation shall be compensation in full for the furnishing of all labor, equipment, and materials necessary described in this section.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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</thead>
<tbody>
<tr>
<td>647.01 M</td>
<td>Removal of Signs - Size A (0.0 to 1.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.02 M</td>
<td>Removal of Signs - Size B (1.1 to 2.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.03 M</td>
<td>Removal of Signs - Size C (2.1 to 4.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.04 M</td>
<td>Removal of Signs - Size D (4.1 to 10.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.05 M</td>
<td>Removal of Signs - Size E (Over 10.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.06 M</td>
<td>Removal and Storage of Signs Size A (0.0 to 1.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.07 M</td>
<td>Removal and Storage of Signs Size B (1.1 to 2.0 S.M.)</td>
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<td>647.08 M</td>
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<tr>
<td>647.09 M</td>
<td>Removal and Storage of Signs Size D (4.1 to 10.0 S.M.)</td>
<td>Each</td>
</tr>
</tbody>
</table>
§647-5

647.10 M Removal and Storage of Signs Size E (Over 10.0 S.M.) Each
647.11 M Relocating Signs Size A (0.0 to 1.0 S.M.) Each
647.12 M Relocating Signs Size B (1.1 to 2.0 S.M.) Each
647.13 M Relocating Signs Size C (2.1 to 4.0 S.M.) Each
647.14 M Relocating Signs Size D (4.1 to 10.0 S.M.) Each 5
647.15 M Relocating Signs Size E (Over 10.0 S.M.) Each
647.18 M Removal of Overhead Sign Panels Each
647.19 M Removal and Storage of Overhead Sign Panels Each
647.20 M Removal of Cantilever Sign Structure Each
647.21 M Removal of Single Span Sign Structure Each 10
647.22 M Removal of Multi-Span Sign Structure Each

SECTION 648 - SUBSURFACE EXPLORATIONS

648-1 DESCRIPTION. This work shall consist of furnishing equipment, drilling for soil and rock samples, and preparing a driller’s log in accordance with these specifications and the direction of the Engineer.

648-2 MATERIALS. Materials for this work shall meet the requirements of the following Subsections of Section 700 - Materials Details:

<table>
<thead>
<tr>
<th>Item</th>
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<tr>
<td>Drill Rigs</td>
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</tr>
<tr>
<td>Drive Pipe</td>
<td>732-02</td>
</tr>
<tr>
<td>Casing</td>
<td>732-03</td>
</tr>
<tr>
<td>Samplers</td>
<td>732-04</td>
</tr>
<tr>
<td>Thin-Walled Sample Tubes</td>
<td>732-05</td>
</tr>
<tr>
<td>Coring Bits</td>
<td>732-06</td>
</tr>
<tr>
<td>Sample Storage Bags</td>
<td>732-07</td>
</tr>
<tr>
<td>Sample Jars</td>
<td>732-08</td>
</tr>
<tr>
<td>Jar Cartons</td>
<td>732-09</td>
</tr>
<tr>
<td>Boulder and Rock Core Boxes</td>
<td>732-10</td>
</tr>
<tr>
<td>Open Well Piezometers</td>
<td>732-11</td>
</tr>
<tr>
<td>Grout</td>
<td>732-12</td>
</tr>
</tbody>
</table>

648-3 CONSTRUCTION DETAILS

648-3.01 General. This work shall consist of furnishing equipment, clearing of all drill holes in accordance with New York State Department of Public Service Rule 753, drilling for soil and rock samples, back filling all drill holes to the satisfaction of the Engineer, and preparing a driller’s log in accordance with these specifications. Any proposed variation from the methods and techniques in the specifications shall be submitted in writing by the Contractor to the Engineer who shall forward the proposal to the Director of the Geotechnical Engineering Bureau for review. Approval, if granted, will be based on the decision of the Director of the Geotechnical Engineering Bureau as to the capabilities of the proposed variation to provide satisfactory samples and subsurface information. If granted, this approval will remain in force only so long as all conditions set forth in the approval are met and satisfactory results are obtained. In the event unsatisfactory results are obtained, the approval will be withdrawn and all remaining work shall be completed in accordance with this specification. Boring work shall not commence until all equipment stated in the proposal is on the project and approved. In addition, the following shall apply:

A. Furnishing equipment for Making Borings. The Contractor shall furnish the number of drill rigs, conforming to §732-01, stated in the proposal or work order, maintain this equipment, and remove it from the site at the time indicated by the Engineer. All equipment shall be acceptable to the Engineer.

B. Driller’s Logs. The forms for the driller’s logs, Form 282e, will be furnished by the State and
shall have the following information legibly printed on them by the Contractor:

Region
County
Contractor Name
Contract Number
Project Identification Number (PIN)
Project Name
Date Started and Finished
Hole Number
Weight and Fall of Hammer (Casing)
Weight and Fall of Hammer (Sampler)
Casing and Sampler Size
Inspector Name (Regional Geotechnical Engineer on Log)
Structure Name/Number
Penetration Records (Blows on Casing, Drive Pipe and Sampler)
Sample numbers

Groundwater Data
  Depth at which drill water was first used
  Depth at which groundwater was first encountered
  Depth to groundwater at the beginning and end of each day's operation

Rock Core
  Length of Run
  Percent Recovery
  Number of Pieces
  Depth Core Obtained
  Size of Core Obtained
  Type of Core Barrel

All pertinent remarks and comments

The hole designation on the final log and sample containers should reflect the actual method of progressing the hole. Any change in hole designation (due to an alternate hole progression method) shall be forwarded to the Engineer in writing in a timely manner.

Provide all measurements and dimensions in metric units on the final log.

Ensure that the completed driller's log is signed by the drill rig operator, the drill rig inspector, and the Chief Inspector.

Deliver the samples and a copy of the completed driller's log to the location indicated in the Contract documents, between the hours of 8:00 A.M. and 3:00 P.M., within five working days following completion of the hole, except holidays. In addition, deliver another copy of the completed driller's log to the Departmental Geotechnical Engineer. Submit the original copy of the completed driller's log to the Engineer.

C. Groundwater Determinations. The level at which groundwater is first encountered in the borings shall be noted. Water level readings shall be taken at the end of each day after the last sample has been taken and the sample and rods have been removed. No soil shall be left in the casing at the end of the day. Do not fill the casing with water unless there is a need to compensate for a condition such as running sand. Measure and record the change in water level when resuming work. Capped borings shall be vented. Groundwater levels shall be measured before and after the casing or drive pipe is pulled. Each water level reading shall be recorded showing the date and time the reading was made, the depth of the drive pipe or casing, and the depth to water. Any loss or gain of water in the boring, except that caused by deliberately introducing water and/or inserting or removing tools, shall be recorded. This record shall show the date and time the loss or gain is noted.
the depth of the casing and the depth to water. The height of artesian rise shall be recorded. All water level readings and related data shall be recorded on the boring logs under “Remarks”. If necessary, additional forms shall be used for recording groundwater data.

Artesian pressures shall be permanently sealed at the elevation at which they were encountered. This seal shall be satisfactory to the Engineer before casing is removed from the hole.

648-3.02 Split Barrel Samples

A. Progressing the Hole. The hole shall be progressed by advancing flush-joint casing, flush-coupled casing, or extra-strength drive pipe by driving or drilling, or where permitted, by a drilling mud process or by using a hollow flight auger. When driven casing is used a 136.3 kg (± 3 percent) hammer falling freely 450 mm shall be used. Actuate the hammer by means of a rope and cathead, or by automatic hammer, when casing or drive pipe is driven.

Casing refusal shall be considered as 300 blows for less than 300 mm of penetration. When refusal is encountered, the casing shall be cleaned and a sample shall be attempted, if no sample is recovered, coring will commence.

Prior to sampling, the drill hole shall be cleaned to the sampling elevation by using equipment that will not disturb the material to be sampled. Bottom discharge bits, including samplers, will not be allowed. A roller bit may be used as a clean out tool if it is of a type that deflects water to the sides rather than downward into the material to be sampled. The Engineer may order a new roller bit at any time he deems the one in use to be unacceptable. “N” size drill rods or larger shall be used in 76.2 mm or larger inside diameter casing.

The Engineer shall be advised of the time of the last sampling operation so he may be present when the hole is measured for payment purposes.

B. Sampling. Samples shall be taken at every change in stratum but in no case at intervals greater than 1.5 m. Continuous sampling may be directed by the Engineer. The sampler shall be placed on the bottom of the cleaned out hole and then driven 450 mm with a 136.3 kg (± 3 percent) hammer falling freely 450 mm. Actuate the hammer by means of a rope and cathead, or by automatic hammer. When the Standard Penetration Test (SPT) is required, use equipment and procedures conforming to ASTM D1586-84, except as modified by this specification.

The number of blows required to drive the sampler each increment of 150 mm shall be recorded. If refusal is encountered before the desired sample length is attained, and the sampler proves to have no recovery, the sampler shall be removed from the hole and core drilling started; however, if refusal is encountered and the material retained represents the best obtainable sample as determined by the Engineer, the hole may be progressed to the next sample elevation or change in soil strata. Refusal shall be 50 hammer blows for less than 150 mm of penetration for the 136.3 kg hammer. When the SPT is used, refusal shall be as defined in ASTM D1586-84.

When a recovery of less than 150 mm of sample in a split barrel sampler is retrieved, the sampler shall be re-driven at the same elevation in an attempt to obtain more material. Only the first set of blows shall be recorded on the boring log, but a note shall be included under “Remarks” indicating that a second sampling attempt was made. The Engineer may direct that a basket or other spring type retainer be used on any or all sampling attempts. Flap or trap valves will only be used when specifically directed by the Engineer. When sampling material below the water table, the hole shall be kept full of fluid during the removal of tools to prevent flowback, unless otherwise directed by the Engineer.

All samples, regardless of the amount of recovery, shall become the property of the State and shall be packaged, transported and delivered in accordance with this specification.

C. Marking, Packaging and Transporting Sample. Samples shall be placed in tied plastic storage bags placed in jars conforming to §732-08 in such a manner so as to maintain the natural structure of the sample. The jar shall be labeled to show the project name, PIN, sample number, hole number, and the depths from which the sample was taken. Jars shall be placed in cartons conforming to §732-09. Samples must be protected from freezing or extreme heat. The samples
shall be delivered by the Contractor to the location indicated in the Contract documents between the hours of 8:00 A.M. and 3:00 P.M., within five working days following completion of the hole, excepting holidays.

If samples are not delivered in a timely manner, work will be suspended until the samples have been delivered as required by the contract.

D. Acceptance. Samples having less than 150 mm of recovery or more than 50 mm of wash material will be considered unacceptable unless, in the judgment of the Engineer, the actual recovery represents the best sample obtainable. All samples shall become the property of the State.

648-3.03 Thin-Walled Tube Samples

A. Progressing the Hole. The hole shall be a minimum of 100 mm in diameter. Drilling mud may be used if permitted in writing by the Engineer. Hollow stem augers will not be allowed. The hole shall be cleaned using methods and equipment which will not disturb the soil to be sampled. Bottom discharge bits, including samplers, will not be allowed.

The 50 mm of soil directly above the sampling elevation shall be removed with a clean-out jet auger without the use of water. “N” size drill rod or larger shall be used.

B. Sampling. Thin-walled tube samples shall be taken in the strata designated by the Engineer. Samples shall be recovered with a stationary piston type sampler or a hydraulically operated piston sampler, modified to accept the thin-walled tubes specified in §732-05. Samplers with piston rods extending to the ground surface must be provided with clamps which positively lock the piston against upward travel during lowering of the sampler until the sampling depth is reached. During the press the piston rods shall be locked in a stationary position to eliminate any movements either up or down. In addition, the sampler shall also be provided with positive locks to secure the piston rods prior to removal of the sampler after penetration.

At the elevation to be sampled, the tube shall be pressed into the soil with a continuous motion a distance of 450 mm. Care must be taken to allow air and water to flow freely through the vent thus preventing compression of the soil sample. After pressing to the required depth and waiting for 5 minutes, the sampler shall be carefully rotated and removed from the hole.

During the removal of the sampler the hole shall be kept full of fluid. Before the thin-walled tube is removed from the piston, the piston rod shall be backed off to admit air past the flattened threads to break the vacuum. For other approved types of equipment, the necessary vacuum breaking measures shall be taken. The length of sample in the tube and also the distance pressed, shall be measured and recorded.

Should a thin-walled sample not be retained, a 50 mm driven sample shall be taken.

The bottom of the sample shall be carefully squared off at least 25 mm back from the end of the tube and a wax seal, approximately 25 mm thick, shall be poured in the bottom end of the tube. The soil at the top of the tube shall be carefully squared off and a wax seal, approximately 15 mm thick, shall be poured. Any space remaining between the top or bottom of the sample tube and the wax seal shall be filled with sawdust or paper after the wax has hardened. Wax will be furnished by the Geotechnical Engineering Bureau. The ends of the tubes shall be sealed with snugly fitting plastic caps which shall be secured in place with friction tape. Wax shall not be placed on the outside of the tube. Labels shall be placed on the tube below center and secured with strips of tape.

C. Marking, Packaging and Transporting Samples. Thin-walled tubes shall be labeled to show the Project Identification Number, Location, hole number, sample number, and depths from which the sample was taken. The samples shall be handled, stored and transported using care to prevent the samples from being subjected to freezing, drying, jarring and any other disturbance. The tubes properly packaged shall be stored and transported in an upright position at all times. The tubes shall be delivered by the Contractor to:

New York State Department of Transportation
Geotechnical Engineering Bureau
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State Campus, Building 7
1220 Washington Avenue
Albany, New York 12232

between the hours of 8:00 A.M. and 3:00 P.M., within five working days after obtaining the tubes, excepting holidays.

D. Acceptance. Thin-walled tubes having less than 300 mm of undisturbed recovery will be unacceptable for payment unless in the judgment of the Engineer, based on a recommendation by the Director of the Geotechnical Engineering Bureau, the actual recovery represents the best available. Thin-walled tubes which have been frozen will be unacceptable for payment. Samples that are not taken in accordance with the specification, or that are not properly sealed, or transported may be rejected.

648-3.04 Rock Core Samples

A. Progressing the Hole. The hole shall be progressed through the overburden in accordance with §648-3.02A until refusal is encountered. Continuous core drilling shall then be progressed in boulders and ledge rock at locations and to depths determined by the Engineer.

B. Sampling. Core shall be drilled using a double tube, swivel type core barrel. If at any time the core barrel is withdrawn more than 30 mm, the core barrel shall be removed from the hole and the core removed from the barrel.

C. Marking, Packaging and Transporting Samples. Rock cores shall be labeled in accordance with the current Geotechnical Engineering Bureau Drawing entitled “Proper Labeling of Rock Cores.” They shall be placed in core boxes constructed in accordance with the current Geotechnical Engineering Bureau Drawing entitled “Core Box - AX, BX, HX, NX Sizes” and delivered to the Department's Regional Office or to a location designated in the proposal within 2 weeks after completion of the hole.

D. Acceptance. Rock core recoveries of less than 85 percent of each run will be considered unacceptable unless, in the judgment of the Engineer, all obtainable state-of-the-art equipment and methods have been used and actual recovery represents the best obtainable.

648-3.05 Open Well Piezometer

A. Progressing the Hole. A 100 mm nominal diameter cased drill hole shall be progressed to the depth specified on the contract documents. Equipment conforming to the requirements contained in §732-01 shall be used.

B. Installing the Well Pipe. The open well piezometer shall be assembled to form a continuous pipe as recommended by the manufacturer or as directed by the Engineer. The open well piezometer shall be placed in the hole as shown in the Open Well Piezometer drawing to the elevation or depth specified in the contract documents or as directed by the Engineer. No grout, debris or other foreign material shall enter the PVC pipe during the installation.

C. (Vacant).

D. Placing the Bentonite Seal. After the final sand placement the steel casing shall be withdrawn an additional 300 mm. and the bentonite pellets placed to form a 300 mm thick seal.

E. Grouting and Casing Removal. The hole shall be grouted from the bottom using the mix found at the end of this subsection or in proportions approved by the Engineer. The contractor shall withdraw the casing. As the casing is being withdrawn, the level of grout shall be maintained within 1.5 m of the top of the hole at all times. The PVC pipe shall not be allowed to move vertically while withdrawing the casing.
<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>NYSDOT SPECIFICATION REQUIREMENT</th>
<th>PROPORTION BY VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
<td>PORTLAND CEMENT TYPE 1 OR 2</td>
<td>§701-01</td>
<td>2 PARTS</td>
</tr>
<tr>
<td>WATER</td>
<td>§712-01</td>
<td>12 PARTS</td>
</tr>
<tr>
<td>BENTONITE (ground to pass a 75 μm mesh sieve)</td>
<td>N/A</td>
<td>1 PART</td>
</tr>
</tbody>
</table>

**F. Finishing.** Wait 18 hours for the grout to cure. If the grout bleeds or shrinks, the hole shall be backfilled with sand to within 300 mm of the top of the hole. The manhole shall be mortared over the top of the open well piezometer as shown in Open Well Piezometer drawing.

**648-3.06 Bore Hole Grouting.** Prior to placing the grout, the sides of the boring shall be supported to the satisfaction of the Engineer using casing or some other positive means. The Contractor shall mix the grout in the following proportions, by volume:

<table>
<thead>
<tr>
<th>BENTONITE</th>
<th>1 PART</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRY CEMENT</td>
<td>12 PARTS</td>
</tr>
<tr>
<td>WATER</td>
<td>18 PARTS</td>
</tr>
</tbody>
</table>

or in proportions approved by the Engineer. After the boring is cleaned out, a grout pipe shall be placed to the bottom of the hole and grout pumped through the pipe to completely fill the boring for the full depth of the boring. After grouting, the casing shall be removed, and the boring topped off with grout. All mixing and placing operations shall be performed to the satisfaction of the Engineer.

**648-4 METHOD OF MEASUREMENT**

**648-4.01 Furnishing Equipment for Making Borings.** The quantities to be paid for will be the number of drill rigs, including barges, platforms and support vessels where required on water, specified in the proposal or work order, and for additional drill rigs ordered on the project by the Engineer. Payment will not be made for any drill rig that does not work at least 75 percent of the total working time computed from the date of actual commencement of the work to the final completion date, except for additional drill rigs ordered to the project by the Engineer.

**648-4.02 Split Barrel Sample.** The quantity to be paid for will be the number of acceptable samples obtained.

**648-4.03 Thin-Walled Tube Sample.** The quantity to be paid for will be the number of acceptable samples obtained.

**648-4.04 Rock Core Drilling.** The quantity to be paid for will be the number of linear meters drilled from which acceptable core was obtained. Measurement for payment shall be made in the presence of the Engineer.

**648-4.05 Drill Hole (65 mm and 100 mm diameter).** The quantity to be paid for will be the number of linear meters of boring progressed in overburden, less a deduction equal to the specified sampling interval for each unacceptable sample. Measurement shall be made from the surface elevation where the boring starts (including top of bridge deck or the water surface if working from a floating platform) at each hole. Measurement for payment shall be made in the presence of the Engineer.
§ 648-4

648-4.06 Open Well Piezometer. The quantity to be paid for will be the number of linear meters of PVC pipe satisfactorily installed in accordance with this specification, measured from the top of the pipe to the bottom of the slotted screen.

648-4.07 Bore Hole Grouting (65 mm and 100 mm diameter). The quantity to be paid for will be the number of linear meters of drill hole grouted in accordance with these specifications.

648-5 BASIS OF PAYMENT

648-5.01 Furnishing Equipment for Making Borings (on land or water). The unit price bid for each drill rig shall include the cost of all labor, materials and equipment including barges, platforms and support vessels necessary to furnish, transport and maintain the drill rig, and dismantling and removing the equipment.

648-5.02 Split Barrel Sample. The unit price bid per sample shall include the cost of all labor, material and equipment necessary to obtain, mark, package and deliver the sample. The jars, cartons and samples shall become the property of the State.

648-5.03 Thin-Walled Tube Sample. The unit price bid per sample shall include the cost of all labor, materials and equipment necessary to obtain, mark, package and deliver the sample. The tubes and samples shall become the property of the State.

648-5.04 Rock Core Drilling. The unit price bid per meter shall include the cost of all labor, material and equipment necessary to obtain, mark, package and deliver the samples. The core boxes shall become the property of the State.

648-5.05 Drill Hole (65 mm and 100 mm diameter). The unit price bid per meter shall include the cost of all labor, clearing of all drill holes in accordance to New York State Department of Public Service Rule 753, and material and equipment used to progress the hole from which an acceptable sample or samples were obtained and acceptably recorded on a driller's log. The unit price bid shall be based on 15 meter incremental depths as follows:

<table>
<thead>
<tr>
<th>Depth Range</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 15 meters</td>
<td>Meter</td>
</tr>
<tr>
<td>15 - 30 meters</td>
<td>Meter</td>
</tr>
<tr>
<td>30 - 45 meters</td>
<td>Meter</td>
</tr>
<tr>
<td>45 - 60 meters</td>
<td>Meter</td>
</tr>
<tr>
<td>over 60 meters</td>
<td>Meter</td>
</tr>
</tbody>
</table>

648-5.06 Open Well Piezometer. The unit price bid for this item shall include the cost of all labor, materials and equipment necessary to satisfactorily install and protect the open well piezometer. The Contractor will receive full payment after the open well piezometer has been approved by the Engineer.

648-5.07 Bore Hole Grouting (65 mm and 100 mm diameter). The unit price bid for grouting borings shall include the cost of furnishing all labor, materials and equipment necessary to complete the work as required by these specifications. The cost for progressing the boring will be paid under its appropriate item.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>648.01 M</td>
<td>Drill Hole, 65 mm diameter 0 to 15 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.02 M</td>
<td>Drill Hole, 65 mm diameter 15 to 30 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.03 M</td>
<td>Drill Hole, 65 mm diameter 30 to 45 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.04 M</td>
<td>Drill Hole, 65 mm diameter 45 to 60 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.05 M</td>
<td>Drill Hole, 65 mm diameter greater than 60 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.06 M</td>
<td>Drill Hole, 100 mm diameter 0 to 15 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.07 M</td>
<td>Drill Hole, 100 mm diameter 15 to 30 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.08 M</td>
<td>Drill Hole, 100 mm diameter 30 to 45 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.09 M</td>
<td>Drill Hole, 100 mm diameter 45 to 60 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.10 M</td>
<td>Drill Hole, 100 mm diameter greater than 60 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.11 M</td>
<td>Split Barrel Sample</td>
<td>Each</td>
</tr>
<tr>
<td>648.12 M</td>
<td>Thin-Walled Tube Sample</td>
<td>Each</td>
</tr>
</tbody>
</table>
648.13 M  Rock Core Drilling AX  Meter
648.14 M  Rock Core Drilling BX  Meter
648.15 M  Rock Core Drilling NX  Meter
648.16 M  Rock Core Drilling HX  Meter
648.17 M  Furnishing Equipment for making Borings  Each  5
648.18 M  Furnishing Equipment for making Borings on water  Each
648.19 M  Furn. Equip. for making Borings on water using stationary platform  Each
648.20 M  Open Well Piezometer  Meter
648.21 M  Grouting 65 mm Bore Hole  Meter
648.22 M  Grouting 100mm Bore Hole  Meter

SECTION 649 (VACANT)

SECTION 650 - JACKING REINFORCED CONCRETE PIPE

650-1 DESCRIPTION. Under this work the Contractor shall install by jacking, an extra strength, reinforced concrete, tongue and groove, culvert pipe of the size and at the location shown on the plans or as specified by the Engineer.

650-2 MATERIALS. Pipe shall meet all the requirements of §706-02, Reinforced Concrete Pipe for Class V, except that the exterior barrel shall be smooth.

650-3 CONSTRUCTION DETAILS

650-3.01 Approval

A. General. Construction drawings, showing the proposed method and procedure of jacking the pipe and construction of jacking and receiving pits shall be submitted to the Engineer for approval before work on the jacking operation is started. Approval of construction drawings shall not relieve the Contractor of his responsibility to perform the work without damage to existing construction. Field conditions may require changes in the approved drawings and such changes shall be subject to the approval of the Engineer.

B. Jacking Under Railroad. Construction drawings, methods, work and necessary precautions related to jacking pipe under a railroad shall be submitted to, meet the requirements of, and have the approval of the Chief Engineer of the railroad company. No work shall be commenced until such approval has been received from the railroad company.

650-3.02 Jacking Procedures

A. General. The pipe shall be jacked with jacks of sufficient capacity to shove the pipe through the embankment into position true to required line and grade and with tongue downstream. When jacking the pipe, a minimum 13 mm thick steel cutting shield at least 600 mm long with an arc length equal to 1/3 of the pipe circumference shall be required to abut the upper 1/3 circumference and extend beyond the forward end of the pipe being jacked. The outside radius of this shield shall not exceed the outside radius of the pipe. Excavation ahead of the pipe shall not be permitted to progress beyond the end of the shield being used.

B. Jacking Under Railroad. Rail hangers shall be installed by railroad company forces prior to the jacking operations, unless the Engineer is advised otherwise by the railroad company. The rail hangers will not be removed by railroad forces until all voids in the embankment as a result of the jacking operation, have been filled by the Contractor to the satisfaction of the railroad company.

650-3.03 Contractor Responsibility. The Contractor shall be held responsible for surface subsidence and damage or disturbance to adjacent property and facilities that may result from his construction methods. In case loose material is encountered and cave-ins occur or are anticipated, all jacking will be discontinued, approved shoring shall be provided and all voids filled either by pressure...