

**RULE NO.: R161-23.11****NOTICE OF PROPOSED RULE****POSTING DATE: 04/20/2023**

The Director of the Department of Transportation proposes to adopt the following rule after May 22, 2023.

Comments on the proposed rule are requested from the public. Comments should be submitted to Brian Van De Walle at 8700 Cameron Road, Austin, TX or (512) 974-3958) or [brian.vandewalle@austintexas.gov](mailto:brian.vandewalle@austintexas.gov). To be considered, comments must be received before May 22, 2023, the 32nd day after the date this notice is posted.

An affordability impact statement regarding the proposed rule is pending; once approved it is available for inspection or copying at the address noted in the preceding paragraph.

**EFFECTIVE DATE OF PROPOSED RULE**

A rule proposed in this notice may not become effective before the effective date established by a separate notice of rule adoption. A notice of rule adoption may not be posted before May 22, 2023 (the 32nd day after the date of this notice) and not after June 29, 2023 (the 70th day after the date of this notice).

If a proposed rule is not adopted on or before June 29, 2023 it is automatically withdrawn and cannot be adopted without first posting a new notice of a proposed rule.

**BRIEF EXPLANATION OF PROPOSED RULE**

*Rule R161-23.11 is a proposed rule change to the Standards Specification Manual initiated by the Austin Transportation Department. The following standard specifications are being replaced:*

- 831S – Traffic Signal Drilled Shaft Foundations 9-26-12
- 832S – Vehicular Traffic Signal Installation 9-26-12
- 833S – Pedestrian Push Button Assembly 9-17-01
- 834S – Traffic Signal Pull Boxes 9-26-12
- 835S – Traffic Signal Conduit 9-26-12
- 840S – Installation of Traffic Signals 9-26-12

*The new standard specifications that will be replacing the above are:*

- 831 Traffic Signal Drilled Shaft Foundations – 02-06-23
- 832 Vehicular Traffic Signal Installation 02-06-23

- 833 Pedestrian Push Button Assembly 02-06-23
- 834 Traffic Signal Pull Boxes – 02-06-23
- 835 Traffic Signal Conduit – 02-06-23
- 840 Installation of Traffic Signals 02-06-23
- 842 Removal of Traffic Signal Poles and Foundations 02-06-23
- 843 Accessible Pedestrian System 02-06-23
- 845 Electrical Service for Traffic Signals 03-06-23
- 847 Grounding of Traffic Signals 02-06-23

A copy of the complete text of the proposed rule is attached to this Notice of Proposed Rule. Additionally, a copy of the complete text of the proposed rule is available for public inspection and copying at the following locations. Copies may be purchased at the locations at a cost of ten cents per page:

Department of Transportation, located at 901 South MoPac Expressway, Building V, Suite 300, Austin, Texas; and

Office of the City Clerk, City Hall, located at 301 West 2nd Street, Austin, Texas.

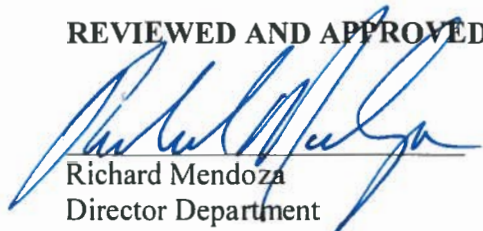
#### **AUTHORITY FOR ADOPTION OF PROPOSED RULE**

The authority and procedure for adoption of a rule to assist in the implementation, administration, or enforcement of a provision of the City Code is provided in Chapter 1-2 of the City Code. The authority to regulate construction requirements is established in Section 25-6-267 and Section 25-6-268 of the City Code.

#### **CERTIFICATION BY CITY ATTORNEY**

By signing this Notice of Proposed Rule (R161-23.11), the City Attorney certifies the City Attorney has reviewed the rule and finds that adoption of the rule is a valid exercise of the Director's administrative authority.

#### **REVIEWED AND APPROVED**

  
Richard Mendoza  
Director Department

Date: 4-10-23

Anne L. Morgan

Anne L. Morgan  
City Attorney

Date: 4/17/2023

**ITEM NO. ~~831S831~~ TRAFFIC SIGNAL DRILLED SHAFT FOUNDATIONS ~~9-26-12~~****~~831S831~~.1 Description**

This item shall govern furnishing and installation of traffic signal foundations in accordance with the specifications herein, Standard Detail ~~831S831~~-1, "Traffic Signal Drilled Shaft Foundation", Standard Detail No. ~~831S831~~-2, "Solar Powered Flasher Assembly, the Drawings and/or as approved by the Engineer or designated representative.

Traffic signal pole foundation types shall be as designated on the Drawings and shall be one of the following:

<u>Type 0</u>		<u>24" diameter drilled shaft</u>
-Type 1	<u>30"</u>	<del>(760-mm)</del> <u>30"</u> diameter drilled shaft
Type 2	<u>36"</u>	<del>(915-mm)</del> <u>36"</u> diameter drilled shaft
Type 3	<u>42"</u>	<del>(1070-mm)</del> <u>42"</u> diameter drilled shaft
Type 4	<u>48"</u>	<del>(1220-mm)</del> <u>48"</u> diameter drilled shaft
Type 5	<u>4"</u>	<del>(100-mm)</del> <u>4"</u> pedestrian <del>signal</del> pole foundation

~~This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.~~

~~831S~~

**~~831~~.2 Submittals**

The submittal requirements of this specification item may include:

- A. The foundation plan and drilling/excavation details;
- B. Class A p.c. concrete mix design;
- C. Anchor bolt plan and details;
- D. Reinforcing steel details and placement drawings and
- E. Casing plan and details (if required).

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## ~~831S~~831.3 Materials

### A. General

All Portland cement (p.c.) concrete, materials, anchor bolts, ground rod, conduits and construction methods shall conform to Standard Detail ~~831S~~831-1, "Traffic Signal Drilled Shaft Foundation Details".

### B. Traffic Signal Pole Types ~~0~~, 1, 2, 3 and 4

Materials for Types ~~0~~, 1, 2, 3, and 4 pole foundations include p.c. concrete, anchor bolt assemblies, reinforcing steel, conduits, and copper clad ground rod.

Additional information on the types of material for use in Types ~~0~~, 1, 2, 3, and 4 pole foundations is provided in Standard Detail No. ~~831S~~831-1 "Traffic Signal Drilled Shaft Foundation".

### C. Pedestrian Signal Pole Type 5

Materials for Type 5 pedestrian signal pole foundations include p.c. concrete, 4" ~~(100-mm)~~ threaded coupling, 10' x 4' ~~(3-meter x 100-mm)~~ intermediate metal pole (for pedestrian signals) or a 10' x 4' ~~(3-meter x 100-mm)~~ intermediate metal pole (for vehicle signals), and 4" ~~(100-mm)~~ rigid metal sweep with plug.

Additional information on the types of material for use in Type 5 pedestrian pole foundation is provided in Standard Detail No. ~~831S-2831~~ "Solar Powered Flasher Assembly".

### D. Portland Cement Concrete

The p.c. concrete for foundations shall be Class A, conforming to Standard Specification Item No. 403S, "Concrete for Structures". The p.c. concrete mix design shall consist of a minimum of 5 sacks of cement per cubic yard ~~(280 kilograms of cement per cubic meter)~~ and shall attain a minimum compressive strength of 3000 psi ~~(20.7 mPa)~~ at 28 days unless noted otherwise on the Drawings. Slump of the p.c. concrete shall be between 4" and 5" ~~(100-mm and 125-mm)~~.

The fine and coarse aggregate shall meet the requirements of Standard Specification Item No. 403S, "Concrete for Structures". The maximum nominal size of coarse aggregate shall be 1 ½ inches ~~(38-mm)~~. The cement shall meet the requirements for a Type 1 of ASTM C-150. The water shall be clear, potable and free of all substances, which may be harmful to the p.c. concrete. A retarder or water reducing agent (Standard Specification Item 405S, "Concrete Admixtures") will be required in all p.c. concrete when casing is required in unstable soil conditions.

### E. Reinforcing Steel

Reinforcing steel, when required shall conform to the sizes and dimensions shown on the Drawings. The reinforcing steel shall be new domestic deformed billet steel conforming to ASTM A-615/615M, grade 60 (SI grade 400) and shall conform to Standard Specification Item No. 406S, "Reinforcing Steel". If necessary the reinforcing steel may be spliced as long as the splice involves overlapping a minimum of 40 bar diameters.

### F. Anchor Bolts

Unless noted otherwise on the Drawings, anchor bolts shall be medium strength, mild steel or alloy steel with maximum design yield strength of 55 ksi ~~(380 mPa)~~. Alloy anchor bolts shall conform to the requirements of ASTM A 193 Grade B7. Medium strength, mild steel anchor bolts shall conform to the requirements of a modified ASTM A-36 [with a 55 ksi ~~(380 mPa)~~ yield strength] or ASTM A 572.

Welded splicing of rod material for anchor bolts will not be permitted.

Each anchor bolt shall have a 6-inch ~~(150-mm)~~ "L" bend at the bottom end and shall be threaded at the top end. The anchor bolts shall have the threaded end galvanized a minimum of 12 inches ~~(300-mm)~~.

Threads for anchor bolts shall be rolled or cut threads of unified coarse thread series in accordance with ANSI B1.1. For rolled threads, the diameter of the unthreaded portion shall not be less than the minimum pitch diameter nor more than the maximum major diameter of the threads.

All threads for bolts and nuts shall have Class 2 fit tolerances in accordance with ANSI B1.1.

~~Each high strength steel anchor bolt assembly shall include the following parts:~~

~~One (1) 1-3/4" x 90" (45 mm x 2.29 meter) Each foundation shall consist of four anchor bolt assemblies. The size of the anchor bolts for each foundation shall be shown on the drawings or specified by the Engineer.~~

~~The typical anchor bolt assemblies are shown below:~~

~~Two (2) 1-3/4" (45 mm) heavy hex nuts;~~

~~Two (2) 1-3/4" (45 mm) hardened flat washers;~~

~~One (1) 1-3/4" (45 mm) split lock washer.~~

<u>Anchor Bolt Dimension</u>	<u>Anchor Bolt Assembly Parts</u>
<u>1 1/4" x 48"</u>	<u>One (1) 1-1/4" X 48" anchor bolt</u>
	<u>Two (2) 1-1/4" heavy hex nuts</u>
	<u>Two (2) 1-1/4" hardened flat washers</u>
	<u>One (1) 1-1/4" split lock washer</u>
<u>1 1/2" x 60"</u>	<u>One (1) 1-1/2" X 60" anchor bolt</u>
	<u>Two (2) 1-1/2" heavy hex nuts</u>
	<u>Two (2) 1-1/2" hardened flat washers</u>
	<u>One (1) 1-1/2" split lock washer</u>
<u>1 3/4" x 90"</u>	<u>One (1) 1-3/4" X 90" anchor bolt</u>
	<u>Two (2) 1-3/4" heavy hex nuts</u>
	<u>Two (2) 1-3/4" hardened flat washers</u>
	<u>One (1) 1-3/4" split lock washer</u>
<u>2" x 90"</u>	<u>One (1) 2" X 90" anchor bolt</u>
	<u>Two (2) 2" heavy hex nuts</u>
	<u>Two (2) 2" hardened flat washers</u>
	<u>One (1) 2" split lock washer</u>

G. Nuts and washers

Nuts for alloy steel anchor bolts shall conform to ASTM A-194 Grade 2H or ASTM A-563, heavy hex, Class 12. Nuts for medium strength, mild steel anchor bolts shall conform to ASTM A-194 Grade 2H or ASTM A-563, Grade D or better. All threads for nuts shall have a Class 2b tolerance in accordance with ANSI B1.1. When nuts are to be galvanized, the untapped blanks shall be galvanized prior to cutting the threads.

Exposed nuts shall be galvanized or coated with a zinc-rich coating if the anchor bolts are not galvanized.

Washers installed with anchor bolts of any type shall conform to the requirements of ASTM F-436 and shall have the same finish or coating as the bolt and nut.

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H. Grout Cap

The cement grout cap to cover the anchor bolts and conduit shall consist of a mixture of 5 sacks of sand for every 1 sack of cement.

**~~831~~831.4 Construction Methods**

A. General

The traffic signal drilled shaft foundation shall be constructed in accordance with the details and instructions provided on the Drawings, in conformance with Standard Specification Item No Standard Detail ~~831~~831-1, "Traffic Signal Drilled Shaft Foundation" and in accordance with the specification requirements described herein.

B. Foundation Location

The foundation shall be located as shown on the Drawings; however the Engineer or designated representative may within design guidelines shift a foundation where necessary to secure a more desirable location or to avoid conflict with utilities. Unless otherwise indicated on the Drawings, the Contractor shall stake and the Engineer or designated representative will verify all foundation locations.

C. Safety

Construction near any underground or overhead utilities shall be accomplished using established industry and utility safety practices.

D. Construction Requirements.

The Contractor shall adhere to the following requirements:

1. The Contractor shall verify existing underground utilities through review of record data, use of one-call utility locates, collection/observation of visible surface evidence, consultation with utility facility owners and application of subsurface utility engineering techniques (e.g., potholing, ground penetrating radar, etc.) to determine the location of existing utilities and structures.
2. The use of explosives will not be permitted.
3. Any damage to utilities and/or structures, that occurs as a result of any construction activity performed by the Contractor, shall be repaired by the Contractor at the Contractor's sole expense. Foundations shall only be paid for once, regardless of extra work caused by obstructions and/or Contractor damage.
4. All loose material shall be removed from the bottom of the excavation before p.c. concrete is placed. Any water, that accumulates in the bottom of the excavated foundation, shall be removed by pumping or bailing, prior to p.c. concrete placement.
5. Anchor bolts, posts, conduits, ground rods or other hardware to be embedded in the foundation shall be held in place with templates during p.c. concrete placement or by other means approved by the Engineer or designated representative. Conduit when used shall be capped prior to placement of p.c. concrete. Conduit shall be reamed to remove burrs and sharp edges. Bell ends or bushings shall be installed on the conduit.
6. The p.c. concrete shall be placed as soon as possible after excavation is completed, the reinforcing steel placed and other hardware (anchor bolts, conduits, ground rod, etc.) installed. Reinforcing steel and concrete shall be placed during the same work day that the drilled shaft is excavated. Drilled shafts that cannot be completed the same work day as they are excavated shall be backfilled that same day with material removed from the excavation, subject to the approval of the Engineer or designated representative. Unless permission is provided by the Engineer or designated representative the p.c.

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concrete shall not be placed when the atmospheric temperature (temperature reading taken in the shade away from artificial heat) drops below 350F (20C).

7. The p.c. concrete shall be continuously placed in the drilled shaft until the construction joint indicated on the Drawings is attained. The p.c. concrete shall be placed with a suitable tremie or tube at a free fall height limited to 3 to 4 feet ~~(0.9 to 1.2 meters)~~. A mechanical vibrator shall be used for consolidating the wet p.c. concrete. During consolidation of the p.c. concrete, the Contractor shall insure that there is minimal contact of the vibrator with the reinforcing steel.
8. After p.c. concrete placement is completed and the top struck off, the exposed surface shall be cured for a minimum of 96 hours using wet cotton or burlap mats. All external bracing and templates for anchor bolts shall also remain in place for 96 hours after the p.c. concrete is placed. During this curing time, anchor bolts and conduit shall not be subjected to any applied strain. Springing or racking of anchor bolts or posts to secure proper alignment shall not be permitted.
9. Placement and compaction of backfill shall be performed in accordance with Standard Specifications Item Nos. 201S, "Subgrade Preparation" and 132S, "Embankment". Each layer shall be compacted to the required density by any method, and/or type and size of equipment, which will produce the required compaction. Prior to and in conjunction with the compaction operation, each layer shall be brought to the moisture content necessary to obtain the required density and shall be kept leveled with suitable equipment to insure uniform compaction over the entire layer.
10. Unless directed otherwise, earth embankments shall be constructed in successive layers, with a thickness of 8 inches ~~(200 mm)~~ or less in loose measure, for the full width of the individual cross section in a length that is best suited to the sprinkling and compaction methods utilized, while rock embankments shall be constructed in successive layers of 18 inches ~~(450 mm)~~ or less in thickness for the full width of the cross section.
11. Where excavation is undertaken in the roadway shoulder, the shoulder shall be replaced with material equal to the original composition. All backfill shall be completed prior to erection of any structure on the foundation.
12. All excavated material, not required for backfill, shall be known as "Waste" and shall become the property of the Contractor. It shall be the Contractors responsibility to promptly remove and dispose of the material outside the limits of the project. The work site shall be kept clean and neat at all times.
13. A cap of cement grout shall completely cover the anchor bolts and conduits on traffic signal pole foundations (Standard Detail ~~831S831~~-1) that have been earmarked to receive such protection on the individual project drawings. Anchor bolts and conduits shall be covered with plastic film prior to construction of the dome to prevent the cement grout from adhering to these items.

### **~~831S831~~.5 Measurement**

Traffic signal drilled shaft foundations shall be measured by each type of traffic signal pole foundation, complete in place:

- Type ~~1-30" (760 mm)~~ 0 - 24" diameter traffic signal pole foundation
- Type ~~2-36" (914 mm)~~ 1 - 30" diameter traffic signal pole foundation
- Type ~~3-42" (1067 mm)~~ 2 - 36" diameter traffic signal pole foundation
- Type ~~4-48" (1220 mm)~~ 3 - 42" diameter traffic signal pole foundation

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Type ~~5~~ 4" (100 mm) - 48" diameter traffic signal pole foundation

~~831S~~ Type 5 - 4" pedestrian pole foundation

### 831.6 Payment

Traffic signal pole foundations will be paid for at the unit bid price per ~~each~~ lineal foot. The unit bid price shall include full compensation for a) locating utilities, b) all excavations, c) any necessary removal of loose material and pumping of standing water; d) proper disposal of waste materials, e) furnishing and installation of anchor bolts, conduits and ground rods, f) placement and removal of required casings; g) furnishing and placing all p.c. concrete and reinforcing steel, h) all backfilling, i) procurement of materials and covering the foundation with a grout cap (if required), j) curing of exposed p.c. concrete and k) furnishing all tools, labor, equipment and incidentals necessary to complete the work.

All foundations will be paid for only once, regardless of the need to abandon and reinstall a foundation due to unforeseen utility conflicts or any other reason

Extra payment will not be made for casings left in place.

Payment will be made under:

Pay Item No. <del>831S-1</del> <del>1831-024</del> :	<del>30</del> 24" diameter Traffic Signal Drilled Shaft Foundations (typically 8' Depth)	per Each LF.
Pay Item No. <del>831S-2</del> :	<del>36"</del> diameter Traffic Signal Drilled Shaft Foundations <del>10'</del> Depth	per Each.
Pay Item No. <del>831S-3</del> :	<del>42"</del> diameter Traffic Signal Drilled Shaft Foundations <del>12'</del> Depth	per Each.
Pay Item No. <del>831S-4</del> :	<del>48"</del> diameter Traffic Signal Drilled Shaft Foundations <del>14'</del> Depth	per Each.
Pay Item No. <del>831S-5</del> :	<del>4"</del> diameter Pedestrian Signal Foundation	per Each.
Pay Item No. <del>831S-1</del> <del>1C831-30</del> :	30" diameter Traffic Signal Drilled Shaft Foundations (typically 8' Depth with casing-)	per Each LF.
Pay Item No. <del>831S-2</del> <del>2C831-36</del> :	36" diameter Traffic Signal Drilled Shaft Foundations (typically 10' Depth with casing-)	per Each LF.
Pay Item No. <del>831S-3</del> <del>3C831-42</del> :	42" diameter Traffic Signal Drilled Shaft Foundations (typically 12' Depth with casing-)	per Each LF.
Pay Item No. <del>831S-4</del> <del>4C831-48</del> :	48" diameter Traffic Signal Drilled Shaft Foundations (typically 14' Depth with casing-)	per Each LF.
Pay Item No. <del>831S-5</del> <del>5C831-5</del> :	4" diameter Pedestrian Signal Foundation with casing- (typically 4' Depth)	per Each LF.

End



<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
Standard Specification Item No. <del>831S831</del> , "Traffic Signal Drilled Shaft Foundations"	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 403S	Concrete for Structures
Item No. 405S	Concrete Admixtures
Item No. 406S	Reinforcing Steel
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Detail No. <del>831S831</del> -1	Traffic Signal Drilled Shaft Foundation Details
Detail No. <del>831S831</del> -2	Solar Powered Flasher Assembly
<u>American Society for Testing and Materials, ASTM</u>	
<u>Designation</u>	<u>Description</u>
A 36	Standard Specification for Carbon Structural Steel
A 193/193M	Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
A 194/194M	Specification for Carbon and Alloy-Steel Nuts for Bolts for High-Pressure and for High Temperature Service
A 563/563M	Specification for Carbon and Alloy-Steel Nuts
A 572/572M	Specification for High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality
A 615/615M	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
C-150/150M	Specification for Portland Cement
<u>American National Standards Institute (ANSI) and ANSI/ASME/AWWA</u>	
<u>Designation</u>	<u>Description</u>
ANSI/ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)

<u>RELATED CROSS REFERENCE MATERIALS</u>	
Standard Specification Item No. <del>831S831</del> , "Traffic Signal Drilled Shaft Foundations"	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 104S	Removing Concrete
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 401	Structural Excavation Backfill
Item No. 403S	Concrete for Structures
Item No. 405	Concrete Admixtures
Item No. 406	Reinforcing Steel

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Item No. 410	Concrete Structures
Item No. 420	Drilled Shaft Foundations
Item No. 430S	Concrete Curb and Gutter
Item No. 432S	Concrete Sidewalks
Item No. 433S	Concrete Driveways
Texas Department of Transportation: Standard Specifications for Construction, Maintenance Of Highways, Streets and Bridges	
<u>Designation</u>	<u>Description</u>
Item No. 420	Concrete Structures
Item No. 421	Portland Cement Concrete
Item No. 440	Reinforcing Steel
Item No. 449	Anchor Bolts
Item No. 618	Conduit

**ITEM NO. ~~832S~~832 VEHICULAR TRAFFIC SIGNAL INSTALLATION ~~9-26-12~~****~~832S~~832.1 Description**

This item shall govern furnishing and installation of, traffic signal heads in accordance with the specifications contained herein, the Drawings, Standard Detail Nos. ~~839S~~837-1, "Traffic Signal Electrical Notes", 839-1, "Pedestrian and Vehicular Signals Installation Details," 839S-2, "Wood Pole Span Wire Details," 839S-4, "Traffic Signal Structures: Mast Arm Details," 839S-5, "Traffic Signal Structures: Span Wire Details," 839-1 "Pedestrian and Vehicle Wiring", manufacturer recommendations and/or written instructions from the Engineer or designated representative.

~~This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.~~

~~832S~~

**~~832S~~832.2 Submittals**

The submittal requirements of this specification item include:

- A. Wire size, characteristics and designation for each wire application (i.e. traffic signal, pedestrian signal and/or pedestrian push button);
- B. Type, number of sections, lens configuration and manufacturer for each traffic signal item specified on the Drawings;
- C. Type, number of sections and manufacturer for each traffic signal item specified on the Drawings; and
- D. Catalog cut and manufacturer installation recommendations for signal heads and louvers.

**~~832S~~832.3 Materials**

The traffic signal heads described herein shall be designed and constructed in accordance with Signal Head Standard included in the latest edition of ITE Technical Report entitled, "Adjustable Face Vehicle Traffic Control" and any additional requirements contained in this specification.

The "Standard Traffic Signal Head" shall consist of three LED lenses; each mounted in an individual door. The signal face shall be assembled for horizontal installation and shall be so assembled that the red lens will be located at the left, the yellow lens at the center, and the green lens at the right.

**A. General Requirements**

All exposed metal surfaces of the housing and door and the outside surface of all visors shall be given two coats, separately baked on, of high-grade Federal yellow enamel. The inside surfaces of all visors shall be given two coats of high-grade dull black enamel. Colors shall conform to ITE and Federal Highway Administration Color standards where applicable.

**B. LED Lenses**

If proper orientation of the LED unit is required for optimum performance, prominent and permanent directional marking(s), that is an "UP arrow," for correct indexing and orientation shall exist on the unit.

The manufacturer's name, serial number, manufactured date (month and date) and other necessary identification shall be permanently marked on the backside of the LED traffic signal lamp unit. A label shall be placed on the unit certifying compliance to ITE standards.

1. Physical and Mechanical Requirements

The LED traffic signal lamp unit shall be a single, self-contained device, not requiring on-site assembly for installation into an existing traffic signal housing.

The assembly and manufacturing process for the LED traffic signal lamp unit assembly shall be such as to assure all internal LED and electronic components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.

Each LED traffic signal lamp unit shall comprise a UV stabilized polymeric outer shell, multiple LED light sources, and a regulated power supply. LEDs are to be mounted on a polycarbonate positioning plate or conformably coated PC board.

Each LED traffic signal lamp unit shall be assembled to allow easy access to internal components.

2. Optical and Light Output Requirements

The LEDs shall be manufactured using AlInGaP (Aluminum-Indium-Gallium-Phosphorous) technology or other LEDs with lower susceptibility to temperature degradation than AlGaS (Aluminum-Gallium-Arsenic). AlGaS LEDs will not be allowed.

<u>Expanded View</u>		<u>Minimum Luminous Intensity Values (In Candelas)</u>		
<u>Vertical Angle</u>	<u>Horizontal Angle (Left/Right)</u>	<u>RED</u>	<u>YELLOW</u>	<u>GREEN</u>
<u>±2.5°</u>	<u>2.5</u>	<u>339</u>	<u>678</u>	<u>678</u>
	<u>7.5</u>	<u>251</u>	<u>501</u>	<u>501</u>
	<u>12.5</u>	<u>141</u>	<u>283</u>	<u>283</u>
	<u>17.5</u>	<u>77</u>	<u>154</u>	<u>154</u>
<u>±7.5°</u>	<u>2.5</u>	<u>226</u>	<u>452</u>	<u>452</u>
	<u>7.5</u>	<u>202</u>	<u>404</u>	<u>404</u>
	<u>12.5</u>	<u>145</u>	<u>291</u>	<u>291</u>
	<u>17.5</u>	<u>89</u>	<u>178</u>	<u>178</u>
	<u>22.5</u>	<u>38</u>	<u>77</u>	<u>77</u>
	<u>27.5</u>	<u>16</u>	<u>32</u>	<u>32</u>
<u>±12.5°</u>	<u>2.5</u>	<u>50</u>	<u>101</u>	<u>101</u>
	<u>7.5</u>	<u>48</u>	<u>97</u>	<u>97</u>
	<u>12.5</u>	<u>44</u>	<u>89</u>	<u>89</u>
	<u>17.5</u>	<u>34</u>	<u>69</u>	<u>69</u>
	<u>22.5</u>	<u>22</u>	<u>44</u>	<u>44</u>
	<u>27.5</u>	<u>16</u>	<u>32</u>	<u>32</u>
<u>±17.5°</u>	<u>2.5</u>	<u>22</u>	<u>44</u>	<u>44</u>
	<u>7.5</u>	<u>22</u>	<u>44</u>	<u>44</u>
	<u>12.5</u>	<u>22</u>	<u>44</u>	<u>44</u>
	<u>17.5</u>	<u>22</u>	<u>44</u>	<u>44</u>

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	<u>22.5</u>	<u>20</u>	<u>41</u>	<u>41</u>
	<u>27.5</u>	<u>16</u>	<u>32</u>	<u>32</u>
<u>±22.5°</u>	<u>2.5</u>	<u>20</u>	<u>40</u>	<u>40</u>
	<u>17.5</u>	<u>20</u>	<u>40</u>	<u>40</u>
<u>-27.5°</u>	<u>2.5</u>	<u>20</u>	<u>40</u>	<u>40</u>
	<u>17.5</u>	<u>20</u>	<u>40</u>	<u>40</u>
<u>-32.5°</u>	<u>2.5</u>	<u>20</u>	<u>40</u>	<u>40</u>
	<u>17.5</u>	<u>20</u>	<u>40</u>	<u>40</u>

The number, color of the LED signal lamps, and specific

indications (left arrow, ball, or right arrow) shall be as specified in the plans.

Each LED traffic signal lamp shall meet minimum laboratory light intensity values, color (chromaticity), and light output distribution as described in I.T.E. VTCSH (Vehicle Traffic Control Signal Head Standard) Part 2 of the Specifications 6.4.2.1, 6.4.4.1, 6.4.4.2, 6.4.4.3, 6.4.5 and 6.4.6 as a minimum. The table below replaces the values in Table 1 of Section 4.1.1 of the I.T.E. VTCSH. The 6.4.2.1 test shall include an expanded view for the Red and Green Ball indications with the following minimums for a period of 60 months, based on normal use in traffic signal operation over an operating temperature range of -40°C to +74°C. In addition, yellow LED signal modules shall meet or exceed the following minimum illumination values for a minimum period of 60 months, based on normal use in traffic signal operation at 25°C:

<u>-Expanded View</u>		<u>Minimum Luminous Intensity Values (In Candelas)</u>		
<u>Vertical Angle</u>	<u>Horizontal Angle (Left/Right)</u>	<u>RED</u>	<u>YELLOW</u>	<u>GREEN</u>
<u>±2.5°</u>	<u>2.5</u>	<u>339</u>	<u>678</u>	<u>678</u>
	<u>7.5</u>	<u>251</u>	<u>501</u>	<u>501</u>
	<u>12.5</u>	<u>141</u>	<u>283</u>	<u>283</u>
	<u>17.5</u>	<u>77</u>	<u>154</u>	<u>154</u>
<u>±7.5°</u>	<u>2.5</u>	<u>226</u>	<u>452</u>	<u>452</u>
	<u>7.5</u>	<u>202</u>	<u>404</u>	<u>404</u>
	<u>12.5</u>	<u>145</u>	<u>291</u>	<u>291</u>
	<u>17.5</u>	<u>89</u>	<u>178</u>	<u>178</u>
	<u>22.5</u>	<u>38</u>	<u>77</u>	<u>77</u>
	<u>27.5</u>	<u>16</u>	<u>32</u>	<u>32</u>
<u>±12.5°</u>	<u>2.5</u>	<u>50</u>	<u>101</u>	<u>101</u>
	<u>7.5</u>	<u>48</u>	<u>97</u>	<u>97</u>
	<u>12.5</u>	<u>44</u>	<u>89</u>	<u>89</u>
	<u>17.5</u>	<u>34</u>	<u>69</u>	<u>69</u>
	<u>22.5</u>	<u>22</u>	<u>44</u>	<u>44</u>
	<u>27.5</u>	<u>16</u>	<u>32</u>	<u>32</u>
<u>±17.5°</u>	<u>2.5</u>	<u>22</u>	<u>44</u>	<u>44</u>
	<u>7.5</u>	<u>22</u>	<u>44</u>	<u>44</u>
	<u>12.5</u>	<u>22</u>	<u>44</u>	<u>44</u>
	<u>17.5</u>	<u>22</u>	<u>44</u>	<u>44</u>
	<u>22.5</u>	<u>20</u>	<u>41</u>	<u>41</u>
	<u>27.5</u>	<u>16</u>	<u>32</u>	<u>32</u>
<u>±22.5°</u>	<u>2.5</u>	<u>20</u>	<u>40</u>	<u>40</u>
	<u>17.5</u>	<u>20</u>	<u>40</u>	<u>40</u>

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-27.5°	2.5	20	40	40
	-17.5	20	40	40
-32.5°	2.5	20	40	40
	-17.5	20	40	40

LEDs for arrow indications shall be spread evenly across the illuminated portion of the arrow area. Arrow LED signal modules shall be tested in conformance with California Test 3001.

-Arrow Indication	Arrow Indications (in candelas/m <sup>2</sup> )
Red	5 500
Yellow	11 000
Green	11 000

Measured chromaticity coordinates of LED signal modules shall conform to the chromaticity requirements of the following table, for a minimum period of 60 months, over an operating temperature range of -40°C to +74°C. Each LED traffic signal lamp unit shall meet the minimum requirements for light output for the entire range from 80 volts to 135 volts.

-Chromaticity Standards	
Red	Y: not greater than 0.308, or less than 0.998 - x
Yellow	Y: not less than 0.411, nor less than 0.995 - x, nor less than 0.452
Green	Y: not less than 0.506 - 0.519x, nor less than 0.150 + 1.068x, nor more than 0.730 - x

LED signal modules tested or submitted for testing shall be representative of typical production units. Optical testing shall be performed with LED signal modules mounted in standard traffic signal sections without visors or hoods attached to the signal sections. LEDs for arrow indications shall be spread evenly across the illuminated portion of the arrow area.

After burn in, LED signal modules shall be tested for rated initial luminous intensity in conformance with the provisions in "Optical and Light Output Requirements." Before measurement, LED signal modules shall be energized at rated voltage, with 100 percent on time duty cycle, for a time period of 30 minutes. Test results for this testing shall record the current, voltage, total harmonic distortion (THD) and power factor (PF) associated with each measurement.

Photometrics, luminous intensity and color measurements for yellow LED signal modules shall be taken immediately after the modules are energized. The ambient temperature for these measurements shall be ~~25°C/77°F~~. Test results for this testing shall record the current, voltage, total harmonic distortion (THD) and power factor (PF) associated with each measurement.

### 3. Electrical

Each unit shall incorporate a regulated power supply engineered to electrically protect the LEDs and maintain a safe and reliable operation. The power supply shall be fused with an in-line ½ amp. 250V replaceable fuse. The power supply shall provide capacitor filtered DC regulated current to the LEDs per the LED manufacturer specification. Design of the power supply shall be such that the failure of an individual component or any combination of components cannot cause the signal to be illuminated

after AC power is removed. Any deviation without prior testing and approval from the City of Austin (COA) and the Texas Department of Transportation (TxDOT), shall be grounds for automatic removal from the TxDOT Qualified Product List (QPL) for an undetermined time and for bid disqualification.

The LED traffic signal lamp unit shall operate on a 60 Hz AC line voltage ranging from 80 volts RMS to 135 volts RMS. The circuitry shall prevent flickering over this voltage range. Nominal rated voltage for all measurements shall be 117 volts RMS.

The LED traffic signal lamp unit shall be operationally compatible with TS1, TS2, 170 and 2070 controllers, conflict monitors with plus features, and malfunction management units currently used by TxDOT and any other Texas government entities. In the case of conflicts between specifications, the latest TxDOT specifications will control.

The LED lamp shall be designed to sense a loss of light output due to catastrophic LED failures of between 25% and 40%. Loss of light output due to LED failure will not be detected for losses of less ~~than~~ 25% but will be detected for any loss of light greater than 40%. The unit, upon sensing a valid loss of light, shall present impedance of at least 500K Ohms to the AC line.

Any deviation to product design after testing and approval from the COA and TxDOT shall consist of a new model and must be resubmitted for acceptance. Failure to adhere to this requirement shall be grounds for automatic removal from the TxDOT Qualified Product List (QPL) for an undetermined time. Random testing of average production modules will be tested to ensure compliance with specification.

Two, captive, color coded, ~~900 mm long~~ 36 inch, 600 V, 18 AWG minimum jacketed wires, three feet long, conforming to the National Electric Code, rated for service at 105°C, are to be provided for an electrical connection.

LEDs shall be arranged in no less than five equally loaded circuits.

The LED signal shall operate with a minimum 0.90 power factor.

Total harmonic distortion (current and voltage) induced into an ac power line by a signal module shall not exceed 20%.

LED signal modules and associated on-board circuitry shall conform to the requirements in Federal Communications Commission (FCC) Title 47, SubPart B, Section 15 regulations concerning the emission of electronic noise.

#### 4. Environmental Requirements

The LED traffic signal lamp unit shall be rated for use in the ambient operating temperature range of - 40°C ~~F~~ to +74°C ~~165°F~~.

The unit shall be dust and moisture tight to protect all internal LED and electrical components.

The unit shall consist of a housing that is a sealed watertight enclosure that eliminates dirt contamination and allows for safe handling in all weather conditions. Moisture resistance testing shall be performed on LED signal modules in conformance with the requirements in NEMA Standard 250-1991 for Type 4 enclosures. Evidence of internal moisture after testing shall be cause for rejection.

#### 5. Production Testing Requirements

Each new LED traffic signal lamp unit shall be energized for a minimum of 24 hours at operating voltage and at a temperature of +60°C ~~140°F~~ in order to cause any electronic infant mortality to occur, and to ensure electronic component reliability prior to shipment.

After the burn-in procedure is completed, each LED traffic signal lamp unit shall be tested by the manufacturer for rated initial intensity at rated operating voltage.

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Destructive testing will be conducted to determine that the units are in conformance with the catastrophic LED failure clause (Item 2.4.4).

6. Documentation Requirements

Each LED traffic signal lamp unit shall be provided with the following documentation:

Complete and accurate installation wiring guide.

Contact name, address, telephone number for the representative, manufacturer, or distributor for warranty repair.

If requested by the purchaser, the bidders shall supply schematics for all electronics.

Bidders shall be required to submit a copy of a test report certified by an independent laboratory that the LED traffic signal lamp model submitted meets I.T.E. Standards for light distribution, chromaticity, and power (consumption, power factor and harmonic distortion) with the bid. The table in Item 2.3.3 of this specification replaces the values in Table 1 of Section 4.1.1 of the I.T.E. VTCSH. In addition, the independent lab report shall specify the drive current being supplied to individual LEDs within the unit. Designs which require LEDs to be operated at currents greater than the LED manufacturer's recommended drive current will not be allowed.

One schematic diagram shall be provided for each LED lamp unit, along with any necessary installation instructions.

For each unit submitted, the manufacturer name, brand and model number of LEDs used shall be provided, along with the LED manufacturer's recommended drive current and degradation curves.

7. Warranty

The LED traffic signal lamp unit shall be warranted against any failure due to substandard work, material defects or intensity within the first 60 months of field operation. The LED signal shall meet or exceed minimum luminous intensity values (2.3.3) during the 60 months of field operation.

Light emitting diode signal modules shall meet or exceed 85% of the standard light output values specified in the I.T.E. VTCSH, after 60 months of continuous use over the temperature range of -40°F to +74°F in a traffic signal operation.

The measured chromaticity coordinates of light emitting diode signal modules shall conform to the requirements for chromaticity in Section 8.04 and Figure 1 of the I.T.E. VTCSH over the temperature range of -40°F to +74°F.

The manufacturer shall provide a written warranty against substandard work and material defects for LED signal modules for a period of 60 months after installation of LED signal modules. Replacement LED signal modules shall be provided within five days after receipt of failed LED signal modules at no cost to the state, except the cost of shipping the failed modules.

8. Quality Assurance Testing (Random Sample Testing)

The city may perform random sample testing on all shipments. Random sample testing will be completed within 30 days after delivery.

Optical testing shall be performed with the module mounted in a standard traffic signal section, but without a visor or hood attached to the section or housing. The number of modules tested shall be determined by the quantity of each model in the shipment. The sample size shall conform to ANSI/ASQC Z1.4. The city, in cooperation with the TxDOT Traffic Operations Division shall determine the sampling parameters to be used for the random sample testing. All parameters of the specification



may be tested on the modules. Acceptance or rejection of the shipment shall conform to ANSI/ASQC Z1.4 for random sampled shipments

C. Material Requirements

Traffic signal housings, signal face, and visors shall be of unitized construction. The housings shall be constructed of die-cast corrosion-resistant, non-ferrous metal such as aluminum. They shall have a smooth homogeneous finish and shall be accurately formed and free from pouring faults, sponginess, cracks, blowholes, or other defects affecting their strength and appearance.

All traffic signal housings when completely assembled with doors, lenses, and mounting attachments, shall be dust and moisture proof (except that the contractor shall drill a 5/16" weep hole in the housing beneath each signal indication to drain rain water from the head), and shall be of such construction as to assure permanent alignment of all lenses in the signal faces.

The portions of signal housings that provide attachment to supporting arms shall be manufactured with large bosses frilled for the supporting arms. Each housing case shall be attached to its supporting arm in a manner that will adjustment by rotation about its vertical axis through a full 360 degrees and may be rigidly clamped in any position throughout the range of its rotation.

LENS	HOT WIRE	NEUTRAL WIRE
Red	Red	White
Yellow	Yellow	White
Green	Green	White

Each signal head shall be provided with a common terminal block mounted in the center section of the signal head assembly in an easily accessible position. It shall be of weatherproof molded construction and equipped with identified terminals for signal and field wires. The terminal block shall have a minimum of six positions. Five of the positions shall be configured for signal circuits Green ball, Yellow ball, Red ball, two vacant positions and one position for a common connection point of all neutral wires. All neutral wires shall be terminated on one terminal point.

Each signal head shall have a backplate installed. The front surface of the backplate shall have a dull black finish. A yellow retroreflective strip with a minimum width of 1 inch and a maximum width of 3 inches shall be placed along the perimeter of the front face of the signal backplate.

D. Louvers

Where indicated on the Drawings, the contractor shall be required to furnish and install optically programmed louvers in the traffic signal heads. These louvers shall be 12" ~~(300-mm)~~ GPL 13 degree cut-off. Pelco part No. GL-1006 or equivalent approved by the Engineer or designated representative. The cost to provide and install louvers shall be included in the unit price bid for this bid item.

E. Other Requirements

All signal heads installed on the job shall be from the same manufacturer. The horizontal assembly shall be oriented with the red lens on the left, amber lens in the middle, and the green lens on the right.

The contractor will include a certificate with the Contractor's bid indicating that the materials and the equipment to be supplied conform to the above specifications.

Upon request, the contractor shall furnish the engineer or designated representative within seven working days of the bequest a sample of the proposed equipment.

The Department of Transportation Planning and Sustainability or successor department may test a sample of the signal head under normal conditions. Failure of the equipment to meet these specifications or perform in an unsatisfactory manner during such testing shall be cause to reject signal heads.

#### **~~832S~~832.4 Installation**

The contractor will be responsible for installation of the signal heads and backplates in the field. This work shall include providing and installing the signal heads, louvers, backplates, wiring, and mounting hardware at the job site. Drilling wire feed holes and mounting the signal heads will be the contractor's responsibility.

The contractor shall wire all signal heads with adequate wire to tie each signal section into the signal cable for the system. Wiring for the signal head shall consist of connecting the terminal block in each signal section to the common terminal block in each signal face, and where applicable, connecting the common terminal block in each signal face to the terminal block in the signal head terminal compartment. All wire feeding through the mast arm or pole structure shall be wrapped once with plastic electrical tape and wrapped again with electrical friction tape extending 12 inches ~~(300 mm)~~ on each side of the pole opening for a total of 24 inches ~~(600 mm)~~. The contractor shall conform to the City of Austin's color code when splicing all conductors. Cabling for each signal (number of conductors, wire gauge, etc.) shall be in accordance with the Drawings.

Where required, the contractor will be required to adjust all signal heads with louvers so that they provide visibility to the intended lane(s) of traffic.

All signal heads or parts of heads not in operation shall be covered with burlap until placed into service.

#### **~~832S~~832.5 Measurement**

This item will be measured by each traffic signal installed in place.

The cost of procuring, installing, and connecting mounting hardware, optically programmed louvers, and cable from the traffic signal heads to the controller shall be considered ancillary to various bid items and will not be paid for separately.

#### **~~832S~~832.6 Payment**

Traffic signals shall be paid for at the unit bid price per each. The unit bid price shall include full compensation for: a) furnishing and installing all materials; b) drilling wire feed holes (as needed); c) mounting the signal heads on the mast arms and signal poles; d) covering the signal heads with contractor-supplied burlap (if required); e) correctly cabling the signal head per the drawings; f) furnishing and installing optically programmable louvers; g) adjusting the signal head for proper visibility, as indicated on the Drawings and for furnishing all labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

<b><u>Pay Item No. 832-VSM-1:</u></b>	<u>Vehicular Signal Installation, 1 Section, Complete in Place</u>	<u>per Each.</u>
<b><u>Pay Item No. <del>832S</del>832-VSM-3:</u></b>	<u>-Vehicular Signal Installation, 3 Section, Complete in Place</u>	<u>per Each.</u>
<b><u>Pay Item No. 832-VSM-3R:</u></b>	<u>Vehicular Signal Installation, Pedestrian Hybrid Beacon, 3 Section, Complete in Place</u>	<u>per Each.</u>
<b><u>Pay Item No. <del>832S</del>832-VSM-4:</u></b>	<u>-Vehicular Signal Installation, 4 Section, Complete in Place</u>	<u>per Each.</u>
<b><u>Pay Item No. <del>832S</del>832-VSM-5:</u></b>	<u>-Vehicular Signal Installation, 5 Section, Complete in Place</u>	<u>per Each.</u>

END

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SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item No. 832S, "Vehicular Traffic Signal Installation"	
City of Austin Standard Details	
<u>Designation</u>	<u>Description</u>
Detail No. <del>839S</del> 839-1	Pedestrian and <del>Vehicular Signals Installation Details</del> <u>Signal Wiring</u>
<del>Detail No. 839S-2</del>	<del>Wood Pole Span Wire Details</del>
<del>Detail No. 839S-4</del>	<del>Traffic Signal Structures: Mast Arm Details</del>
<del>Detail No. 839S-5</del>	<del>Traffic Signal Structures: Span Wire Details</del>

**ITEM NO. ~~833S~~833 PEDESTRIAN PUSH BUTTON ASSEMBLY ~~9-17-01~~03-29-23****~~833S~~833.1 Description**

This item shall govern furnishing and installation of, pedestrian push button assemblies in accordance with the specifications contained herein, Standard Detail No. 839S-1, "Pedestrian and Vehicular Signal Installation ~~Details~~Detail", No. 839S-2, "Wood Pole Span Wire ~~Details~~Detail", No. 839S-4, "Traffic Signal Structures: Mast Arm Details", No. 839S-5, "Traffic Signal Structures: Span Wire Details", manufacturer recommendations, the Drawings and/or written instructions from the Engineer or designated representative.

~~This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.~~

~~833S~~

**~~833S~~833.2 Submittals**

The submittal requirements of this specification item include:

- A. Wire size, characteristics and designation for each wire application (i.e. traffic signal, pedestrian signal and/or pedestrian push button),
- B. Catalog cut and Manufacturer installation recommendations for required items.

**~~833S~~833.3 Materials**

A. General

The pedestrian push button assembly shall be weather-tight and tamper-proof. The assembly shall be designed to prevent an electrical shock under any weather condition and shall have provisions for grounding in accordance with the National Electrical Code (NEC).

Pedestrian push button housing shall be cast from aluminum alloy, free of voids, pits dents, molding, sand and excessive grinding marks. All design radii shall be smooth and intact. Exterior surface finish shall be smooth and cosmetically acceptable and free of blemishes. The manufacturer's name or trademark shall be located on the housing.

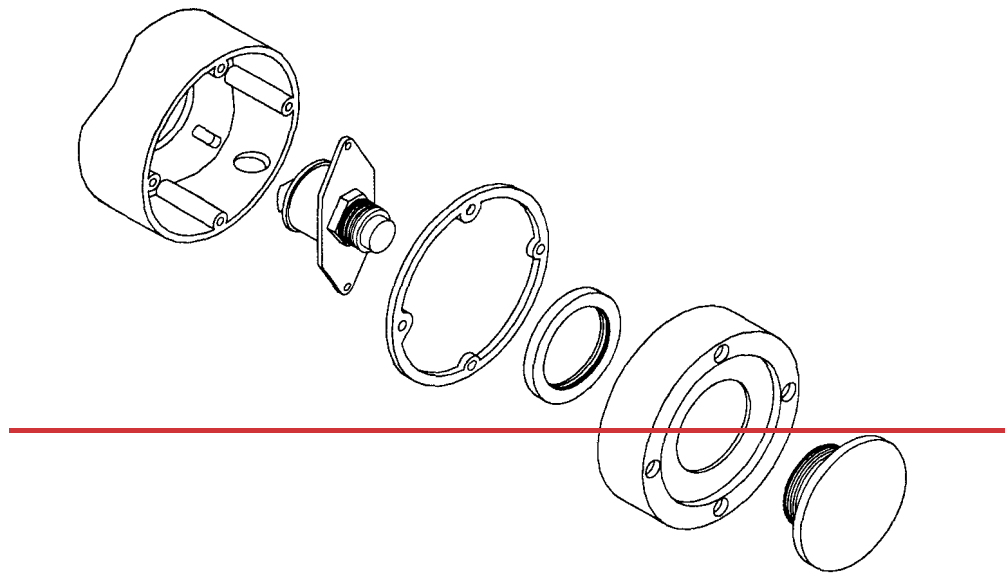
B. Design

The Push button assembly shall be fabricated with design characteristics shown in Figure 1

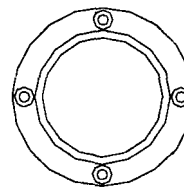
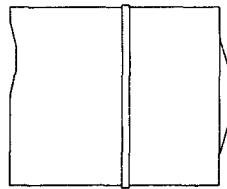
The bottom of the push button housing shall be tapped for and provided with a ½ inch ~~(12.5-mm)~~ NPT threaded conduit plug. The back of the push button housing shall be provided with a hole capable of being threaded for a ½ inch ~~(12.5-mm)~~ NPT threaded conduit plug and capped with a non-threaded ½ inch ~~(12.5-mm)~~ plastic plug. The back portion of the housing shall be designed to accommodate pole diameters from 3" to 14" ~~(76-mm to 356-mm)~~". The push button housing shall be tapped and provided with (4) hex nut, mounting positions, as shown to accommodate the push button cover. A neoprene O-ring as shown shall be provided for a weather tight seal between the housing and cover.

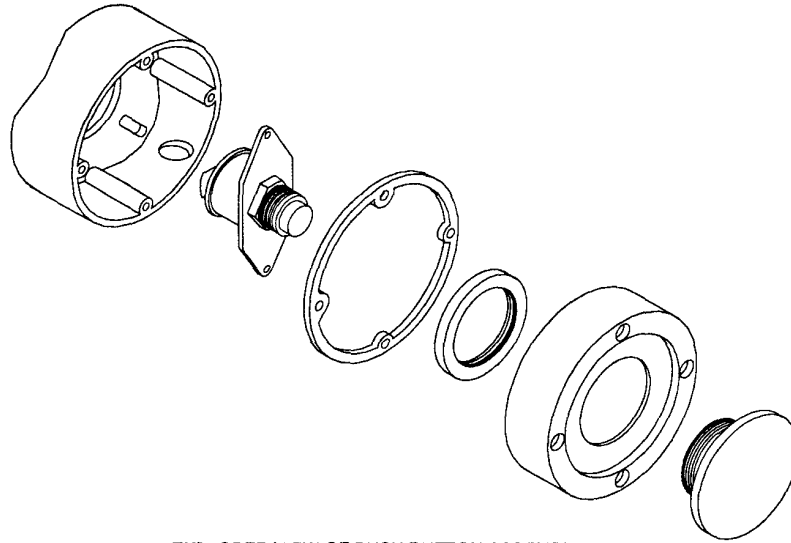
The push button switch shall be actuated by a minimum 2" ~~(50-mm)~~ diameter plunger. The plunger shall have an integral shaft to actuate the switch and have a clear anodized finish. The assembly shall be designed so that the maximum plunger travel does not exceed the switch travel. A spring shall be installed between the plunger and switch. The spring shall provide an operating force of less than 5 lbs ~~(22.2 newtons)~~. A

protective shroud shall encircle the plunger to deter vandalism. The shroud shall be cast as an integral part of the cover. There shall be a moisture barrier between the plunger and the switch. The assembly shall conform to all minimum requirements set forth with the American with Disabilities Act.



**EXPLODED VIEW OF PUSH BUTTON ASSEMBLY**





EXPLODED VIEW OF PUSH BUTTON ASSEMBLY

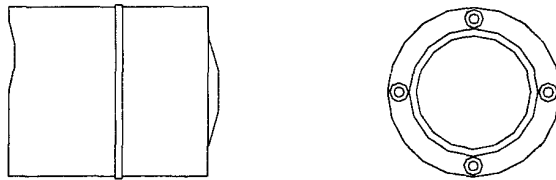


Figure 1

C. Finish

Both housing and cover shall have an alodine conversion coating to provide a proper base for paint adhesion. The assembly shall be painted Federal Yellow and baked in a drying oven after painting.

D. Push Button Switch

The switch shall have terminal connection points on back to allow for an electrical spade connection to the back of the switch allowing user to connect twisted pair directly to the back of the switch. Wire and Wire nut connections from the back of the switch shall not be acceptable.

The switch assembly shall be capable of operating in temperature ranges of 65°F through 180°F ~~(180C through 820C)~~ and have a mechanical life of up to 10,000,000 actuations. The switch assembly shall be electrically rated to carry 25 Amp at 125 volts AC, 250 volts maximum. The switch assembly must have the following recognized certifications and/or approval: UL, CSSA, Mil Spec # MIL-S-8805.

All pedestrian push buttons installed on a job shall be of the same manufacturer.

Upon request, the Contractor shall furnish a sample within (7) working days of the equipment they propose to furnish the City of Austin.

The Department of Transportation Planning and Sustainability or succeeding department may test a sample of the signal head under normal conditions. Failure of the equipment to meet these specifications or perform in a satisfactory manner during such testing shall be cause to reject push buttons.

E. Mounting Attachments

Mounting attachments shall be as indicated on the Drawings.

F. Hardware

All bolts, nuts, washers, lock washers, screws and other assembly hardware shall be galvanized steel, stainless steel or dichromate sealed aluminum in conformance with ~~TxDOT~~ Departmental Materials Specifications DMS-7120, "Sign Hardware". When dissimilar metals are used, the metals shall be so selected or insulated to prevent corrosion.

G. Pedestrian Instructional Sign

The instructional sign shall include the legend indicated on the Drawings and shall meet the requirements presented in sections 824S.3.E (Sign Blanks) and 824S.3.F (Sign Faces) of Standard Specification Item No. 824S, "Traffic Signs".

~~833S~~833. Push Button Extension

As required, provide a push button extension up to 18 inches in length. The push button assembly should be able to be mounted tangential or perpendicular to the pole as necessary.

~~833S~~833.4 Installation

The Contractor will be responsible for installing the pedestrian push-buttons and signs in the field. Drilling wire feed holes and mounting the pedestrian push-button on signal poles will be the Contractor's responsibility.

All wire feeding through the mast arm pole structure shall be wrapped once with plastic electrical tape and wrapped again with electrical friction tape extending 12 inches ~~(300-mm)~~minimum on each side of the pole opening for a total of 24 inches ~~(600-mm)~~. Pedestrian push-buttons shall have a common ground wire that is completely isolated and independent from all other ground wires.

~~833S~~833.5 Measurement

This item will be measured by each pedestrian push button or Pedestrian Push-button Extension installed.

~~833S~~833.6 Payment

Pedestrian push buttons shall be paid for at the unit bid price per each. The unit bid price shall include full compensation for: a) furnishing and installing all ancillary materials, b) drilling wire feed holes (as needed), c) mounting the push buttons on the signal poles and for furnishing all labor, tools, equipment and incidentals necessary to complete the work.

The cost of procuring, installing, and connecting mounting hardware, pedestrian signs, and cable from the push button to the controller is considered ancillary to various bid items and will not be paid for separately.

Payment will be made under:

Pay Item No. <del>833S</del> <u>833</u> -PPB:	Pedestrian Push-button	per Each.
Pay Item No. <u>833-PPBE:</u>	<u>Pedestrian Push-button Extension</u>	<u>per Each.</u>

END

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item No. <del>833S</del> 833, "Pedestrian Push Button Assembly"	
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
No. <del>839S</del> 839-1	Pedestrian and Vehicular Signal Installation Details
No. <del>839S</del> 839-2	Wood Pole Span Wire Details
No. <del>839S</del> 839-4	Traffic Signal Structures: Mast Arm Details
No. <del>839S</del> 839-5	Traffic Signal Structures: Span Wire Details
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 824S	Traffic Signs
Section 824S.3.E	Sign Blanks
Section 824S.3.F	Sign Faces
<u>TxDOT Departmental Materials Specifications</u>	
<u>Designation</u>	<u>Description</u>
DMS-7120	Sign Hardware



**ITEM NO. ~~834S834~~ TRAFFIC SIGNAL PULL BOXES ~~9-26-12~~****~~834S834~~.1 Description**

This item shall govern constructing, furnishing and installing new traffic signal pull boxes and adjusting, removal and replacement of existing pull boxes as indicated on the Drawings; in conformity with this specification item; Standard Detail Nos. 834S-1 through 834S-8; the Drawings and/or written instructions from the Engineer or designated representative.

~~This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.~~

~~834S~~

**~~834~~.2 Submittals**

The submittal requirements of this specification item include:

- A. Identification of the number and types (i.e. types A, B, C or D) of pull boxes proposed,
- B. Mix design for 'Class A' Portland cement concrete,
- C. Construction details (mortar, reinforcing steel, etc.) for the pull box and supporting foundation.

~~834SD. Type structures and proposed adjustment technique (lowering, raising, lateral displacement).~~

~~E. Type structure, repair technique and materials to be furnished (new replacement or reuse of existing) Type of mixing plant and associated equipment including chart indicating the calibration of each cold bin.~~

**~~834~~.3 Materials****A. Portland Cement Concrete**

The Portland cement concrete shall be Class A conforming to Standard Specification Item No. 403S, "Concrete for Structures".

**B. Mortar**

Unless otherwise specified or approved by the Engineer or designated representative, the mortar for bedding castings shall consist of one (1) part Portland cement and three (3) parts sand, by volume based on dry materials. Sufficient water will be added to provide the desired consistency. The gradation of the fine aggregate shall meet the requirements for "Fine Aggregate" as given in Standard Specification Item No. 403S, "Concrete for Structures".

Traffic signal pull box types of the size specified on the Drawings, shall be constructed as shown in the following Standard Details:

No. <del>834S834</del> -1	"Type A Traffic Bearing Pull Box,"
No. <del>834S834</del> -2	"Frame and Lid for use with Type A Traffic Bearing Pull Box,"
No. <del>834S834</del> -3	"Type B Pull Box,"
No. <del>834S834</del> -4	"Ring and Lid for use with Type B Pull Boxes,"

No. <del>834</del> 834-5	"Type C Pull Box with Light Weight Cover,"
No. <del>834</del> 834-6	"Ring and Lid for use with Type C Pull Box,"
No. <del>834</del> 834-7	"Ring and Lid for Traffic Bearing Type C Pull Box," and
No. <del>834</del> 834-8	"Type D Communication Pull Box and Torsion Assisted Lid."

Ring and Lid for each type pull box shall be produced by a manufacturer approved by the Engineer or designated representative. For relocation of pull boxes, precast reinforced concrete rings and castings in good condition, which are removed from the structures to be adjusted, may be reused with the written approval of the Engineer or designated representative. Additional materials required shall conform to the details indicated on the Drawings.

Brick for pull boxes shall be new common brick.

Portland cement concrete for the pull box base and encasement shall be Class A p.c. Concrete conforming to Standard Specification Item No. 403S, "Concrete for Structures."

## **~~834~~834.4 Construction Methods**

### A. General

Construction near any underground or overhead utilities shall be accomplished using established industry and utility safety practices. The Contractor shall verify existing underground utilities through review of record data, use of one-call utility locates, collection/observation of visible surface evidence, consultation with utility facility owners and application of subsurface utility engineering techniques (e.g., potholing, ground penetrating radar, etc.) to determine the location of existing utilities and structures.

Pull boxes shall be constructed in accordance with the lines, grades, details and dimensions indicated on the Drawings or established by the Engineer or designated representative. Pull boxes, which are exposed to view, as in sidewalks, shall be accurately set to the finished grade and anchored.

Pull boxes scheduled for reuse shall be carefully removed and the contact areas shall be cleaned of all mortar, concrete, grease and sealing compounds. Any items broken in the process of removal and cleaning shall be replaced in kind by the Contractor at its own expense.

All adjustments shall be completed prior to the placement of the final surface.

Masonry work for the lower portion of the pull boxes shall be accurately cut around the conduits and a smooth accurate bed shall be provided for the pre-cast concrete upper portion of the pull box. The pre-cast section shall be set in mortar upon the lower masonry course. The inside of pull boxes shall be left clean and the joints shall be wiped.

Any damage to utilities and/or structures, that occurs as a result of any construction activity performed by the Contractor, shall be repaired by the Contractor at the Contractor's sole expense. Pull boxes shall only be paid for once, regardless of extra work caused by obstructions and/or Contractor damage.

### B. Locating Existing Pull Boxes

In many cases, existing pull boxes may be covered by dirt, grass, concrete or other surface making the pull boxes difficult to find. The contractor shall locate the pull box based on the approximate location shown in the plans. Once located the contractor shall expose the pull box for additional action as shown on the plans or as directed by the Engineer.

### C. Vertical Adjustment of Existing Pull Boxes

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If the adjustment involves a vertical (lowering or raising) of a pull box, this work shall be completed in accordance with Standard Installation Details included in the City of Austin Standard Details 834S.

For pull box adjustments in the sidewalk, the sidewalk surrounding the pull box must be demolished prior to adjustment and restored after the pull box has been adjusted. All sidewalk work shall be paid out separately under City of Austin Specification 432S.

For adjustments outside of the sidewalk, the surface surrounding the pull box should be restored to the surrounding area conditions.

After all adjustments have been completed, the surface surrounding the pull box should be restored to previous conditions.

#### D. Converting / Upgrading of Existing Pull Boxes

The contractor shall enlarge the pull box by remove the existing pull box (ring, lid, bricks, etc) and rebuild a larger size pull box centered in the same location as specified in the plans or as directed by the Engineer. This work shall be completed in accordance with Standard Installation Details included in the City of Austin Standard Details 834S. Existing conduit entering the box shall be modified in accordance with Standard Installation Details included in the City of Austin Standard Details 834S.

For the conversion of TXDOT ground boxes to "stacked" boxes, the existing ground box should be reused if possible

For pull box adjustments in the sidewalk, the sidewalk surrounding the pull box must be demolished prior to adjustment and restored after the pull box has been adjusted. All sidewalk work shall be paid out separately under City of Austin Specification 432S.

For adjustments outside of the sidewalk, the surface surrounding the pull box should be restored to the surrounding area conditions.

After all adjustments have been completed, the surface surrounding the pull box should be restored to previous conditions.

#### E. Demolition of Existing Pull Boxes

The contractor will remove the ring, lid and bricks (if applicable) and back fill the pull box with material in accordance with Standard 506S-15 or as directed by the Engineer or designated representative.

Owner will determine if the ring and lid are able to be salvaged. Owner will retain salvaged rings and/or lids. Contractor will remove all non-salvaged items from the work site.

For pull box demolition within the sidewalk, the sidewalk surrounding the pull box must be demolished prior to demolition of the pull box. All sidewalk work shall be paid out separately under City of Austin Specification 432S.

For demolition of pull boxes outside of the sidewalk, the surface surrounding the pull box should be restored to the surrounding area conditions.

After all adjustments have been completed, the surface surrounding the pull box should be restored to previous conditions.

#### F. Concrete Work For Pull Boxes

All loose material shall be removed from the bottom of an excavation before p.c. concrete is placed. Any water accumulated in the bottom of the excavated foundation shall be removed by pumping or bailing, prior to p.c. concrete placement.

The use of explosives will not be permitted.

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The p.c. concrete shall be placed as soon as possible after excavation is completed, the reinforcing steel placed and other hardware (anchor bolts, conduits, ground rod, etc.) installed. The p.c. concrete shall not be placed when the atmospheric temperature (temperature reading taken in the shade away from artificial heat) drops below 35°F (~~2°C~~) unless permission is provided by the Engineer or designated representative.

A mechanical vibrator shall be used for consolidating the wet concrete. During consolidation of the p.c. concrete, the Contractor shall insure that there is minimal contact of the vibrator with the reinforcing steel.

Anchor bolts shall be held in place with templates during the placement of Portland cement concrete. Any pots, conduits or other hardware to be embedded in the foundation shall be held in place during p.c. concrete placement by templates or other suitable means approved by the Engineer or designated representative. Conduit, when used, shall be capped prior to placement of p.c. concrete. Conduit shall be reamed to remove burrs and sharp edges. Bell ends of bushings shall be installed on the conduit.

After the concrete has been placed and the top struck off, it shall be covered with wet cotton or burlap mats, for not less than 96 hours. Top templates may be removed after the p.c. concrete has achieved initial set. Forms and other bracing, when used, shall not be removed until the p.c. concrete has cured a minimum of 96 hours. When a Type III cement is used in the foundation, the p.c. concrete must cure a minimum of 48 hours. Anchor bolts and conduit shall not be subjected to any applied strain during the curing period.

Placement and compaction of backfill shall be performed in accordance with Standard Specifications Item Nos. 201S, "Subgrade Preparation" and 132S, "Embankment." Each layer shall be compacted to the required density by any method, and/or type and size of equipment, which will produce the required compaction. Prior to and in conjunction with the compaction operation, each layer shall be brought to the moisture content necessary to obtain the required density and shall be kept leveled with suitable equipment to insure uniform compaction over the entire layer.

Unless directed otherwise, earth embankments shall be constructed in successive layers, with a thickness of 8 inches (~~200 mm~~) or less in loose measure, for the full width of the individual cross section in a length that is best suited to the sprinkling and compaction methods utilized, while rock embankments shall be constructed in successive layers of 18 inches (~~450 mm~~) or less in thickness for the full width of the cross section.

Where excavation is undertaken in the roadway shoulder, the shoulder shall be replaced with material equal to the original composition. All backfilling shall be completed prior to erection of any structure on the foundation.

All excavated material, not required for backfill, shall be known as "Waste" and shall become the property of the Contractor. It shall be the Contractor responsibility to promptly remove and dispose of the material outside the limits of the project. The work site shall be kept clean and neat at all times. All backfilling shall be completed prior to the erection of any structure on the p.c. concrete foundation.

Unless permission is given by the Engineer or designated representative concrete shall not be placed when the atmospheric temperature drops below 35°F (2°C), where the temperature reading are taken in the shade away from artificial heat.

All parts of the p.c. concrete foundations extending above the natural or finished ground shall be given an ordinary finish in accordance with Standard Specification Item No. 410, "Concrete Structures."

Where existing surfacing is removed for placement of p.c. concrete foundations, repair shall be made by backfilling with material equals in composition and density to the surrounding area and by replacing any

removed surfacing, such as asphalt pavement or p.c. concrete rip-rap, with like material to equivalent section and condition.

### 834S.5 Measurement

Pullboxes shall be measured as each type, complete in place.

### 834S.6 Payment

Pull boxes shall be paid for at the unit bid price per each. The unit bid price shall include full compensation for furnishing and constructing the pull-box as detailed on the Drawings and Standard Details, complete with all fittings, ring and lids covers, masonry work, excavation and backfill, for all labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

Pay Item No. <del>834S</del> 834-A:	-Traffic Signal Pull Box, Type A	Per Each.
Pay Item No. <del>834S</del> 834-B:	-Traffic Signal Pull Box, Type B	Per Each.
Pay Item No. <del>834S</del> 834-C:	-Traffic Signal Pull Box, Type C	Per Each.
Pay Item No. <del>834S</del> 834-CT:	-Traffic Signal Pull Box, Traffic Bearing Type C	Per Each.
Pay Item No. <del>834S</del> 834-D:	-Traffic Signal Pull Box, Type D	Per Each.
Pay Item No. 834-E1:	<u>Locate and expose pull box in grass/dirt</u>	<u>Per Each.</u>
Pay Item No. 834-E2:	<u>Locate and expose pull box in concrete/asphalt</u>	<u>Per Each.</u>
Pay Item No. 834-E3:	<u>Vertical Adjustment 24" pull box</u>	<u>Per Each.</u>
Pay Item No. 834-E4:	<u>Vertical Adjustment 36" pull box</u>	<u>Per Each.</u>
Pay Item No. 834-E5:	<u>Vertical Adjustment TXDOT pull box</u>	<u>Per Each.</u>
Pay Item No. 834-E6:	<u>Converting 24" pull box to 36"</u>	<u>Per Each.</u>
Pay Item No. 834-E7:	<u>Converting standard TXDOT ground box to M60</u>	<u>Per Each.</u>
Pay Item No. 834-E8:	<u>Converting Type "D" Communications Pull Box to Type "C"</u>	<u>Per Each.</u>
Pay Item No. 834-E9:	<u>xConverting standard TXDOT ground box to 24"</u>	<u>Per Each.</u>
Pay Item No. 834-E10:	<u>Converting standard TXDOT ground box to 36"</u>	<u>Per Each.</u>
Pay Item No. 834-E11:	<u>Converting standard TXDOT box to stacked TXDOT "D" ground box</u>	<u>Per Each.</u>
Pay Item No. 834-E12:	<u>Demolition 24" pull box</u>	<u>Per Each.</u>
Pay Item No. 834-E13:	<u>Demolition 36" pull box</u>	<u>Per Each.</u>
Pay Item No. 834-E14:	<u>Demolition standard TXDOT pull box</u>	<u>Per Each.</u>

End

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item No. <del>834S</del> 834, "Traffic Signal Pull Boxes"	
City of Austin Standard Details	

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Designation	Description
No. <del>834S834</del> -1	Type A Traffic Bearing Pull Box
No. <del>834S834</del> -2	Frame and Lid for use with Type A Traffic Bearing Pull Box
No. <del>834S834</del> -3	Type B Pull Box
No. <del>834S834</del> -4	Ring and Lid for use with Type B Pull Boxes
No. <del>834S834</del> -5	Type C Pull Box with Light Weight Cover
No. <del>834S834</del> -6	Ring and Lid for use with Type C Pull Box
No. <del>834S834</del> -7	Ring and Lid for Traffic Bearing Type C Pull Box
No. <del>834S834</del> -8	Type D Communication Pull Box and Torsion Assisted Lid
City of Austin Standard Specifications	
Designation	Description
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 410	Concrete Structures

RELATED CROSS REFERENCE MATERIALS	
Standard Specification Item No. <del>834S834</del> , "Traffic Signal Pull Boxes"	
City of Austin Standard Specifications	
Designation	Description
Item No. 401	Structural Excavation and Backfill
Item No. 406	Reinforcing Steel
Item No. 410	Concrete Structures
Item No. 411	Surface Finishes for Concrete

**ITEM NO. ~~835~~835 TRAFFIC SIGNAL CONDUIT ~~9-26-12~~****~~835~~835.1 Description**

This item shall govern furnishing and installation of all traffic signal conduit and/or materials in accordance with the specifications contained herein, Standard Detail No. ~~835~~835-1 "Trench Detail for Traffic Signal Conduit", the Drawings and/or written instructions from the Engineer or designated representative. This item shall consist of all applicable work, including conduit and termination of conduit in pull boxes, etc., as prescribed under this item and in accordance with the City of Austin Standard Specifications, Standards (Details) and Utility Criteria Manual, Section 5, "Cuts in Public Rights-of-Way".

Cutting, removal and restoration of pavement and base courses, driveways, curb and gutter, sidewalk and ramps, the furnishing and placement of select bedding, backfilling, the hauling and disposition of surplus materials, bridging of trenches and other provisions for maintenance of traffic or access as indicated on the Drawings shall be conducted and compensated in accordance with Standard Specification Item No. 844S, "Trench Excavation and Backfill for Traffic Signal Conduit."

~~This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.~~

~~835~~

**~~835~~835.2 Submittals**

The submittal requirements of this specification item may include:

A manufacturer's certification that the PVC, RMC, and other appropriate materials furnished under this Item were manufactured, sampled, tested, and inspected in accordance with the requirements of the pertinent ASTM, ANSI/AMSE and UL specifications.

**~~835~~835.3 Pipe/Conduit Materials**

All conduit and materials furnished by the Contractor shall be new and UL-listed and shall meet NEMA and NEC requirements. Unless indicated otherwise on the Drawings, junction boxes, expansion joints and conduit fittings shall be fabricated from a material similar to the connecting conduit.

Any PVC pipe and fittings, that are to be encased in Portland cement concrete or buried, shall meet the requirements of ASTM D3034 type SDR-35 of the nominal size shown on the Drawings. All other conduit shall be electrical conduit, schedule 40 PVC. All bends shall be large radius [minimum of 18 inches ~~(450 mm)]~~] to facilitate pulling of cable.

~~The Rigid metal conduit Aluminum Conduit (RMC), elbows, couplings and fittings shall be steel, hot-dipped galvanized inside and outside. When tested designated as Trade Size 4, manufactured in nominal 10' lengths, made from 6063 aluminum alloy, T-1 temper designation. The conduit shall be manufactured in accordance with ASTM A 90, zinc coating of RMC shall be a minimum of 1 ANSI C80.5 ounces per square foot (0.45 kilograms per square meter) inside, and outside. Polyvinyl chloride (PVC) shall conform to UL Standard 6A. The conduit shall meet the requirements of NEMA Standard TC-2, UL 651, and the NEC.~~

~~All 1" (50 mm) conduits including elbows and couplings shall be schedule 40 zinc-coated steel rigid threaded conduit (hot-dipped galvanized), at each end, conforming to Federal Specification WW-C-581d, ANSI C80-1, and Underwriters' Laboratories Specifications.~~

~~All 2", 3", and 4" (50 mm, 75 mm and 100 mm) conduits~~the American National Standard for Pipe Threads, General Purpose, AMSE B1.20.1. Thread taper is 3/4 inch per foot. One coupling shall be ~~PVC-~~provided with each unit of Rigid Aluminum Conduit.

All PVC conduits, including elbows and couplings shall be schedule 40 PVC conduit, conforming to Federal Specification W-C 1094 and Underwriters' Laboratories, Inc. Standard UL-651.

#### ~~835~~**835.4 Construction Methods**

Prior to commencement of work, all erosion control and tree protection measures required shall be in place and all utilities located and protected as set forth in Standard Contract Document Section 00700, "General Conditions", the City of Austin "Utility Criteria Manual, Section 5, Cuts in Public Rights of Way", and the City of Austin "Environmental Criteria Manual". Adequate temporary supports and protection of surface and underground utilities shall be the responsibility of the contractor.

A street cut permit is required for excavation in an existing City street (City of Austin Utilities Criteria Manual Section 5.2.0, "Permit for Excavation in the Public Rights-of-Way" and article 15-12-166, "Permit Required" of The Code of The City of Austin). Where traffic must cross open trenches, the Contractor shall provide suitable bridges. For trenches less than 2 feet (0.6 meter) in width, sheet steel plates having a minimum thickness of 1/2 inch ~~(12.5 mm)~~ shall be used. The plates shall overlay the top of the trench a minimum of 18 inches ~~(450 mm)~~ on both sides and secured by Cold-Mix asphalt that meets TxDOT Specification Item No. 334, "Hot Mix-Cold Laid Asphaltic Concrete Pavement".

Conduit shall be placed in accordance with the lines, grades, details and dimensions shown on the Drawings or as otherwise directed in writing by the Engineer or designated representative. Unless indicated otherwise on the Drawings, underground conduit shall be installed a minimum of 36 inches ~~(914 mm)~~ deep, measured from the finished grade, or 18 inches ~~(457 mm)~~ deeper than the bottom of the sub-grade, whichever is greater. Installation of conduit shall be in accordance with the requirements of NEC. Conduit placed for Portland cement concrete (pcc) encasement shall be secured and supported in such a manner that the alignment will not be disturbed during placement of the p.c. concrete. No p.c. concrete shall be placed until all of the conduit ends are capped and all box openings closed. Field bends in rigid metal conduit shall have a minimum radius equal to 12 times the nominal diameter of the conduit.

Each length of rigid metal conduit shall be reamed and threaded on each end and couplings shall be made tight. PVC conduit shall be joined by the solvent-weld method in accordance with the conduit manufacturer's recommendations. No reducer couplings shall be used.

Construction near any underground or overhead utilities shall be accomplished using established industry and utility safety practices. The Contractor shall verify existing underground utilities through review of record data, use of one-call utility locates, collection/observation of visible surface evidence, consultation with utility facility owners and application of subsurface utility engineering techniques (e.g., potholing, ground penetrating radar, etc.) to determine the location of existing utilities and structures.

Any damage to utilities and/or structures, that occurs as a result of any construction activity performed by the Contractor, shall be repaired by the Contractor at the Contractor's sole expense. Conduits shall be paid for once, regardless of extra work caused by obstructions and/or Contractor damage.

The Contractor shall comply with City of Austin's Standard Specifications, Standards (Details) and latest edition of the Street Cut and Excavation Repair Standards (City of Austin Utility Criteria Manual Section 5.0, "Cuts in Public Rights-of-Way"), when installing 2-inch ~~(50 mm)~~ conduit.

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Unless otherwise noted by the Engineer, all traffic signal conduits shall be terminated in a new or existing pull box. The cost to make the termination is considered ancillary to the various bid items and no additional compensation will be made to the contractor for this work.

All conduit and fittings shall have burrs and rough places smoothed and shall be clean and free of obstructions before the cable is installed. Field cuts shall be made with a hacksaw only, and shall be square and true so that the ends will butt or come together for the full diameter thereof. In no case shall a cutting torch be used to cut or joint conduit. Slip joints or running threads will not be permitted for coupling conduit unless approved by the Engineer or designated representative. When a standard coupling cannot be used, an approved union coupling shall be used and shall provide a watertight coupling between the conduit. All couplings shall be properly installed to bring their ends of connected conduit together to produce a good rigid connection throughout the entire length of the conduit run. Where the coating on a metal conduit run has been damaged in handling or installation, such damaged parts shall be thoroughly painted with rust preventive paint. Ends of conduits shall be capped or plugged until installation of the wire is complete.

Upon request by the Engineer or designated representative, the Contractor shall draw a full-size metal wire brush, attached by swivel joint to a pull tape, through the metal conduit to ensure that the conduit is clean and free from obstructions. Any conduit not passing the wire brush shall be replaced at the contractor's expense. Conduits shall be placed in an open trench to provide a minimum cover of 30 inches ~~(750 mm)~~ below the curb grade in the sidewalk areas, and 30 inches ~~(750 mm)~~ cover in the street areas.

Prior to final acceptance by the Owner of any conduit placed for future use, the contractor shall furnish and install a continuous nylon mule tape in each duct. The mule tape shall have a tensile strength of not less than 1800 pounds ~~(8 kilonewtons)~~. The mule tape shall be securely tied at each end of the conduit.

The Contractor shall provide adequately bent conduit and shall properly excavate so as to prevent damage to the conduit or conductor by a bend radius, which is too short.

Unless otherwise specified or directed by the Engineer or designated representative, all conduit runs shall be continuous and of the same material (metal only or PVC only). Where tying into existing conduit, the Contractor must continue with the same material (metal to metal or PVC to PVC). All conduits placed in trenches shall be laid side by side (no stacking.)

The size and number of conduits shall be as called out on the Drawings. The ends of all conduit placed for future use shall be fitted with caps.

### ~~835~~835.5 Trenching, Boring and Backfill

All trenching, excavation and backfill shall be to the lines and grades indicated on drawings and construction detail drawing and in accordance with Standard Detail No. ~~835~~835-1, "Trench Detail for Traffic Signal Conduit" and Standard Specification Item No. 401S, "Structural Excavation and Backfill," except for measurement and payment. Where existing surfacing is removed for placing conduit, the repair shall be made by backfilling with material equal in composition and density to the surrounding areas and by replacing any removed surfacing, such as asphalt pavement or concrete riprap, with like material to equivalent condition.

Jacking and Boring shall be as shown on the Drawings and in accordance with Standard Specification Item Nos. 501S, "Jacking or Boring Pipe" except for measurement and payment.

The work shall be executed in a safe and orderly fashion and in accordance with applicable Federal, State, and local laws, rules, and regulations. All work shall be performed in a competent manner consistent with the best modern practices, notwithstanding any omissions from the plans or these specifications.

All conduits shall be placed on a minimum 1" ~~(25 mm)~~ layer of bedding sand and covered with a minimum 4" ~~(100 mm)~~ layer of sand prior to backfill.

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Trench safety and trench safety systems shall be the responsibility of the contractor and shall be prepared in accordance with Standard Item No. 509S, "Excavation Safety Systems" and all applicable Federal, State, and local laws, rules, and regulations.

Trenches shall be excavated to lines and grades as indicated by on construction plans or as directed by the engineer. Trenches shall be a minimum of 4" ~~(100 mm)~~ and a maximum of 8" ~~(200 mm)~~ wider than the outside dimension of the conduit configuration. Trench bottoms shall be graded smooth with a minimum 1" ~~(25 mm)~~ layer of sand or other fine grain materials and shall be free of any trash, debris, loose material, or water. Trenches shall be excavated to a depth that insures that the required 30" ~~(750 mm)~~ conduit cover is achieved. Blasting or use of explosives as an aid to digging is not permitted.

The Engineer or designated representative reserves the right to inspect and approve all trenching prior to conduit placement.

Placement and compaction of backfill shall be performed in accordance with Standard Specifications Item Nos. 201S, "Subgrade Preparation" and 132S, "Embankment". Each layer shall be compacted to the required density by any method, and/or type and size of equipment, which will produce the required compaction. Prior to and in conjunction with the compaction operation, each layer shall be brought to the moisture content necessary to obtain the required density and shall be kept leveled with suitable equipment to insure uniform compaction over the entire layer.

Unless directed otherwise, earth embankments shall be constructed in successive layers, with a thickness of 8 inches ~~(200 mm)~~ or less in loose measure, for the full width of the individual cross section in a length that is best suited to the sprinkling and compaction methods utilized, while rock embankments shall be constructed in successive layers of 18 inches ~~(450 mm)~~ or less in thickness for the full width of the cross section.

Backfill under streets, driveways and all other pavement repairs shall conform to the City of Austin's Standard Specifications, Standards (Details) and Utility Criteria Manual, Section 5, "Cuts in Public Rights of Way". Backfill material for use in backfiring trenches under streets and driveways shall be selected based on the material's characteristic to maintain a consistent compacted density. Emphasis is placed upon the need to obtain uniform density throughout the backfill. Backfill shall be compacted by mechanical tamping equipment.

If boring under a roadway or other structure is required, the contractor shall be responsible for all utility locations including any required pot holing. Such pot-holing and boring shall be completed at the sole expense of the contractor and shall be conducted in accordance with the requirements of the Utility Criteria Manual, Section 5, "Cuts in Public Rights of Way".

### **~~835S~~835.6 Measurement**

The lineal foot will measure the Work prescribed by this item ~~(lineal meter: 1 lineal meter equals 3.281 lineal feet) of conduit for actual quantities completed based on the dimensions indicated on the Drawings.~~

The cost for utility location (including pot holing), boring, trenching, and any other excavation shall be conducted and compensated in accordance with Standard Specification Item No. ~~844S~~844, "Trench Excavation and Backfill for Traffic Signal Conduit".

### **~~835S~~835.7 Payment**

The work performed as prescribed by this item will be paid for at the unit bid price per lineal foot for "Installing PVC Traffic Signal Conduit" and "Installing RMC Traffic Signal Conduit". The unit bid price shall include full compensation for cutting, removal and restoration of pavement surface and base courses, furnishing and installation of all conduit to the lines and grades indicated on the Drawings; for repair of entry of conduit through walls of existing pull boxes; the furnishing and placement of select bedding, backfilling, the hauling and disposition

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of surplus materials, bridging of trenches and other provisions for maintenance of traffic or access as indicated on the Drawings and for all labor, tools, equipment, manipulation, and incidentals necessary to complete the work.

The cost for utility location (including pot holing), boring, trenching and any other excavation shall be conducted and compensated in accordance with Standard Specification Item No. ~~844S~~844, "Trench Excavation and Backfill for Traffic Signal Conduit".

The Work associated with construction of a new pull box will be paid for separately under a separate bid item identified with Standard Specification Item No ~~834S~~834, "Traffic Signal Pull Boxes."

Payment will be made under the following:

<b>Pay item No. 835-RT1:</b>	<u>Installing RMC Traffic Signal Conduit with Conduit 1 inch in diameter</u>	<u>Per Lineal Foot of conduit</u>
<b>Pay item No. 835-RT12</b>	<u>Installing RMC Traffic Signal Conduit with Conduit 2 inch in diameter</u>	<u>Per Lineal Foot of conduit</u>
<b>Pay item No. <del>835</del>835-LT1:</b>	-Installing <u>PVC</u> Traffic Signal Conduit with Conduit 1 inch in diameter	Per Lineal Foot of conduit
<b>Pay item No. <del>835</del>835-LT2:</b>	-Installing <u>PVC</u> Traffic Signal Conduit with Conduit 2 inch in diameter	Per Lineal Foot of conduit
<b>Pay item No. <del>835</del>835-LT3:</b>	-Installing <u>PVC</u> Traffic Signal Conduit with Conduit 3 inch in diameter	Per Lineal Foot of conduit
<b>Pay item No. <del>835</del>835-LT4:</b>	-Installing <u>PVC</u> Traffic Signal Conduit with Conduit 4 inch in diameter	Per Lineal Foot of conduit
<b>Pay item No. <del>835</del>835-LTM:</b>	-Installing _____ Traffic Signal Conduit with	Per Lineal Foot of conduit
	- _____ Conduit _____ inches in diameter,	
	- _____ Conduit _____ inches in diameter, and	
	- _____ Conduit _____ inches in diameter	

END

<b>SPECIFIC CROSS REFERENCE MATERIALS</b>	
Standard Specification Item No. <del>835</del> 835, "Traffic Signal Conduit"	
City of Austin Standard Specifications	
<u>Designation</u>	<u>Description</u>
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 401S	Structural Excavation and Backfill
Item No. <del>501</del> 501	Jacking or Boring Pipe
Item No. 509S	Excavation Safety Systems
Item No. <del>834</del> 834	Pull Boxes
Item No. <del>844</del> 844	Trench Excavation and Backfill for Traffic Signal Conduit
City of Austin Standard Details	
<u>Designation</u>	<u>Description</u>
No. <del>835</del> 835-1	Trench Detail for Traffic Signal Conduit
City of Austin Standard Contract Documents	
<u>Designation</u>	<u>Description</u>
Section 00700	General Conditions
City of Austin Utility Criteria Manual	

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(Supp. No. 8-2022)

<u>Designation</u>	<u>Description</u>
Section 5	Cuts in Public Right-of-Way
Article 5.2.0	Permit for Excavation in the Public Rights-of-Way
<u>The Code of the City of Austin, Code of Ordinances, Volume 1</u>	
<u>Designation</u>	<u>Description</u>
Article 14-11-181	Permit Required
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
ASTM D-3034	Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM A90/90M	Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
<u>Underwriter Laboratories (UL)</u>	
<u>UL 6A</u>	<u>Standard for Electrical Rigid Metal Conduit – Aluminum, Red Brass and Stainless Steel</u>
<u>American National Standards Institute (ANSI)</u>	
<u>C80.5</u>	<u>Electrical Rigid Metal Conduit - Aluminum (ERMC-A)</u>
<u>American Society of Mechanical Engineers (ASME)</u>	
<u>B1.20.1</u>	<u>Standard on Pipe Threads, General Purpose, Inch</u>
<u>Texas Department of Transportation and Development: Standard Specifications For Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 334S	Hot Mix-Cold Laid Asphaltic Concrete Pavement

Federal Specification WW-C-581d, ANSI C80 1

Federal Specification W-C 1094

<b>RELATED CROSS REFERENCE MATERIALS</b>	
Standard Specification Item No. <del>835S</del> 835, "Traffic Signal Conduit"	
<u>-City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 104S	Removing Concrete
Item No. 111S	Excavation
Item No. 210S	Flexible Base
Item No. <del>401S</del> 401	Structural Excavation Backfill
Item No. 402S	Controlled Low Strength Material
Item No. 403S	Concrete for Structures
Item No. 405	Concrete Admixtures

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(Supp. No. 8-2022)

Item No. 406S	Reinforcing Steel
Item No. 410S	Concrete Structures
Item No. 420	Drilled Shaft Foundations
Item No. 836S	Traffic Signal Risers
Item No. 837S	Traffic Signal Loop Detectors
Item No. 838S	Pedestrian Signal Risers
Item No. <del>840S</del> 840	Installation of Traffic Signals
Item No. 842S	Ducts
<u>-City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
No. 510S-1	Concrete Trench Cap
No. 510S-3	Typical Trench with Paved Surface
No. 510S-5	Typical Trench with Unfinished Surface
<u>-City of Austin Utility Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Article 5.5.0	Backfill of Excavated Area
Article 5.6.0	Restoration of Excavated Area
Article 5.7.0	Pavement Repairs
Article 5.8.0	Materials
Article 5.9.0	Miscellaneous Repairs
<u>-The Code of the City of Austin, Code of Ordinances, Volume 1</u>	
<u>Designation</u>	<u>Description</u>
Article 14-11-189	Conditions for Permit Issuance
Article 14-11-190	Excavation Sequence and Permit Term

## ***ITEM NO. 840 INSTALLATION OF TRAFFIC SIGNALS***

### **840.1 Description**

This item shall govern furnishing and installation of traffic signals in the City of Austin, Texas and its traffic signal maintenance jurisdiction in accordance with the specifications herein, the Standard Specifications and Standard Details listed below, the Drawings, manufacturers' recommendations, and/or written instructions from the Engineer or designated representative.

A. Standard Specifications:

Item No. 830S "Traffic Signal Controller Foundation"

Item No. 831 "Traffic Signal Drilled Shaft Foundation"

Item No. 832 "Vehicular Traffic Signal Installation"

Item No. 833 "Pedestrian Push Button Assembly"

Item No. 834 "Traffic Signal Pull Boxes"

Item No. 835 "Traffic Signal Conduit"

Item No. 836S "Traffic Signal Risers"

Item No. 837S "Traffic Signal Loop Detectors"

Item No. 838 "Pedestrian Signal Installation"

Item No. 839S "Traffic Signal Poles"

Item No. 841S "Removal of Traffic Signals"

B. Standard Details

No. 830-1 "Foundation Details for Base Mounted Controller Cabinet",

No. 831-1 "Traffic Signal Drilled Shaft Foundation",

No. 831-2 "Solar Powered Flasher Assembly",

No. 832-1 "Rectangular Rapid Flashing Beacon",

No. 832-2 "RRFB Placement",

No. 832-3 "Solar Powered Rectangular Rapid Flashing Beacon",

No. 834-1 "Type A Traffic Bearing Pull Box",

No. 834-2 "Frame and Lid for use with Type A Traffic Bearing Pull Box ",

No. 834-3 "Type B Pull Box",

No. 834-4 "Ring and Lid for use with Type B Pull Box",

No. 834-5 "Type C Pull Box with Light Weight Cover ",

No. 834-6 "Ring and Lid for sue with 36" Pull Box",

No. 835-1 "Trench Detail for Traffic Signal Conduit",

No. 836S-1 "Riser Details for 50-mm (2") and 75-mm (3") Risers ",

No. 836S-2 "Overhead Detector Run Details",

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No. 837-1 "Loop Detector Installation Details",  
No. 837-2 "Loop Detector lead-in Wire Details",  
No. 837-3 "Vehicular Detection Placement"  
No. 838-1 "Traffic Signal Electrical Notes"  
No. 838-2 "Signal Electrical Service"  
No. 838-3 "Traffic Signal Phasing"  
No. 839-1 "Pedestrian and Vehicular Signal Installation Detail",  
No. 839S-2 "Wood Pole Span Wire Detail",  
No. 839S-3 "Wood Pole Span Wire Installation Detail",  
No. 839S-4 "Traffic Signal Structures: Mast Arm Detail",  
No. 839S-5 "Traffic Signal Structures: Span Wire Details"

## 840.2 Submittals

Submittal requirements are identified with other relevant City of Austin Traffic Signal standard specifications.

## 840.3 Materials

Multi-conductor cable shall be supplied with a sufficient number of conductors to safely operate the traffic signal. The required number of conductors will either be indicated on the individual project Drawings or established by the Contractor. In either case, the Engineer or designated representative shall have final authority and approval over the number of conductors used in a specific traffic signal.

All multiconductor cable shall be capable of operating at 600 volts maximum and suitable for use at conductor temperature not exceeding 165°F. All such cable shall meet the requirements of the National Electrical Code.

Conductors shall be stranded annealed uncoated copper. The copper wire (before insulating) shall meet the requirements of the latest American Society for Testing and Materials' (ASTM) standards for uncoated wire.

The 2 conductor, 4 conductor, 7 conductor, and 12 conductor cables shall be #12 AWG. The 20 conductor cable shall be #14 AWG.

The overall cable jacket shall consist of a polyvinyl chloride compound, that provides a tough, heat, moisture, and flame resistant covering meeting the requirements of the Insulated Power Cable Engineer's Association (I.P.C.E.A.).

Standard color-coding shall be in accordance with IMSA specifications and the following table. The base color shall be the insulation color. Tracers shall be colored stripes, that are part of or are firmly adhered to the insulation surface for the full length of the wire.

Conductor No.	Base Color	Tracer Color	Conductor No.	Base Color	Tracer Color
1	Black	-	11	Blue	Black
2	White	-	12	Black	White
3	Red	-	13	Red	White
4	Green	-	14	Green	White
5	Orange	-	15	Blue	White
6	Blue	-	16	Black	Red
7	White	-	17	White	Red
8	Red	Black	18	Orange	Red
9	Green	Black	19	Blue	Red
10	Orange	Black	20	Red	Green



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## **840.4 Construction and Installation**

The Contractor will be responsible for a) acquisition and installation of all materials and equipment and b) providing the experience and labor necessary to insure a complete and operational traffic signal. The contractor shall provide the controller cabinet and timer unless indicated otherwise. The contractor shall be responsible for setting and wiring the cabinet.

Inspections by the City shall include but be not limited to all concrete pours, all trenching, all conduit installation, and all cable installation. The Contractor shall be responsible for contacting the City of Austin traffic signal shop a minimum of 48 hours prior to all required inspections.

The Contractor shall be responsible for coordinating all power installation and hook-up with Austin Energy or appropriate power company.

The contractor shall install all required cables as shown on the Drawings. Cabling shall be accomplished in accordance with the City of Austin standard splicing procedures and color codes for cabling traffic signals.

## **840S.5 Installation Requirements**

Prior to pulling cable in an existing underground conduit, the conduit shall be cleared of obstructions using a mandrel or cylindrical wire brush and blown out with compressed air.

The conductors shall be installed in a manner that prevents harmful stretching of the conductors or damage to the insulation. Installation methods shall conform to the recommendations of the cable manufacturer.

All cables in a given conduit run shall be pulled at the same time and the conductors shall be assembled to form one loop so that the pulling tension is equally distributed to all the cables. Long, hard pulls will necessitate the use of pulling eyes. For short runs, the cables may be gripped directly by the conductors by forming them into a loop to which the pull wire or rope can be attached. The insulation on each conductor shall be removed before the loop is formed. The method used will depend on the anticipated maximum pulling tension in each case.

In many instances, existing conduits, which contain signal cable, shall be used for the installation of new cables. In locations where new cables are to replace existing cables, the existing cables may be used to pull in the new cables. At locations where new cables are to be added to existing cable runs, the existing cables shall first be pulled out, then replaced when adding the new cables to the existing cables to form one cable pull. Installation and removal shall be done in such a way that prevents damage to the existing and/or new cables. In the event of damage, the Contractor shall bear the responsibility for providing the material and labor required in the replacement of defective cables at no extra cost to the City.

The cable shall be fed freely off the reel into the conduit without making a reverse curve. At the pulling end, the pull wire and cables shall be drawn from the conduit in direct line with the conduit. Sheaves or other suitable devices shall be used as required to reduce any hazards to the cable during installation. The cables shall be adequately lubricated to reduce friction and further minimize possible damage. Lubricants for lead sheathed cables shall not be grease or oil types but shall be one of several commercially available wire pulling compounds that are suitable for P. V. C. sheathed cables. They shall consist of soap, talc, mica, or similar materials and shall be designed to have no deleterious effect on the cables being used.

Cables shall be neatly trained to their destinations in manholes, cabinets, pole bases, pullboxes, and all other terminations. The Contractor shall adhere to the cable manufacturer's recommended values for the minimum bending radii to which cables may be bent for permanent training during installation. These limits do not apply to conduit bends, sheaves, or other curved surfaces around which these cables may be pulled under tension while being installed. Larger radius bends are required for such conditions.

Splices are strictly prohibited inside conduit runs.

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Splicing methods shall follow standard electrical practices and the cable manufacturer's recommendations. All materials used shall be of high quality and specifically intended for this purpose. Cables shall be trained to their final position and cut to proper lengths. The cable jacket and insulation shall be removed as required. Proper care should be exercised to ensure against nicking the conductors. The connection shall be installed tightly and all burrs, rough edges, etc. shall be removed.

Where two conductors are to be spliced, only crimp style "butt" connectors shall be used. If three or more conductors are to be connected, then a Kearney connector shall be used.

If the Engineer or designated representative directs that connectors shall be soldered, then heat shall be applied by using a hot soldering iron. Heating the connection with a direct flame will be allowed only on a case by case basis and only when specifically approved by the Engineer or designated representative. Care shall be used to protect insulation during soldering operations. The entire surface shall be cleaned taking special care in cleaning the outside jacket in order to remove the wax finish. Two (2) layers of reverse wrap vinyl tape shall be applied. Then two (2) layers of rubber tape shall be applied taking special care to diaper adjacent cables. (Note: This tape requires a pressure and temperature in service to complete its vulcanizing process and shall be stretched to  $\frac{3}{4}$  its normal width when applied.) The completed splice shall be covered with two (2) layers of vinyl plastic electrical tape. This wrapping shall be smooth, but the tape shall not be stretched more than necessary.

## **840.6 Contractor Obligations**

All work shall be done in a safe and conscientious manner and in conformance with all local, State, and Federal safety guidelines.

The Contractor will not be allowed to conduct work in the street during peak traffic periods (7:00 AM to 8:30 AM and 4:30 PM to 6:00 PM.) Exceptions to this stipulation may be made on a case-by-case basis and only with special permission by the Engineer or designated representative.

Completed traffic signal installations shall operate continuously for a minimum of thirty calendar days in a manner satisfactory to the Engineer or designated representative. If any equipment furnished by the Contractor fails during the thirty-day test period, the Contractor shall repair or replace that equipment at no cost to the City of Austin, and a new thirty-day test period shall commence. The test period will be suspended when any equipment fails that is not furnished by the Contractor. The test period will resume after the failed equipment has been repaired.

The Contractor will be responsible for providing and installing miscellaneous minor hardware items, including, but not limited to nuts, bolts, electrical tape, etc, that are necessary for the proper installation and operation of individual bid items in this item. The cost of providing and installing this hardware will be considered incidental to the various bid items. In addition, the cost of reconnecting or reassigning existing signal cables will be considered incidental. The cost of removing stop signs and their corresponding signposts at intersections where a new signal has been activated shall also be considered incidental. The Contractor shall be responsible for returning the removed signs and signposts to the City's Traffic Sign Shop.

The Contractor's responsibility for correcting any substandard work and/or materials shall extend for a period of twelve months from the date the work is accepted by the City.

If deviations from any of the stated procedures or substitutions for any materials or equipment are desired, the Contractor shall submit a written request with sample(s) or cut sheets of the substitute materials or equipment to the Engineer or designated representative for approval. The approval of the Contractor's submittal by the Engineer or designated representative shall be in written form.

The locations of signal pole foundations, controller cabinet foundations, pull boxes, conduits and steel guy poles that are shown on construction drawings shall be considered approximate. The Contractor shall verify existing underground utilities through review of record data, use of one-call utility locates, collection/observation of visible surface evidence, consultation with utility facility owners and application of subsurface utility engineering techniques (e.g., potholing, ground penetrating radar, etc.) to determine the location of existing utilities and structures.

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The Contractor shall give the Owner 48 hours notice of the Contractor's intention to establish the final location of these items and shall acquire approval for the locations on the ground by the Owner representative, or the Owner's inspector.

It shall be the Contractor's responsibility to locate all utilities prior to initiation of any excavation work. If utilities must be relocated in order for construction to proceed, then the contractor shall coordinate the work with the Utility Location and Coordination Committee of the Public Works and Transportation Department. If damage to utilities occurs as a result of any construction performed by the Contractor, it shall be the Contractor's responsibility to effect and pay for the repairs at no cost to the City of Austin.

If more than one unit of a given bid item is required, then the Contractor shall ensure that all units are the product of one manufacturer, unless otherwise directed by the Engineer or designated representative.

All materials furnished by the Contractor shall become the property of the City of Austin effective from the date the Contractor is paid by the City for the materials. The Contractor shall have full responsibility with respect to damage, theft, or loss of the material until the date of installation.

After installation, but prior to final acceptance of the work, the Contractor shall be responsible for damages or losses to installed City-furnished material that are caused by the Contractor's own negligent act(s) or omission(s). The Contractor agrees to replace materials furnished by the City that are lost, damaged or destroyed due to the Contractor's negligence, at the Contractor's sole cost, or reimburse the City for replacement cost of such material.

The Contractor agrees to defend, indemnify, and hold harmless the City, its officers, agents, and employees, from any and all claims, judgments, lawsuits, fines, penalties, liens, costs, and other damages, whether suffered by third persons or by the Contractor, arising out of the transportation, storage, installation, or use of the City's material during performance of the work. The City will not be responsible for storage rental charges of any kind, and no lien shall be attached to the materials as a result of Contractor's failure to pay rental charges or other charges. The Contractor agrees to prevent liens and encumbrances of any nature from attaching to the material while it is in the Contractor's possession.

Materials furnished by the City shall at all times remain the property of the City, and the Contractor shall ensure that the materials are kept, protected and stored separately from the Contractor's property or other property. The Contractor shall advise others by labeling or other means that the materials are the City's property solely for use in the performance of the particular work. The City may require return of any materials hereunder, or refuse to furnish further materials in the event of failure to abide by these provisions.

While performing work under this price agreement, the Contractor bears the sole risk of loss for damages to or destruction of any traffic signal equipment, appurtenances or any equipment that was not to be replaced or installed under this price agreement, but which was damaged or destroyed through the fault or negligent act of the Contractor. The Contractor shall replace such damaged or destroyed equipment, etc., at no cost to the City of Austin.

The Contractor shall assume full responsibility for the preservation of existing landscaping (sod, shrubbery, trees, and etc.), sprinkler systems, and other private property at the job site during the installation of items covered by this specification item. Damaged landscaping, sprinkler systems, and other private property shall be replaced and/or repaired to the satisfaction of the Owner within a reasonable time, by the Contractor at the Contractor's own expense.

No trees or shrubbery shall be cut except upon the specific authority of the Owner.

Removal of mailboxes in the way of construction requires 48 hours advance notice to the U.S. Post Office.

The Contractor shall secure permission from the proper authority and the approval of the Owner before cutting into or removing any walks or curbs that is required during construction.

After work is completed, the Contractor shall restore any curbs or walks, that have been removed and/or damaged during construction to the equivalent or better than the original condition. The repair and/or replacement shall be completed to the satisfaction of the Engineer or designated representative at no additional cost to the City of Austin.

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Initial testing of all materials, construction items (including initial compaction and density tests deemed necessary in connection with the construction of embankment, backfill of structures or excavation) and/or products incorporated in the work shall be performed at the direction of the Engineer or designated representative and at the expense of the Contractor,

In the event that a material, construction item, product incorporated in the work, embankment fill, backfill, excavation or any other item fails to satisfy the minimum requirements of the initial test described above, appropriate prove-out tests shall be made as directed by the Engineer or designated representative to determine the extent of the failure and to verify that corrective measures successfully satisfy appropriate specification requirements. The cost of all testing necessary to determine the extent of the failure and the adequacy of the corrective measures shall be the responsibility of the Contractor.

The Contractor shall comply with the latest requirements of the City of Austin Environmental Criteria Manual that are related to construction projects. The costs associated with such compliance will be considered incidental to the various bid items, and no additional compensation will be made to the Contractor for any associated work or materials. This work shall include, but not be limited to furnishing and installing filter dikes and silt fences. The Contractor shall comply with all City of Austin Planning Environmental and Conservation Services Department (PECSD) inspector requirements for erosion control.

The Contractor shall comply with the latest requirements of the City of Austin's Utility Criteria Manual; in particular Section 5 "Cuts In Public Rights of Way." The costs associated with such compliance will be considered incidental to the various bid items, and no additional compensation will be made to the Contractor for any associated work or materials.

The Contractor shall comply with all the requirements of the latest editions of Chapter 8 of the City of Austin's Transportation Criteria Manual, City of Austin Standard Specification Item Nos. 801S, "Construction Detours", 802S, "Project Signs" and 803S, "Barricades, Signs and Traffic Handling" and the State of Texas Manual on Uniform Traffic Control Devices as they relate to work zone safety requirements. The costs associated with such compliance will be considered incidental to the various bid items, and no additional compensation will be made to the Contractor for any associated work or materials except as noted in this item. This work shall include but not be limited to furnishing and installing traffic cones barricades, arrow boards and signs for work zones on City streets.

The Contractor shall provide and maintain all warning devices and shall take all precautionary measures required by law to protect persons and property while said persons or property are approaching, leaving, or located within the work site of any area adjacent to said work site. No separate compensation will be paid to the Contractor for the installation or maintenance of any warning devices, barricades, lights, signs, or any other precautionary measures, including off duty police officers, required by law for the protection of persons or property.

The Contractor shall be held responsible for all damages to work items and other public or private property due to the failure of warning devices, barricades, signs, lights, or other precautionary measures in protecting said property. Whenever evidence is found of such damage, the Engineer or designated representative may order the damaged portion immediately removed and replaced by the Contractor at the Contractor's own expense.

The Contractor shall provide adequate police traffic control assistance for planned signal controller replacements or any other operational procedures, when requested by the Engineer or designated representative. Police assistance shall be arranged by the Contractor directly, at least twenty-four (24) hours in advance of the work activity. If it is discovered that the Contractor has failed to provide adequate police assistance, the Engineer or designated representative may order additional assistance. Police traffic control assistance, for any purpose, shall be the financial responsibility of the Contractor, regardless of the person requesting the assistance.

As the work proceeds, the Contractor shall retain and mark-up an original set of Drawings, indicating all revisions and additions to the work, including field relocation of work concealed from view and conductor cable lengths. The Contractor shall deliver these "as-built" drawings to the City's traffic signal engineer within ten (10) working days after the work has been accepted.

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## 840.7 Measurement

Each traffic signal complete, in place, and operational.

## 840.8 Payment

Traffic signal installations will be paid for at the unit bid price per each. The unit bid price shall include full compensation for furnishing and installing all materials, labor, tools, equipment and incidentals necessary to complete the work and result in an operational traffic signal.

Payment will be made under:

<b>Pay Item No. 840-TS1</b>	Traffic Signal Installation, including contractor supplied cabinet and controller	Per Each.
<b>Pay Item No. 840-TS2</b>	Traffic Signal Installation, City supplied cabinet and controller	Per Each.

END

<b><u>SPECIFIC CROSS REFERENCE MATERIALS</u></b>	
Standard Specification Item No. 840S, " Installation of Traffic Signals"	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 830S	Traffic Signal Controller Foundation
Item No. 831	Traffic Signal Drilled Shaft Foundation
Item No. 832	Vehicular Traffic Signal Installation
Item No. 833	Pedestrian Push Button Assembly
Item No. 834	Traffic Signal Pull Boxes
Item No. 835	Traffic Signal Conduit
Item No. 836S	Traffic Signal Risers
Item No. 837S	Traffic Signal Loop Detectors
Item No. 838S	Pedestrian Signal Installation
Item No. 839S	Traffic Signal Poles
Item No. 841S	Removal of Traffic Signals
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
No. 830-1	Foundation Details for Base Mounted Controller Cabinet
No. 831-1	Traffic Signal Drilled Shaft Foundation
No. 831-2	Solar Powered Flasher Assembly
No. 832-1	Rectangular Rapid Flashing Beacon
No. 832-2	RRFB Placement
No. 832-3	Solar Powered Rectangular Rapid Flashing Beacon
No. 834-1	Type A Traffic Bearing Pull Box
No. 834-2	Frame and Lid for use with Type A Traffic Bearing Pull Box
No. 834-3	Type B Pull Box
No. 834-4	Ring and Lid for use with Type B Pull Box

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No. 834-5	Type C Pull Box with Light Weight Cover
No. 834-6	Ring and Lid for sue with 36" Pull Box
No. 835-1	Trench Detail for Traffic Signal Conduit
No. 836S-1	Riser Details for 50-mm (2") and 75-mm (3") Risers
No. 836S-2	Overhead Detector Run Details
No. 837-1	Loop Detector Installation Details
No. 837-2	Loop Detector Lead-In Wire Details
No. 837-3	Vehicle Detector Placement
No. 838-1	Electrical Notes For Traffic Signals
No. 838-2	Signal Electrical Services
No. 839S-1	Pedestrian and Vehicular Signal Installation Details
No. 839S-2	Wood Pole Span Wire Details
No. 839S-3	Wood Pole Span Wire Installation Details
No. 839S-4	Traffic Signal Structures: Mast Arm Details
No. 839S-5	Traffic Signal Structures: Span Wire Details

**ITEM 842 REMOVAL OF SIGNAL POLE, MAST ARM AND FOUNDATIONS****842.1 Description**

Remove mast arms, poles, and foundations. Work may be performed on a scheduled or emergency basis. Emergency work shall be defined as unscheduled work occurring between the hours of 7:00 PM and 7:00 AM Monday through Friday and all day on weekends. Emergency work would typically be associated with repairs resulting from a traffic signal knockdown. Scheduled work may occur during emergency hours, but will not be paid at emergency rates.

**842.2 Submittals**

There are no submittal requirements for this specification item.

**842.3 Materials**

N/A

**842.4 Construction Methods**

Use established industry and utility safety practices to remove assemblies near overhead or underground utilities. Contractor is responsible for providing all the equipment necessary to remove poles including boom truck, harness lifting equipment, etc. City of Austin personnel will assist with removing poles. Contractor shall transport and unload the pole from the job site to the City of Austin pole yard or salvage yard as directed by the Engineer or designee.

**A. Timber Pole Removal**

The Contractor will be responsible for removing the timber poles and backfilling and compacting the resulting hole. Backfill material shall be similar to the surrounding material and shall be compacted full depth to the density of the surrounding soil. The contractor shall submit, to the engineer, samples of the material to be used for backfill prior to placement. The engineer shall make the final determination of the suitability of backfill material.

The Engineer will identify existing damage to salvaged material and mark damaged items in the field. The Contractor will not be held responsible for damage he does not cause. If damage to material is the fault of the Contractor, he will have three working days to supply equal items at his expense. If the Contractor fails to replace damaged items in said time, the City will charge the Contractor for the assessed value as determined by the Engineer.

**B. Steel Pole Removal**

City of Austin poles to be removed and transported may be up to 35' in length. Contractor shall have the means of transporting these on a boom truck and/or a trailer.

**C. Mast Arm Removal**

Use established industry and utility safety practices to remove assemblies near overhead or underground utilities. Contractor is responsible for providing all the equipment necessary to remove mast arms including boom truck, harness lifting equipment, etc. City of Austin personnel will assist with removing mast arms. Contractor shall transport and unload the mast arm from the job site to the City of Austin pole yard or salvage yard as directed by the Engineer or designee.

Mast arms to be removed and transported may be up to 60' long. Contractor shall have the means of transporting these on a boom truck and/or a trailer.

**D. Signal Pole Foundation Removal**

Use established industry and utility safety practices. Raze the foundation to a depth of at least 8 inches below ground surface. Restore the ground surface to the surrounding conditions. Properly dispose of excavated and razed material. Salvage any items identified by the Engineer.

**E. Ped Pole Foundation Removal**

Use established industry and utility safety practices. Raze the foundation to a depth of at least 8 inches below ground surface. Restore the ground surface to the surrounding conditions. Properly dispose of excavated and razed material. Salvage any items identified by the Engineer.

**F. Controller Cabinet Foundation Removal**

Use established industry and utility safety practices. Raze the foundation to a depth of at least 8 inches below ground surface. Restore the ground surface to the surrounding conditions. Properly dispose of excavated and razed material. Salvage any items identified by the Engineer.

**842.5 Measurement**

The price shall include full compensation for furnishing all materials, handling, placing, labor, tools, equipment and incidentals necessary to complete the work.



**842.6 Payment**

The work performed, materials furnished and measures as provided above, will be paid by the unit bid price per each. The price shall include full compensation for furnishing all materials, handling, placing, labor, tools, equipment, permits, and incidentals necessary to complete the work.

Payment will be made under one of the following:

<b>Pay Item No. 842-1:</b>	Remove Steel Pole .....	Per Each
<b>Pay Item No. 842-1(E):</b>	Remove Pole – (Emergency).....	Per Each
<b>Pay Item No. 842-2:</b>	Remove Mast arm .....	Per Each
<b>Pay Item No. 842-2(E):</b>	Remove Mast arm – (Emergency) .....	Per Each
<b>Pay Item No. 842-3:</b>	Remove Pole Foundation .....	Per Each
<b>Pay Item No. 842-4:</b>	Remove Ped Pole Foundation .....	Per Each
<b>Pay Item No. 842-5:</b>	Remove Controller Foundation .....	Per Each
<b>Pay Item No. 842-6:</b>	Remove Timber Pole .....	Per Each

**End**

## ***ITEM NO. 843 ACCESSIBLE PEDESTRIAN SYSTEM (APS)***

### **843.1 Description**

This item shall govern furnishing and installation of Accessible Pedestrian Systems (APS). This includes Accessible Pedestrian Push Buttons and Accessible Pedestrian Push Button Control Units in accordance with the specifications contained herein, Standard Detail No. 839-1, "Pedestrian and Vehicular Signal Installation Details", No. 839S-2, "Wood Pole Span Wire Details", No. 839S-4, "Traffic Signal Structures: Mast Arm Details", No. 839S-5, "Traffic Signal Structures: Span Wire Details", manufacturer recommendations, the Drawings and/or written instructions from the Engineer or designated representative.

The systems shall meet or exceed the requirements of the latest version of the Federal MUTCD and the requirements listed in this specification and latest version of the Texas MUTCD. The bid shall be awarded to the lowest responsive, responsible bidder. The APS systems shall be installed on 332, 336, 352 and ATC cabinets.

### **843.2 Submittals**

The submittal requirements of this specification item include:

- A. Wire size, characteristics and designation for each wire application (i.e. traffic signal, pedestrian signal and/or pedestrian push button),
- B. Catalog cut sheets and Manufacturer installation recommendations for required items.
- C. Upon request, the Contractor shall furnish a sample within (7) working days of the equipment they propose to furnish the City of Austin. Samples will be used for assuring compliance with this specification. Failure to provide the requested samples shall subject the item to disqualification from acceptance by the City.
- D. Upon request, the Bidder shall include a list of users who have had the bid items installed and in operation for a minimum of 2 years. Items being bid which have not been in use by at least ten (10) municipalities for a minimum of two (2) years may be excluded for consideration for this bid.

Bidders shall acknowledge with their bid that the Accessible Pedestrian Push Button assemblies and Accessible Pedestrian Push Button Control units comply with this specification.

### **843.3 Materials**

The systems shall meet or exceed the requirements of the 2009 Federal MUTCD and the requirements listed in this specification and 2011 Texas MUTCD. The bid shall be awarded to the lowest responsive, responsible bidder. The APS systems shall be installed on 332, 336, and 352 ATC cabinets.

#### **A. General**

The APS push button assembly shall be weather-tight and tamper-proof. The assembly shall be designed to prevent an electrical shock under any weather condition and shall have provisions for grounding in accordance with the National Electrical Code (NEC).

All APS units installed on a job shall be of the same manufacturer.

#### **B. Design**

Pedestrian push button housings shall be cast from aluminum alloy, free of voids, pits dents, molding, sand and excessive grinding marks. All design radii shall be smooth and intact. Exterior surface finish shall be smooth and cosmetically acceptable and free of blemishes. The manufacturer's name or trademark shall be located on the housing.

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Each Pedestrian Push Button Pole unit assembly shall have a 2" push button with a raised tactile arrow on the button. The arrow/button shall vibrate during the WALK interval and the WALK audible message. The arrow shall be able to be oriented to point either to the left or to the right edge of the Pedestrian Push Button Pole unit assembly. The manufacture shall provide, at additional cost, an optional dual arrow insert for use in median installations.

The Pedestrian Push Button Pole unit assembly frame shall be made of cast aluminum and shall be painted or powder coated Federal yellow. The frame provided shall incorporate threaded mounting holes with screws to accept a 9" x 15" pedestrian R10-3e reflective sign. It shall be possible to install two (2) Pedestrian Push Button Pole unit assemblies on a single 4 1/2" OD pole at 90 degrees to each other.

Mounting attachments shall be as indicated on the Drawings. All bolts, nuts, washers, lock washers, screws and other assembly hardware shall be galvanized steel, stainless steel or dichromate sealed aluminum in conformance with the latest version of the TxDOT Departmental Materials Specifications DMS-7120, "Sign Hardware". When dissimilar metals are used, the metals shall be so selected or insulated to prevent corrosion.

When tamper/vandal proof fasteners/screws are used in the Pedestrian Push Button Pole unit assembly, Twenty-five (25) "screwdriver" type tools shall be provided for each of the different type of tamper resistant fasteners used. The tools shall be 1-piece and comprise of a handle, a shaft, and the appropriate tip to remove and replace the fasteners. Removable bits alone are not acceptable. These tools shall be provided as part of the first order of this contract at no additional cost to the City. There is no separate pay item for these devices.

#### C. Pedestrian Instructional Sign

Each Pedestrian Push Button unit assembly shall be delivered with a double sided R10-3e reflective sign with 3M High Intensity Reflective sign sheeting or equal. All colored sheeting shall be 3M sign sheeting or equal and have the same warranty as the 3M High Intensity sheeting.

The instructional sign shall include the legend indicated on the Drawings and shall meet the requirements presented in sections 824S.3.E (Sign Blanks) and 824S.3.F (Sign Faces) of Standard Specification Item No. 824S, "Traffic Signs".

### **843.4 System Components and Operation**

#### A. Two-Wire and Three-Wire Mode

The APS systems shall be able to operate in either 2-wire mode or 3-wire mode. For 2-wire systems, the system will include pedestrian push buttons and a control unit located in the traffic signal cabinet. The control unit will include an ethernet interface that can be connected to the traffic signal communication network allowing for remote communication from the City's Mobility Management Center to the push button control units. All references below to communication refer to the 2-wire systems. The 3-wire system shall include pedestrian push buttons and an interface in the traffic signal head (the 3-wire module) that connects to the pedestrian push button. This interface provides power to the push button and provides the logic necessary for the button to know the state of the Walk/Don't Walk indications. Remote communication to these devices from the MMC is not necessary.

- 1) Each APS push button shall be capable of being used in 2-wire or 3-wire mode.
- 2) 2-wire mode - Each button shall communicate directly with the control unit in the signal cabinet.
- 3) 3-wire mode - Push buttons shall be wired to a module installed in the pedestrian head to obtain power and Walk / Don't Walk indications.

Pedestrian Push Button Pole unit assemblies shall require only two wires from the traffic control cabinet to each individual Pedestrian Push Button Pole unit for each phase/crosswalk. This will allow for upgrading from

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existing 2 wire pedestrian push buttons to an Accessible Pedestrian Push Button Pole unit assembly without any additional wiring. All required hardware and electronics for a functional Pedestrian Push Button Pole unit shall be housed in the Pedestrian Push Button Pole unit assembly.

**B. Scalability and Compatibility**

Although a complete system typically consists of: one (1) Accessible Pedestrian Push Button Control unit, eight (8) Accessible Pedestrian Push Button units/assemblies, (8) 3 Wire Modules, and eight (8) signs, it shall be possible to install and operate the system with various numbers of Push Button assemblies based on the number of crosswalks and pedestrian phases at the location. It shall be possible to operate the system with as few as two (2) Pedestrian Push Button assemblies serving a single crosswalk. While each pedestrian phase will typically have two (2) Push Button assemblies installed, it shall be possible to install up to three (3) Push Button assemblies for each pedestrian phase. It shall also be possible to connect a conventional 2" pedestrian button with tone and LED indication and provide a latching output for the LED.

**C. Audible Messaging**

- 1) Any time other than when the associated WALK indication is being displayed, each activation of the push button shall be accompanied by a "WAIT speech message.
- 2) The system shall be able to provide the following audible features:
  - A pushbutton locator tone with a duration of 0.15 seconds that repeats at 1-second intervals. At least 3 locator tones shall be available for uses selection.
  - An audible WALK indication. This audible WALK indication shall be user programmable to be either a percussive tone or a speech WALK message. At least five (5) selectable choices for the percussive tone shall be provided.
  - At least three (3) user programmable pedestrian change interval sounds shall be provided.
  - During the pedestrian change interval following a WALK indication, the accessible pedestrian signal shall revert to the pushbutton locator tone.
- 3) All audible sounds shall emanate from the Accessible Pedestrian Push Button pole unit. Each audible feature shall have independently settable minimum and maximum volume limits. All sounds shall automatically adjust to ambient noise levels.
- 4) All volumes and optional features shall be settable using:
  - wireless handheld programming device with password security, or
  - Smartphone and tablet and at the cabinet through existing wiring

**D. Programming**

- 1) The programming device shall be capable of setting/updating all Pedestrian Push Button Pole unit assemblies at an intersection. If required, five (5) Pedestrian Push Button Pole unit programming devices shall be provided, at no additional cost to the City, for configuring the Pedestrian Push Button Pole unit assemblies and shall be delivered with the initial order of this contract.
- 2) Custom voice programming shall be accomplished with the use of software loaded on a laptop computer with Windows 10 operating system. Custom voice programming of the Pedestrian Push Button Pole unit shall be accomplished by downloading to the pushbutton or control unit through a USB interface or wirelessly. Special software required for programming and creating the voice files shall be provided, at no additional cost to the City, and delivered with the first order of this contract. Any USB ports on the Pedestrian Push Button Pole unit assembly shall be secured by an easily removable cover with vandal proof screws. Twenty-five (25) USB interface cables shall be provided with the appropriate connectors to connect a laptop computer to the

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Pedestrian Push Button Pole unit. These interface cables shall be provided, at no additional cost to the City, and shall be delivered at the beginning of the project.

- 3) An IP Ethernet port shall be provided on the Accessible Pedestrian Push Button Control Unit allowing access to all programming and alarm features between the control unit and the City's Mobility Management Center utilizing the City's communication network. All software required to accomplish remote access shall be provided. On site technical support shall be provided to ensure proper software installation and communications. Software upgrades shall be provided at no cost and will be provided to the City within 10 days of release for the duration of the warranty period. Technical support for installation and activation of the upgraded software shall be available at no cost to the City if needed for the duration of the warranty period.
- 6) The system shall be able to self test each pole unit assembly and report any faults to the traffic controller and/or to the IP Ethernet port on the Accessible Pedestrian Push Button Control Unit when connected to a fiber Ethernet switch and send the information to the Traffic Management Center.
- 7) The system shall be capable of utilizing a schedule to change output volume by time of day.
- 8) The control unit shall utilize SNTP and SNMP to generate email notifications and to respond to a central network monitoring system.
- 9) It shall be possible to connect a latching LED pedestrian push button to the Pedestrian Push Button Pole unit assembly. When the latching pedestrian push button is pressed it shall actuate all the features of the Pedestrian Push Button Pole unit assembly.
- 10) The control unit shall be capable of communicating with the signal controller via SDLC cabling.
- 11) Push buttons shall be capable of transmitting a call wirelessly to an adjacent push button on the same signal phase.
- 12) The vendor shall provide Management Information Base (MIB) information upon request.
- 13) For traffic signal operations where a pedestrian signal rests in WALK, the audible WALK indication shall be able to be programmed to be limited to the first 7 seconds of the WALK indication. If the pushbutton is actuated during the WALK interval after the audible indication has ceased, the audible WALK indication shall be reactivated provided that the crossing time remaining is greater than the pedestrian change interval.

E. Push Button Extension

As required, provide a push button extension up to 18 inches in length. The push button assembly should be able to be mounted tangential or perpendicular to the pole as necessary.

## **843.4 Installation**

The Contractor will be responsible for installing the audible pedestrian push-buttons and signs in the field. Drilling wire feed holes and mounting the pedestrian push-button on signal poles will be the Contractor's responsibility.

All wire feeding through the mast arm pole structure shall be wrapped once with plastic electrical tape and wrapped again with electrical friction tape extending 12 inches on each side of the pole opening for a total of 24 inches. Pedestrian push-buttons shall have a common ground wire that is completely isolated and independent from all other ground wires.

Where existing pedestrian pushbuttons are being removed to accommodate the audible pedestrian buttons, the Contractor shall be responsible for their removal and appropriate recycling and disposal. Any "Bulldog" type pushbuttons that are removed as a part of this project shall be returned to the City.

## 843.5 Measurement

This work performed and material furnished with this item will be paid for at the unit bid price for the appropriate pay item as listed in the "Payment" section. The unit price shall include full compensation for furnishing all labor, tools, equipment and incidentals necessary to complete the work.

## 843.6 Payment

Pedestrian push buttons shall be paid for at the unit bid price per each. The unit bid price for "Install Only" shall include: a) drilling wire feed holes (as needed), b) mounting the push buttons on the signal poles and c) furnishing all labor, tools, equipment and incidentals necessary to complete the work. The unit bid price for "Furnish and Install" shall include full compensation for the items described in "Install Only" in addition to furnishing and installing all ancillary materials.

The cost of procuring, installing, and connecting mounting hardware, pedestrian signs, and cable from the push button to the controller is considered ancillary to various bid items and will not be paid for separately.

Payment will be made under:

<b>Pay Item No. 843-APBFI:</b>	Furnish and Install Accessible Pedestrian Push-button	per Each.
<b>Pay Item No. 843-ACUFI:</b>	Furnish and Install Accessible Pedestrian Push-button Control Unit	per Each.
<b>Pay Item No. 843-A3FI:</b>	Furnish and Install 3 Wire Module	per Each.
<b>Pay Item No. SS1843-APBEFI:</b>	Furnish and Install Accessible Pedestrian Push-button Extension	per Each
<b>Pay Item No. 843-APBI:</b>	Install Only - Accessible Pedestrian Push-button	per Each.
<b>Pay Item No. 843-ACUI:</b>	Install Only - Accessible Pedestrian Push-button Control Unit	per Each.
<b>Pay Item No. 843-A3I:</b>	Install Only - 3 Wire Module	per Each.
<b>Pay Item No. SS1843-APBEI:</b>	Install Only - Accessible Pedestrian Push-button Extension	per Each

END

<b><u>SPECIFIC CROSS REFERENCE MATERIALS</u></b>	
<b><u>Special Specification Item No. SS1843, "Accessible Pedestrian System"</u></b>	
<b><u>City of Austin Standard Details</u></b>	
<b><u>Designation</u></b>	<b><u>Description</u></b>
No. 839S-1	Pedestrian and Vehicular Signal Installation Details
No. 839S-2	Wood Pole Span Wire Details
No. 839S-4	Traffic Signal Structures: Mast Arm Details
No. 839S-5	Traffic Signal Structures: Span Wire Details
<b><u>City of Austin Standard Specifications</u></b>	
<b><u>Designation</u></b>	<b><u>Description</u></b>
Item No. 824S	Traffic Signs
Section 824S.3.E	Sign Blanks
Section 824S.3.F	Sign Faces
<b><u>TxDOT Departmental Materials Specifications</u></b>	
<b><u>Designation</u></b>	<b><u>Description</u></b>
DMS-7120	Sign Hardware

## **Item No. 845 Electrical Service For Traffic Signals**

### **845.1 Description**

This item shall govern furnishing and installation of overhead and underground electrical services in accordance with the specifications contained herein, the drawings, Detail Sheet 838-2 "Traffic Signal Electric Service", Austin Energy Figure 1-15A/B, "Meter Loop for Permanent Overhead Service Installation Residential 120/240 Volt Single Phase Typical Installation", Figure 1-16A/B, "Meter Loop for Permanent Underground Service Installation Residential 120/240 Volt Single Phase Typical Installation", 1410-60, "Conduit Terminations Riser", 1410-63, "Conduit Terminations Various", 1419-10, "Base, Sand, and Backfill", 1448-15, "Pullbox 18 In. w/Traffic Cover", 1488-10, "Grounding Structures in Soft Soil", 1488-20, "Grounding Structures in Rocky Soil", and/or written instruction from the Engineer or designated representative. This item shall consist of all applicable work, including conduit, conduit risers, weather-heads, meter sockets, disconnect, straps, concrete, and termination of conduit in pull boxes as prescribed under this item and in accordance with applicable standards.

### **845.2 Submittals**

The submittal requirements for this specification item shall include:

- A. Cut sheets for all materials used in the installation.

### **845.3 Materials**

Materials provided shall comply with the details shown on the attached details, the requirements of this item, and the pertinent requirements of the standard specifications. For the installation of electrical services, use materials that meet the requirements of the NEC, UL, CSA, and NEMA.

### **845.4 Construction Methods**

Perform work in accordance with the details shown on the attached standard details and the requirements of this Item. Use established industry and utility safety practices when installing electrical services located near overhead or underground utilities. Consult with Austin Energy before beginning work.

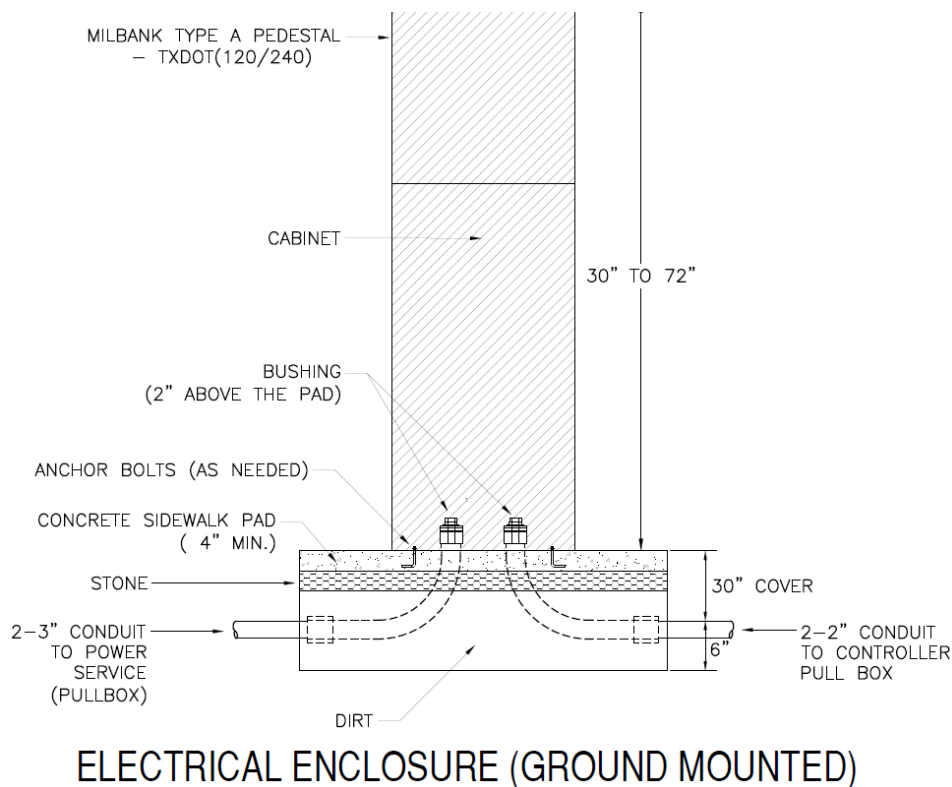
Furnish and install electrical service equipment. Ensure components of the electrical service meet the requirements of the attached standard details. Follow NEC and local utility company requirements when installing the electrical equipment. Coordinate the utility companies' work for providing service.

When required to complete the work, remove existing electrical service support a minimum of 2 ft. below finish grade unless otherwise shown on the plans. Repair the remaining hole by backfilling with material equal in composition and density to the surrounding area. Replace any surfacing such as asphalt pavement or concrete riprap with like material to equivalent condition.

Disconnect conductors and remove them from the conduit. Cut off all protruding conduit 6 in. below finished grade. Abandoned conduit need not be removed unless shown on the plans.

Reconnect conductors and conduit to be reused when shown on the plans. Make all splices in ground boxes unless otherwise shown on the plans.

Install ground mounted electrical enclosures called for in the plans as shown in the image below:



#### 845.5 Measurement

This item will be measured per each Electrical Service installed.



#### **845.6 Payment**

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Electrical Services" of the types specified."

This price is full compensation for making arrangements with the utility company; for all work and materials provided by the utility company; and for furnishing, installing, and connecting all components including poles, service supports, foundations, anchor bolts, riprap, enclosures, switches, meters, breakers, service conduit (from the service equipment including the elbow below ground), fittings, service conductors (from the service equipment including the elbow below ground), removing portions of or all of existing service connections, brackets, bolts, hangers, hardware; and materials, equipment, labor, tools, and incidentals necessary to provide a complete in place electrical service.

Payment will be made under the following:

<b>Pay Item No. 845-ES-CS:</b>	Furnish and Install Overhead Electrical Service-City Std. no Meter	per Each.
<b>Pay Item No. 845-ES-CSM:</b>	Furnish and Install Overhead Electrical Service-City Std. with Meter	per Each.
<b>Pay Item No. 845-UES-CS:</b>	Furnish and Install Underground Electrical Service-City Std. no Meter	per Each.
<b>Pay Item No. 845-UES-CSM:</b>	Furnish and Install Underground Electrical Service-City Std. with Meter	per Each.
<b>Pay Item No. 845-EE</b>	Furnish and Install Electrical Enclosure (Ground Mounted)	per Each.

END

## **Item No. 847 - Traffic Signal Grounding Installation**

### **847.1 Description**

This item shall govern the installation, testing and payment of grounding systems for a) new electrical grounding, and b) improving existing electrical grounding at existing traffic signals and pedestrian hybrid beacon installations. This includes the installation of ground rods and grounding plates in accordance with City specification Item No. 16120S "Electrical" and Detail 838-1 "Traffic Signal Electrical Notes and Details". The goal of the grounding system is to protect the public, employees and equipment from electrical fluctuations in power. To do this the electrical resistivity of the ground at each traffic signal pole shall be under 25 ohms and under 5 ohms at the signal cabinet. Ground rods, # 6 AWG wiring, and grounding connectors and jumpers associated with the initial system shall be installed and considered pertinent to the original items. The pay items provided for in this specification are only associated with additional grounding components beyond that of those shown in the plans.

### **847.2 Submittals**

- #6 Bare Stranded Copper Class A or Class B, Stranded Wire meeting the requirements of ASTM B 8.
- 5/8 Inch Diameter x 10 Foot Long Ground Rod to #6 Wire Connector, Copper
- #6 Wire to #6 Wire Connector, Bronze
- #6 Wire to Grounding Lug Connector, Bronze
- #6 Wire to Rebar Connector, Bronze
- Spec and cut sheets of any grounding plates proposed for use, with a minimum of a 288 square inch area (ex. 12 inch X 24 inch, etc.) X 0.0625 inch, constructed of solid Copper, with #6 bonding connector, UL approved
- Spec and cut sheets of any ground rods proposed for use, with a minimum length of 10 feet and a diameter of 5/8 inch, constructed of copper clad steel.

### **847.3 Materials**

Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials.

### **847.4 Construction Methods**

Install grounding components and systems in accordance with the requirements specified in Underwriters Laboratory, Inc., UL 467, the Institute of Electrical and Electronic Engineers, Inc., IEEE 81 and IEEE 142 prior to connection of power to the traffic signal, Contractor shall install all grounding wires, material and connections as outlined in this specification.

#### **A. Signal Pole and Controller Foundations:**

Connect 10 foot ground rod to reinforcing steel prior to pouring concrete using Owner-approved connector. Traffic Signal Pole grounding rod shall have a minimum of 8 feet of contact with the surrounding soil. Grounding Rod for controller foundation shall have a minimum of 4.5 feet of contact with the soil below the foundation. Contractor may not alter or cut any foundation ground rod.

#### **B. Traffic Signal Poles:**

Traffic Signal Poles: Contractor shall connect the 10 foot long grounding rod in the pole foundation to the pole by use of a #6 bare stranded copper wire to grounding rod using Owner-approved connectors.

#### **C. Streetlight Poles:**

Contractor shall connect to #6 MHD solid copper wire wrapped around streetlight foundation (reference Austin Energy *Small Streetlight Foundation* Drawing # 1921-10-01), to streetlight pole using #6 bare stranded copper wire using Owner-approved connectors.

#### **D. Ground Mounted Controller Cabinets:**

Contractor shall connect the controller cabinet to the 10 foot long grounding rod installed in the controller cabinet foundation by use of a #6 bare stranded copper wire. Contractor shall use Owner approved connectors.

E. Pole Mounted Controller Cabinets

Contractor shall connect the pole mounted controller cabinet to pole grounding rod using #6 bare stranded copper wire and Owner-approved connectors.

F. Grounding System:

1. Grounding Plates:

Copper Grounding plates shall be installed as directed by the plans and specifications. Plates shall be buried with a minimum 24 inches of cover and connected to the cabinet and pole grounding systems by means of #6 bare stranded copper wire. Contractor shall install #6 copper ground wire from the plate to the nearest traffic signal pull box or pole foundation, at a minimum 24 inches in depth and shall backfill with native soil from the area. All soil used to cover the copper plate shall be tamped to the density of the surrounding earth. If rock is encountered within a 30" depth, soil backfill will be provided to ensure grounding plates are surrounded with a minimum 6" of soil. Grounding plates shall not be installed within 6 feet of another plate or foundation with a grounding rod or within 24" of an existing utility.

2. Ground Rods:

Additional ground rods shall be installed as directed by the plans and specifications. Ground rods shall be copper clad steel, 10 feet long x 5/8 inch diameter. Ground rods shall be installed so that they are embedded in the earth a minimum of 8 feet.

3. Underground Intersections:

At each traffic signal pole foundation, the Contractor shall install a grounding plate no closer than 6 feet from the signal pole foundation. This does not include 4" pedestrian signal poles. With Owner's approval, Contractor may install the grounding plate in the bottom of the traffic signal trench. Additional grounding plates may be necessary if electrical resistance measurements do not meet requirements.

Contractor shall connect pole and cabinet grounds together by pulling a #6 bare stranded copper wire through traffic signal conduit and connecting to the #6 grounding wire at each pole and at the cabinet.

3. Overhead Intersections:

Contractor shall install a minimum of two grounding plates at every signal pole connected by overhead conductor. Contractor shall install a minimum of two grounding plates at every streetlight pole installed as part of a pedestrian hybrid beacon or traffic signal. The plates shall be no closer than 6 feet from the foundation or each other. Additional grounding plates may be necessary if electrical resistance measurements do not meet requirements.

Contractor shall connect ground wire from plates to foundation grounding rod or if available, to a traffic signal pull box. All ground wire shall be installed in conduit.

4. Wire:

#6 Bare Stranded Copper Wire used to connect to grounding plates shall be installed in ½ inch PVC conduit to the nearest pull box. Grounding wire may be pulled through traffic signal conduit from pull box.

Contractor shall install #6 Bare Stranded Copper Wire in every individual conduit containing signal control cabling. Grounding wires shall be mechanically bonded at all pull boxes. Grounding wire shall run through conduit(s) from traffic signal poles and be mechanically bonded to the ground rod inside of the pole and to ground wires in pull box. Ground wire shall run in conduits from controller cabinet to pull box and be mechanically bonded to the grounding rod at the cabinet and to ground wires in pull box.

Grounding wire shall never reconnect to itself to prevent creating a ground loop.

5. Controller Cabinet:

Contractor shall install a minimum of two grounding plates near the controller cabinet; maintaining a minimum 6 foot separation from the controller cabinet foundation. Contractor shall attach grounding plate to cabinet ground bus using #6 bare stranded copper wire, installed in a conduit to the nearest traffic signal pull box. Grounding wire may be pulled from the pull box to the controller cabinet foundation through a traffic signal conduit. Additional grounding plates may be necessary if electrical resistance measurements do not meet the 5 ohm or less resistance requirement.

6. Testing:

The ground-resistance measurement of each ground rod will be taken from the ground bus after cabinet installation. The resistance to ground will be measured in accordance with the Fall-of-Potential method specified in IEEE 81 and IEEE 142. The ground-resistance measurements will be made when soil is dry (a minimum of two days without rainfall) and so will be dependent on-site conditions.

Test reports will be submitted on Owner-approved forms but shall at a minimum include a diagram with the location of the ground rod and grounding system (with dimensions), and the resistance and soil conditions at the time the test was performed. If testing does not result in the required electrical resistivity, Owner may direct Contractor to install additional grounding material until resistivity levels are met.

Contractor shall notify Owner once grounding system is installed and ready for testing. Contractor must notify the Owner in writing 2 working days prior to the scheduled test. If Owner is unable to witness test, Owner may opt to verify testing results within 3 working days after test date, weather conditions permitting.

For new installations, Owner will pay for up to two tests per pole and two for the controller cabinet. If the initial test is within the resistivity allowances defined in Section 847.1 of this specification, only one test is required. All additional tests are at the expense of the Contractor.

### **847.7 Measurement**

The price shall include full compensation for either furnishing, installing, or furnishing and installing all materials, handling, placing, labor, tools, equipment, permits, restoration and incidentals necessary to complete the work. All potholing and excavation are incidental to this item.

### **847.8 Payment**

The work performed, materials furnished, and measures as provided above, will be paid by the unit bid price per each. The price shall include full compensation for furnishing all materials, handling, installing, placing, labor, tools, equipment, permits, and incidentals necessary to complete the work. Ground rods installed as part of a traffic cabinet or pole foundation for new traffic signals or PHBs are incidental to that work.

Payment will be made under one of the following:

Pay Item No. 847-1a	Wire, #6 Bare Stranded Copper, furnish and install, Complete and in place	Per LF
Pay Item No. 847-1b	Wire, #6 Bare Stranded Copper, install only, Complete and in place	Per LF
Pay Item No. 847-1c	Wire, #6 Bare Stranded Copper, furnish only	Per LF
Pay Item No. 847-2a	Connector, 5/8 Inch Diameter Ground Rod to #6 Wire, Bronze, furnish and install, Complete and in place.	Per EA
Pay Item No. 847-2b	Connector, 5/8 Inch Diameter Ground Rod to #6 Wire, Bronze, install only, complete and in place.	Per EA
Pay Item No. 847-2c	Connector, 5/8 Inch Diameter Ground Rod to #6 Wire, Bronze, furnish only.	Per EA
Pay Item No. 847-3a	Connector, #6 Wire to #6 Wire, Bronze, furnish and install, Complete and in place.	Per EA
Pay Item No. 847-3b	Connector, #6 Wire to #6 Wire, Bronze, install only, Complete and in place.	Per EA
Pay Item No. 847-3c	Connector, #6 Wire to #6 Wire, Bronze, furnish only.	Per EA
Pay Item No. 847-4a	Connector, #6 Ground Wire to Grounding Lug, Bronze, furnish and install, Complete and in place.	Per EA
Pay Item No. 847-4b	Connector, #6 Ground Wire to Grounding Lug, Bronze, install only, Complete and in place.	Per EA
Pay Item No. 847-4c	Connector, #6 Ground Wire to Grounding Lug, Bronze, furnish only.	Per EA
Pay Item No. 847-5a	Connector, #6 Ground Wire to Reinforcing Steel, Copper, furnish and install, Complete and in Place.	Per EA
Pay Item No. 847-5b	Connector, #6 Ground Wire to Reinforcing Steel, Copper, install only, Complete and in Place.	Per EA
Pay Item No. 847-5c	Connector, #6 Ground Wire to Reinforcing Steel, Copper, furnish only.	Per EA
Pay Item No. 847-6a	Grounding Plate, 288 sq. in. x 0.0625 Inch Copper, with connector, furnish and install, Complete and in place.	Per EA
Pay Item No. 847-6b	Grounding Plate, 288 sq. in. x 0.0625 Inch Copper, with connector, install only, Complete and in place.	Per EA
Pay Item No. 847-6c	Grounding Plate, 288 sq. in. x 0.0625 Inch Copper, with connector, furnish only.	Per EA
Pay Item No. 847-7a	Ground Rod, 10 foot long x 5/8 inch diameter copper clad steel furnish and install, Complete and in place.	Per EA
Pay Item No. 847-7b	Ground Rod, 10 foot long x 5/8 inch diameter copper clad steel install only, Complete and in place.	Per EA
Pay Item No. 847-7c	Ground Rod, 10 foot long x 5/8 inch diameter copper clad steel, furnish only.	Per EA
Pay Item No. 847-8	Grounding Testing, Fall-of-potential method.	Per EA

End