Section 820. TRAFFIC SIGNALS

820.01. Description. This work consists of providing required components to complete the following:

A. Provide complete, operating traffic and pedestrian signals, span wires, strain poles, pedestals, illuminated case signs, traffic loops, and digital loop detectors and cabinets;
B. Remove, salvage, or dispose of traffic and pedestrian signals, span wires, mounting assemblies, strain poles, pedestals, illuminated or non-illuminated case signs, traffic loops, and digital loop detectors, controller, and cabinets;
C. Relocate or re-install, on the project, existing traffic control equipment, traffic and pedestrian signals, mounting assemblies, strain poles, pedestals, illuminated or non-illuminated case signs, and digital loop detectors, controller, and cabinets removed;
D. Excavate, backfill, restore the site in kind, and dispose of excess or unsuitable material;
E. Take ownership of and properly dispose of removed material not identified for salvage; and
F. Store salvaged equipment in a protected and clean environment before installation on the project.

Provide qualified individuals to supervise and complete this work.

The Department uses the abbreviations in Table 820-1 for traffic signals on the plans and in these specifications.

### Table 820-1

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Traffic Signal Abbreviations</th>
</tr>
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<tbody>
<tr>
<td>TS</td>
<td>Traffic signal, pedestrian signal, and flasher signal designated by a number</td>
</tr>
<tr>
<td>LTGA</td>
<td>Left-turn green arrow</td>
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<tr>
<td>RTGA</td>
<td>Right-turn green arrow</td>
</tr>
<tr>
<td>STGA</td>
<td>Straight-through green arrow</td>
</tr>
<tr>
<td>CS</td>
<td>Case sign</td>
</tr>
<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
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</table>

820.02. Materials. Provide materials in accordance with the following:

- Anchor Bolts .......................................................................................... 908
- Span Wire .............................................................................................. 921
- Traffic Loop ......................................................................................... 921
- Vehicular Traffic Signals and Mounting Assemblies .................................. 921
- Pedestrian Signals .................................................................................. 921
- Traffic Signal Strain Pole ...................................................................... 921
- Traffic Signal Pedestal .......................................................................... 921
Secure the Engineer’s approval for components of vehicular traffic signals and mounting assemblies not shown on the plans, or not specified in subsection 918.04.

820.03. Construction.

A. **Span Wire.** Install span wire, guys, and required fittings as shown on the plans or as directed by the Engineer.

If the Contractor requests to replace span wires that are shown on the plans to be installed or replaced by the utility company, the Department will consider this a change to facilitate ease of construction by the Contractor. Obtain prior approval from the utility company and perform work at no additional cost to the Department.

Obtain the approval of the Engineer before changing span wires.

Install new anchor guys on an angle as indicated on the plans, and include a porcelain strain insulator, unless otherwise required. Strain insulators are not required for strut guys.

B. **Vehicular Traffic Signals, Pedestrian Signals, and Mounting Assemblies.** Obtain the Engineer’s approval before removing existing TS equipment. Remove, install, or relocate LED signals and mounting assemblies. Remove the signals in stages, or when the Engineer determines alternate signals are adequate.

Provide LED signal modules that do not require special tools for installation. Ensure the LED modules fit into existing traffic signal housings without modifying the signal housing.

To install the LED module when retrofitting assemblies, remove the existing lamp, socket assembly, gasket, and reflector. Connect the LED module to the existing terminal block. The Engineer will not allow the use of screw-in type products.

Assemble TS heads and wire with fittings and color-coded wire in accordance with the specifications, and as shown on the plans.
Install new TS cable to existing TS heads as required due to the relocation or removal and installation of the TS controller and cabinet as indicated on the plans.

Hang the suspension TS in a vertical plane, face the heads as required, tighten lock nuts, and seal the top of the traffic signal with a construction grade silicone sealant.

If TS span adjustments by the local utility company are required to maintain the TS mounting height, coordinate with and provide at least 48 hours notice to the local utility company before starting work.

For bracket arm signals, drill a hole in each standard, at each required location, to allow the cable to pass through the bracket-arm cable-entrance inlet. If required, drill two holes in the standard to allow the signal cable to loop into the lower bracket and out the upper bracket. Install the bracket arm signals vertically on the standards, face signals as required, and tighten the lock nuts.

Grease TS fittings with a non-oxide type grease.

Use dead-end galvanized steel stand grips on guy wires.

Connect wires with Engineer-approved nylon insulated, solderless connectors, and tape with at least two layers of friction tape, half-lapped.

Construct overhead lines in accordance with the contract. Refer to subsection 819.01 for those items not identified in the contract.

Use signal lamps with brass bases in accordance with ITE standards.

Take ownership of and properly dispose of removed material not identified for salvage. Store and dispose of removed material identified for salvage as directed by the Engineer.

Field paint TS bracket arms as required.

The Department will set the timing and offset of the signals as required unless otherwise indicated on the plans. The Department will put them into operation.

Install cables on poles or in ducts, as shown on the plans.

Install signal cables in a continuous length from the controller to each signal, unless otherwise shown on the plans. Pull the cable through the ducts without damage or kinks. Train cables near the top of the wall, manhole, or handholes. Bend cable without damage.
Bundle cables and secure to the wall of the manhole or handhole with galvanized A and J anchors, or an Engineer-approved equal. Provide supports at no greater than 2 foot spacing.

Extend the sheath of the traffic signal cables into the signal traffic heads and at least 1 inch into the controller cabinet. Strap traffic signal cables inside the controller cabinet. Tag and stamp each traffic signal cable as required with a stamped brass tag.

Maintain present traffic signal service with minimal interruptions during traffic signal equipment relocation. Notify the Department 7 working days before relocating controllers or shutting down other traffic signals.

Provide pedestrian signal units with housing, visors, optical units, mounting brackets, lamps, and wiring.

Notify the Engineer and the local utility responsible for maintaining and operating, and providing power to the traffic signal, when adding or removing a traffic signal load from service.

Use only salvaged traffic signals previously installed as new traffic signals unless otherwise directed by the Engineer.

Bag and unbag temporary or final traffic and pedestrian signal displays and case signs as shown on the plans as part of the installation of traffic signals, unless otherwise directed by the Engineer.

C. Traffic Signal Strain Pole and Traffic Signal Pedestal. Provide traffic signal pedestal equipment for mounting traffic and pedestrian signals and pedestrian pushbuttons, as shown on the plans.

Provide anchor base type steel strain poles, including anchor bolts and associated hardware, as shown on the plans, to support span wire and bracket arm mounted traffic signals.

Orient the pole on the foundation so the handhole is located on the shaft, perpendicular to the resultant span direction for box spans, perpendicular to the span direction for diagonal spans, or as directed by the Engineer.

Ground the pole as shown on the plans.

Rake poles so the upper one-third of the shaft is vertical when loaded.

Install the pole to orient the foundation and anchor bolts as shown on the plans, or directed by the Engineer.

Tighten top anchor bolt nuts, snug, in accordance with subsection 707.03.D.7.c.
Remove steel or concrete poles as shown on the plans. Remove the foundation of embedded steel pole to the elevation required to remove the pole, as directed by the Engineer.

D. **Foundations.** Remove or install foundations for steel strain poles, mast arm standards, pedestals, or traffic signal controller cabinets as shown on the plans or directed by the Engineer.

1. **Concrete Placement.** Provide Grade S2 concrete for the foundations of mast arm standards, steel strain poles, pedestals, or traffic signal controllers, in accordance with section 701. Construct foundations as shown on the plans, in accordance with the signal construction details, or as directed by the Engineer.

   Do not use salt or other chemicals to prevent the concrete from freezing.

   Do not use construction rubble, broken sidewalk, or other deleterious material in place of concrete. Replace cracked or otherwise defective foundations, as determined by the Engineer, at no additional cost to the Department.

   Compact concrete, during and immediately after depositing, using required tools. Ensure the concrete completely fills the form or excavation and fully encases the reinforcement and embedded fixtures. Produce a dense, waterproof concrete, free of voids and honeycomb.

   Cure foundation concrete at least 7 days before installing standards.

   Maintain temporary enclosures and other protection for concrete for at least 24 hours after removing the heating source.

2. **Foundation and Pad Construction.** Construct strain pole foundations, cased or uncased, in accordance with subsection 810.03.J, subsection 810.03.K, and subsection 820.03.D.

   Locate the foundation as shown on the plans, unless otherwise directed by the Engineer.

   Obtain the Engineer’s approval before placing foundations. Place the lower portion of the foundation without forms, unless the soil is subject to caving and the Engineer approves the use of forms. Use forms to shape the upper part of the foundation. Place concrete and finish the top surface of the foundation at the elevation shown on the plans or directed by the Engineer.

   Place base mount controller foundations using forms to shape the foundation as shown on the plans, and the signal details. Ensure the
top surface of the controller foundation is horizontal, finished with a smooth straight surface, free of irregularities. Place the controller cabinet flush with the foundation. Ensure gaps between the foundation and the controller cabinet do not exceed ¾ inch, or as directed by the Engineer.

Place the concrete pad adjacent to the foundation in front of the controller cabinet door as shown on the plans, or directed by the Engineer.

Place concrete in the forms in layers, compact, and finish the concrete to the thickness shown on the plans. Construct a continuous pad between expansion joints. After placing the concrete within forms, use a screed, guided by the forms, spread the concrete and compact.

Protect foundations to prevent injury to pedestrians, motorists, and project personnel until installation of the standards.

Install ground rods and ground wires. Connect the ground wire to the ground rod with a copper–clad, steel, solderless type clamp. Ensure electrically solid and mechanically secure connections.

3. **Backfill and Restoration.** Place backfill in compacted layers no greater than 12 inches thick. Compact layers to at least 95 percent of the maximum unit weight. Place backfill in accordance with section 206.

   Restore disturbed areas in kind in accordance with section 816. Dispose of non-hazardous, contaminated material from drilled shafts, or other foundations as required.

E. **Illuminated Case Signs.** Wire internally illuminated LED and changeable message case signs with color-coded wire in accordance with the owner's specifications, and as shown on the plans.

   Assemble case signs with fittings wired.

   Make wire connections with Engineer-approved solderless connectors and tape with at least two layers of friction tape, half-lapped.

F. **Non-Illuminated Case Signs.** Install, remove, or salvage non-illuminated case signs, including connecting hardware as shown on the plans.

G. **Electrical Wire and Cable.** Provide, install, and remove traffic signal wires and cable in accordance with section 819. Place marking tape from 6 inches to 18 inches above installed underground conduit or cable, except for jack and bored conduit or directional bore conduit. The
Department will provide marking tape with the MDOT logo and telephone number on it.

H. Electrical Service Requirements.

1. Overhead Service Connection. For installing secondary electric service racks on steel poles as shown on the plans, or directed by the Engineer, provide and install a pole band and the required hardware for the local utility company.

2. Service Disconnect. Install stainless steel service disconnect switches as shown on the plans. Provide NEMA, Heavy Duty (HD), fusible quick make, quick break type disconnect switches with full cover interlock. Provide NEMA 4X enclosures, unless otherwise required. The Department will provide means for padlocking the operating handles in the open or closed position. Provide Single Pole Single Throw (SPST) switches with a voltage rating and current carrying capacity shown on the plans or directed by the Engineer.

   Ensure the service disconnect is marked and rated.

3. Metered Service. On wood poles, connect the meter socket to the service disconnect using at least 1½-inch diameter Schedule 80 PVC or galvanized metal conduit. On steel poles, connect the wiring between the meter socket and the service disconnect on the inside of the pole. If directed by the Engineer, run conduit on the outside of the pole. Support the conduit using two-hole galvanized support brackets, spaced no greater than 3 feet apart. Bond the conduits and equipment as required by the NEC, utility company, and the contract documents. Use waterproof elbows with removable covers to enter and exit meters, service disconnects, and controllers.

   Contact the local power company shown on the plans to coordinate removal of metered service and power feed. Perform removal work in accordance with the NEC, the contract document requirements, and the local power company standards.

I. Conduit. Provide, install, relocate, and remove direct buried and encased conduit and associated fittings in accordance with section 819.

   The Contractor may submit an alternate method for conduit installation to the Engineer. Obtain the Engineer’s approval for the alternate method before proceeding. Complete alternate conduit installation at no additional cost to the Department.

   Join conduit pipe fittings and bends with an Engineer-approved PVC conduit cement.
To repair conduit under pavement, sidewalks, or earth, locate the conduit break, replace, and sleeve a new conduit section. Repair the concrete encasement, and restore the site. Use smooth wall, Schedule 80, rigid (PVC) conduit, or coilable, Schedule 80 (PE) conduit in accordance with section 819.

Locate conduit breaks using exploratory trenching techniques. Excavate a trench at least 1 foot on each side of the damaged conduit section to perform the rehabilitation.

Remove the section of broken conduit and replace with new conduit. Ensure the new conduit overlaps the existing conduit by at least 3 inches on each end. Connect the new and existing conduit using the manufacturer-recommended coupling and adhesive to form a waterproof seal. If existing conduit is encased, encase the new conduit in Grade P1 concrete as specified in section 601.

J. **Wood Pole.** Provide, install, relocate, and remove wood poles in accordance with section 819.

K. **Traffic Loop.** The Engineer may change the location of traffic loops.

Center loops in traffic lanes unless otherwise shown on the plans, or directed by the Engineer. Place loops so they do not enclose joints, cracks, manholes, handholes, and other castings and ferrous material. Obtain the Engineer’s approval of loop location changes.

Cut slots in the pavement in accordance with subsection 603.03. Use high-pressure water and air to clean and dry slots before placing traffic loop wire. Remove dirt, dust, oil, and grease, from the slot, that could prevent bonding of the sealant. Remove dirt, dust, debris, and standing water from the adjacent pavement to avoid contaminating the slot during loop installation.

Lay wire in the slot, and reduce the sharpness of bends. Leave the wires loose in the slot.

Ensure wire in the loop and lead-in is free of kinks, abrasions, and punctures. Use required tools to prevent damage to the loop wire. Do not use screwdrivers and sharp instruments.

Use four turns of wire in loops no greater than 6 feet by 10 feet. Use three turns of wire for loops greater than 6 feet by 10 feet. Twist loop lead-ins with at least two turns per foot to prevent mechanical movement between individual wires.
Bring loop lead-ins into handholes at the time of loop installation and protect against damage. Tape the ends to prevent water from entering the wire.

If sealing detector loops, ensure the roadway surface temperature is at least 40 °F for at least 12 hours after sealant application. Place sealant in accordance with the manufacturer's instructions. Do not mix sealant with solvents, thinners, or other solids. Apply sealant when the ambient temperature is from 40 °F to 100 °F. Allow the sealant to cure before placing a layer of paving over the loops.

Place the loop wires at least ½ inch below the surface of the slots in the pavement, and fill the slots with sealant. If required, use soft restraints to hold the wires ½ inch below the surface. Place the sealant flush with the road surface. Before the sealant sets, strike-off surplus sealant. Do not use solvents to clean sealant off pavement. The Engineer will determine when to open the sealed areas to traffic.

Provide at least a 1 megaohm resistance to ground the loop and lead-in. In the absence of circuit grounds, provide a temporary ground by driving a ground rod.

Test each loop for continuity at the handhole, and ensure the resistance does not exceed 1.5 ohms.

L. Digital Loop Detector. Install a rack mounted, digital loop detector in the controller and cabinet with the number of channels shown on the plans, or as directed by the Engineer.

M. Site Restoration and Waste Disposal. Restore the site and dispose of waste as directed by the Engineer, and in accordance with subsection 205.03.

N. Handholes. Install precast concrete handholes of the design and dimensions shown on the plans.

O. Traffic Signal Controller and Cabinets. Secure the traffic signal controller cabinet as shown on the plans for pole or base mounted cabinets.

Provide the Department two copies of the manufacturer’s specifications for the controller, and outline the special details, features, or changes in design operation. Provide the Department one complete wiring diagram, parts list, assembly drawings, and maintenance manual for the controller.

Provide traffic signal controllers capable of accepting the required timing.
Ground traffic signal installations with solid state controllers at each span contact pole. Ensure the ground has a measured resistance no greater than 10 ohms.

P. **Vertical Exploratory Investigation.** Conduct exploratory investigation to expose and verify the location and elevation of existing traffic signal conduit or utilities in accordance with the contract. Start trenching operations after MISS DIG System, Inc. or the owner stakes the utilities. Repair utilities, damaged during excavation, before backfilling.

Backfill exploratory trenches within 24 hours of excavating, or as directed by the Engineer. Place backfill material in the exploratory trenches after the Engineer approves sections for backfilling. Ensure the Engineer approves materials and method for replacing pavement.

Q. **Warning Sign.** Install or remove warning signs equipped with traffic signal sign opticals, including sign supports, as shown on the plans. Provide a sign legend and sign optical lens size as shown on the plans and in accordance with the MMUTCD, Special Sign Details, and signal construction details.

Install or remove sign optical lenses on existing signs as shown on the plans or directed by the Engineer.

R. **Removing and Salvaging TS, Antenna.** Remove TS antennae or install salvaged TS antennae, removed from the project, as shown on the plans or directed by the Engineer.

S. **Removing Emergency Pre-emption.** Remove emergency pre-emption or install salvaged emergency pre-emption, removed from the project, as shown on the plans or directed by the Engineer.

T. **Steel Truss Arms.** Remove or install steel truss arms for video detection cameras or radio antennae, and related equipment as shown on the plans or directed by the Engineer. Install truss arms following the installation of other traffic signal equipment, including span wire, signal heads, and strain poles, to accommodate truss arm adjustments, as directed by the Engineer. Install truss arms in accordance with the NEC and NESC.

Where adjustment of steel truss arms is required, take responsibility for the premature installation of the truss arms at no additional cost or time to the Department.
## 820.04. Measurement and Payment.

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
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<tbody>
<tr>
<td>TS, (number) Way (type) Mtd</td>
<td>Each</td>
</tr>
<tr>
<td>TS, (number) Way (type) Mtd, Salv</td>
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</tr>
<tr>
<td>TS, (number) Way (type) Mtd, (arrow type)</td>
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</tr>
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</tr>
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</tr>
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<tr>
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<tr>
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<tr>
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<td>Pushbutton</td>
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<td>Steel Pole, Rem (Embedded)</td>
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<td>Strut Guy</td>
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<td>Conduit Repr, Under Sidewalk or Earth</td>
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<tr>
<td>Controller and Cabinet, Rem</td>
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<tr>
<td>Controller and Cabinet, Salv</td>
<td>Each</td>
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</table>
Controller Fdn, Base Mount .......................................................... Each
Controller Fdn, Rem .................................................................... Each
Cabinet, Rem ............................................................................... Each
Cabinet, Salv ............................................................................... Each
Vertical Exploratory Investigation .............................................. Foot
Metered Serv ............................................................................... Each
Metered Serv, Rem ...................................................................... Each
Warning Sign ............................................................................... Each
Warning Sign, Rem ...................................................................... Each
Sign Optical (LED) ........................................................................ Each
Bracket, Truss, with __ foot Arm .................................................. Each
Bracket, Truss, Rem ..................................................................... Each
Emergency Pre-emption, Rem ..................................................... Each
Emergency Pre-emption, Salv ...................................................... Each
Sign Optical, Rem ......................................................................... Each

A. **General.** Unless otherwise required, the Engineer will measure traffic signal pay items based on plan quantities in accordance with subsection 109.01.A.

Pay items specified in this subsection, except removal items, include all components required to provide complete and functioning traffic signals.

In addition to specific work for individual pay items, the unit prices for work specified in this subsection include the following:

1. Excavation and backfill, including backfilling for removed items;
2. Turf restoration;
3. Storage and disposal of waste material;
4. Placing marking tape; and
5. Changes in the method of conduit installation requested by the Contractor.

B. **Traffic Signals.** The unit prices for relevant pay items for installing, salvaging as required, and removing traffic signals include the cost of storing and disposing of materials, and providing and installing traffic signal heads, lamps, brackets, hardware, cable, and other material required to complete the work.

The unit prices for the relevant traffic signal pay items include the cost of installing new TS cable from the TS head to the TS controller and cabinet as shown on the plans; coordinate with local utility companies in TS span adjustments; and stemming signal heads to maintain 17 foot under-clearance, from bottom of signal bracket to road surface for each span wire mounted signal head.
The Engineer will measure, and the Department will pay separately for **Louvers**, based on the number of louvers required for a signal face. The cost of installing louvers is included in the unit price for the relevant traffic signal pay item.

The Engineer will measure, and the Department will pay separately for **Louvers**, based on the number of louvers required for a signal face. The cost of installing louvers is included in the unit price for the relevant traffic signal pay item.

The unit price for **TS, Rem** includes the cost of removing traffic signals and pedestrian signals.

The unit price for **TS, Pedestrian** includes the cost of pedestrian traffic signal heads, including salvaged heads.

The unit price for **TS Lens, Pedestrian Sym** includes the cost of providing and installing the new lenses.

The unit price for **TS Lens** includes the cost of installing traffic signal lenses.

The unit price for **TS Lens, Rem** includes the cost of removing traffic signal lenses.

The unit price for **TS Lens, Salv** includes the cost of installing salvaged traffic signal lenses.

The unit prices for **Pushbutton** and **Pushbutton and Sign** include the cost of providing and installing pushbutton and sign.

The unit price for **Pushbutton, Rem** includes the cost of removing the pushbutton, sign, and cables.

The Department will pay separately for **Traffic Signal Retrofit Assembly**, but the cost of removing the existing lamp, socket assembly, gasket and reflector, and installing the LED traffic signal module without modifying the existing signal housing is included in the unit prices for relevant traffic signal pay items.

C. **Strain Poles.** The unit price for **Strain Pole, Steel, Anchor Base** includes the cost of installing steel standards, including salvaged standards, on the foundation and raking the standard.

The unit price for **Strain Pole, Steel, Anchor Fdn** includes the cost of form work for foundation excavation, constructing foundations and installing conduit bends, grounding, and grounding rods.

The Engineer will measure **Strain Pole Fdns, Cased** and **Strain Pole Fdns, Uncased** vertically from the bottom of the foundation and shaft to
the top of the shaft. The unit prices for **Strain Pole Fdns, Cased** and **Strain Pole Fdns, Uncased** include the cost of installing conduit bends, grounding, grounding rods, and steel casing for foundation excavation.

The unit price for **Steel Pole, Rem** includes the cost of removing the steel pole, hardware, fittings, wiring, grounding, ground rods, and conduits.

The Engineer will measure **Steel Pole, Rem (Embedded)** as shown on the plans in accordance with subsection 109.01.A. The unit price for **Steel Pole, Rem (Embedded)** includes the cost removing the steel pole with foundation, hardware, conduit, and other material required to complete the work, and backfilling the hole with granular material.

The unit price for **Fdn, Rem** includes the cost of removing pole foundation and backfilling the hole with granular material.

D. **Pedestals.** The unit price for **Pedestal, Alum** includes the cost of installing pedestals, including salvaged pedestals, fittings, ground rods, and ground wire.

The unit price for **Pedestal, Fdn** includes the cost of excavating and constructing new concrete foundations and installing grounding and ground rods.

The unit price for **Pedestal, Rem** includes the cost of removing pedestals and associated hardware.

The unit price for **Pedestal Salv** includes the cost of installing salvaged pedestals, hardware, fittings, connectors, wiring, service cables, grounding, ground rods, and conduits.

The unit price for **Pedestal Fdn, Rem** includes the cost of removing the pedestal foundation, hardware, conduit, and other material required to complete the work. Backfilling the hole with granular material is included in the pay item.

The unit price for **Pushbutton Pedestal, Alum** includes the cost of installing the aluminum pushbutton pedestal assembly, installing hardware, fittings, grounding, ground rods, and conduits.

The unit price for **Pushbutton Pedestal, Rem** includes the cost of removing the pedestal assembly and hardware.

E. **Case Signs, Illuminated or Non-Illuminated, Changeable Message.** The unit prices for installing, salvaging as required, and removing the relevant case sign pay items for internally illuminated or changeable message signs include the cost of the signs, lamps, brackets, hardware, cable, and other material required to complete the
work. The relevant case sign pay items for non-illuminated signs include the cost of the signs, retroreflective panels, and other materials required to complete the work.

1. **Case Sign Panel.** The unit price for Case Sign, Panel includes the cost of installing the case sign panel, or retroreflective case panels.

2. **Case Sign Removal.** The unit price for Case Sign, Rem includes the cost of removing illuminated, changeable message, and non-illuminated case signs.

3. **Case Sign Panel Removal.** The unit price for Case Sign Panel, Rem includes the cost of removing case sign panels.

F. **Service Disconnect.** The unit prices for installing, salvaging as required, and removing the relevant service disconnect pay items include the cost of the service disconnect (salvaged as required), fuses, brackets, hardware, cable, conduit, and other material required to complete the work.

   The unit price for Serv Disconnect, Rem includes the cost of removing the disconnect, connectors, wiring, grounding, and ground rods.

   The unit price for Serv Disconnect, Salv includes the cost of installing the salvaged service disconnect.

G. **Metered Service.** The unit prices for installing and removing the relevant metered, service pay items include the cost of material required by the local utility company and the NEC, and providing and installing the meter, meter sockets, brackets, hardware, cable, conduit and other material required to complete the work.

   The unit price for Metered Serv includes the cost of returning the meter to the local utility company, storage, or disposal of removed material.

   The unit price for Metered Serv, Rem includes the cost of removing the meter and meter socket.

   The lump sum pay item, **Power Co. (Est. Cost to Contractor)** includes the cost of reimbursing the Contractor for payments made to the power company for providing electrical power at the locations shown on the plans. The Department will estimate the reimbursement costs to the Contractor and establish a lump sum price as shown on the plans. The Engineer will measure and the Department will pay the Contractor for power company invoices paid, as submitted to the Engineer.

   The Contractor is responsible for scheduling and coordinating installation, and payment with the Engineer.
The unit prices for the relevant pay items include the cost of installing overhead service connections.

H. **Span Wire.** The unit price for **Span Wire** includes the cost of installing new span wire, insulators, guys, and anchors.

The Department considers the cost of changing out span wires, as requested by the Contractor, an accommodation to the Contractor at no additional cost to the Department.

The unit price for **Span Wire, Rem** includes the cost of removing span wire, guys and associated hardware, and disposing of these items off the project.

I. **Anchor Guy, Strut Guy, and Pole Guy.** The Engineer will measure the required sizes of **Anchor Guy**, **Strut Guy**, and **Pole Guy** as a unit. The unit prices for **Anchor Guy**, **Strut Guy**, and **Pole Guy** include the cost of installing the guy wire, anchor rod, anchor, strut, and hardware.

J. **Traffic Loop.** The unit prices for **Traf Loop** and **Traf Loop (type)** include the cost of the following:

1. Sawing the slots in the pavement;
2. Making expansion joints;
3. Installing wires in the saw slots;
4. Placing caulking in ends of conduit;
5. Placing sealant and the shielded cable in conduit from its connection to the loop wire in the handhole to the traffic signal controller or digital loop detector cabinet; and
6. Connecting the cabinet to the loop detector.

K. **Digital Loop Detector.** The unit prices for **Digital Loop Detector** and **Digital Loop Detector, Salv** include the cost of installing the following:

1. Connections in existing cabinets;
2. Digital loop detectors, including salvaged loop detectors; and
3. Cables to loop terminals in handholes.

The unit price for **Loop Detector, Rem**, if a stand-alone item, includes the cost of removing the loop detector.

L. **Riser.** The Engineer will measure the required type of **Riser** as a unit. The unit price for **Riser** includes the cost of installing PVC Schedule 80 or galvanized rigid metal pipe riser, weather head, wire arrangements on poles, and associated hardware.

The unit price for **Riser, Rem** includes the cost of removing risers, weather heads, hardware, and fittings.
M. Conduit Repair under Pavement. The Engineer will measure Conduit Repr, Under Pavt based on plan quantities in accordance with subsection 109.01.A. The unit price for Conduit Repr, Under Pavt includes the cost of the following:

1. Locating the conduit break;
2. Repairing and sleeving new conduit sections; and
3. Repairing the concrete encasement.

The Engineer will measure, and the Department will pay for, pavement removal and replacement in accordance with the standard specifications and pay items for that work.

N. Conduit Repair under Sidewalk or Earth. The Engineer will measure Conduit Repr, Under Sidewalk or Earth based on plan quantities in accordance with subsection 109.01.A. The unit price for Conduit Repr, Under Sidewalk or Earth includes the cost of the following:

1. Locating the conduit break;
2. Repairing and sleeving new conduit sections; and
3. Repairing the concrete encasement.

The Engineer will measure, and the Department will pay for, sidewalk removal and replacement in accordance with standard specifications and pay items for that work.

O. Controllers and Cabinets. The unit prices for removing controllers and cabinets, and installing salvaged controllers and cabinets include the cost of removing brackets, hardware, fittings, connectors, cables, grounding, conduits, and other material.

The unit prices for Controller and Cabinet, Rem and Cabinet, Rem include the cost of removing the digital loop detector as required, wiring, ground rods, and storing or disposing of removed material.

The unit prices for Controller and Cabinet, Salv and Cabinet, Salv include the cost of installing ground rods and reconnecting wiring.

The unit price for Controller Fdn, Base Mount includes the cost of placing and compacting backfill, and installing conduit bends and ground rods.

The unit price for Controller Fdn, Rem includes the cost removing traffic signal controller foundations, controller pads, wiring, and ground rods.

P. Vertical Exploratory Investigation. The Engineer will measure Vertical Exploratory Investigation in accordance with the contract.
Q. **Warning Signs.** The unit prices for installing and removing the relevant **Warning Sign** or **Sign Optical (LED)** pay items include the cost of the storing and disposing of materials and providing and installing warning signs, supports, opticals, hardware, cable conduit and other material required to complete the work.

The unit price for **Warning Sign, Rem** includes the cost of removing warning signs, sign supports, and sign opticals with assembly.

The unit price for **Sign Optical (LED)** includes the cost of installing LED traffic signals, and sign opticals with assembly.

The unit price for **Sign Optical, Rem** includes the cost of removing sign opticals with assembly.

R. **Bracket Truss.** The unit price for **Bracket, Truss, with __ foot Arm** includes the cost of installing brackets, hardware, fittings, connectors, ground rods, ground wire, and grounding.

The unit price for **Bracket, Truss, Rem** includes the cost of removing brackets, hardware, fittings, connectors, ground rods, ground wire, and grounding.

S. **TS Antenna.** The unit prices for installing, salvaging as required, and removing the relevant **TS, Antenna** pay items include the cost of the antenna (salvaged as required), surge protection, brackets, hardware, cable, conduit and other material required to complete the work.

The unit price for **TS, Antenna, Rem** includes the cost of removing antenna, wiring, cable from controller, grounding, and ground rods.

The unit price for **TS, Antenna, Salv** includes the cost of installing salvaged antennae.

T. **Emergency Pre-emption.** The unit prices for removing and installing the salvaged emergency pre-emption pay items include the cost of the traffic signal pre-emption equipment, associated with intersection traffic signal control devices, pre-emption units and confirmation lights facing one or more directions, brackets, hardware, cable, conduit and other material required to complete the work.

The unit price for **Emergency Pre-emption, Rem** includes the cost of removing the traffic signal pre-emption equipment for emergency vehicles, as associated with intersection traffic signal control devices, pre-emption units facing one or more directions, and confirmation lights facing one or more directions.
The unit price for **Emergency Pre-emption, Salv** includes the cost of installing the salvaged traffic signal pre-emption equipment, as associated with intersection traffic signal control devices, pre-emption units facing one or more directions, and confirmation lights facing one or more directions.

U. **Concrete Pole Removal.** The unit price for **Conc Pole, Rem** includes the cost of removing concrete poles, hardware, fittings, connectors, wiring, grounding, ground rods, and conduits.