805-T-086 TRAFFIC SIGNAL MAINTENANCE AND REPAIR

(Revised 05-01-25)

Description

This work shall consist of the repair or replacement of traffic signal equipment as described herein, as shown on the plans, or as otherwise directed.

Contract Extension

The contract may be extended for one additional year if the Contractor mutually agrees to the same unit prices and requirements of the existing contract.

Departmental Rights

Changes may not be made to a traffic signal which alter its design, phasing, or functional operation without authorization from the Engineer.

If the Department awards a separate contract to modernize, modify, rebuild, or remove a signal installation included in this work, the Department will reserve the right to determine which contractor will be responsible for routine and non-routine maintenance of the existing or temporary signal installation during the term of the separate modernization or modification contract. If interconnect systems are to be installed under separate contract, the Contractor may be required to assume maintenance of the basic signal as if it were an isolated signal. Maintenance of those portions of the equipment which affect the coordination of the signal with other signals will be maintained by the installation contractor until such contractor is released from maintenance responsibility.

The Contractor shall maintain existing signal equipment as long as it is in service, unless otherwise directed. The Contractor shall assume maintenance of new signals and equipment after they have been accepted by the Department until otherwise directed.

The Department will reserve the right to inspect the Department’s inventory which is maintained by the Contractor. The Department will notify the Contractor at least two business days prior to the time of such inspection.

Maintenance of Traffic

Maintenance of traffic shall be in accordance with 801. Traffic control layout sheets on the plans show minimum guidelines for situations which may occur. If unusual working conditions occur, the Contractor shall provide the Engineer a proposal for the traffic control measures to be used, subject to approval.

If the Contractor finds it necessary to temporarily occupy a part of a shoulder or the traveled width of pavement and restrict traffic, the Contractor shall provide all barricades, lights, flaggers, and other protection of traffic as may be deemed necessary by the Engineer and as specified in 801.

Construction warning lights shall be in accordance with the applicable requirements of 801.14, except that Type III-A barricades, plastic drums, or construction warning signs used only for maintaining traffic during daylight hours will not require a Type B low intensity flashing warning light.

When barricades, plastic drums, or other channelization devices are used to divert traffic, the length of the taper L shall be determined by means of the formulas as follows:

For a speed limit of 40 mph or less:

$$L = \frac{S \times S \times W}{60}$$

For a speed limit of 45 mph or greater

$$L = S \times W$$

where:

L = Length of the taper, ft
S = Speed limit, mph
W = Lateral distance traffic is being moved, ft

Where these devices are used to close a travel lane, the spacing in feet will be the same as the numerical value of the speed limit. When used to define the presence of a vehicle or workers temporarily occupying the traveled way, without lane closure, these devices shall be appropriately spaced to clearly outline the work area and prevent vehicles from entering the work area. A 48 in. by 48 in. "Workers Ahead" sign shall be placed just off the shoulder 700 to 800 ft ahead of each operation. The signs shall be removed from view when no work operations are being conducted. Traffic control requirements not addressed herein shall be as shown on the plans. Extended work shall consist of work which takes place on the roadway for over 30 minutes. Short term repair activity and short term repair work shall consist of work which takes place for 30 minutes or less.

If a work activity involves frequent moving of the work setup, such that no work setup is in place for more than 30 minutes, the Engineer may require that the work being performed at an intersection, or series of intersections, be treated as an extended work zone.

When aerial work is being performed which occupies a portion of the traveled way, a minimum of one flagger will be required.

All equipment which is used on or near a traveled way shall be equipped with revolving amber warning lights. These warning lights shall be a minimum of 8 in. in diameter. Such lights shall be clearly visible to approaching vehicles through all phases of the equipment operation for a minimum distance of 500 ft. Strobe warning lights may be used provided that they output 2,000,000 candlepower during daylight hours and 1,000,000 candlepower during other hours.

Identification placards shall be affixed to all equipment.

The longitudinal spacing of multiple construction signs, where required, shall be 500 ft. This distance may require adjustment based upon location conditions. All variations shall be subject to approval.

If a traffic signal blacks out or goes to conflict flash during the bulb replacement and inspection operation, the Contractor shall contact the Department’s radio dispatcher to report the malfunction. The

Contractor shall not reset a conflict monitor. All labor, materials, and equipment required for returning the signal to operation shall be with no additional payment.

The Contractor shall secure and maintain the intersection until the Department's signal technician has made necessary repairs. Such intersection maintenance shall include, but shall not be limited to flaggers, signs, or other traffic control devices.

Schedule of Operations

The Contractor shall notify the Engineer at least two business days prior to performing regularly scheduled visits.

The Contractor shall submit a schedule of operations at the preconstruction conference to the Engineer for review and approval. This schedule shall consist of the hours of work for a normal work week and the method of transportation, storage, and handling of Department materials.

The minimum crew size and personnel qualifications required to perform the above work shall be in accordance with the minimum crew size requirements included elsewhere herein. Flaggers required for traffic control shall not be included in the minimum crew size.

The work day shall consist of eight consecutive hours between 7:00 a.m. and 5:30 p.m. A work week shall consist of 40 h on Monday through Friday. Work outside of these hours will be permitted only when directed.

Interruptions to traffic flow will not be permitted after noon on the day before a holiday to noon on the day following the holiday.

(a) Emergency Response Maintenance

Emergency response will be defined as the response to a reported or discovered malfunction of all traffic signals and flashers included in this work. Such response shall occur within 2 h of notification or discovery of the malfunction. Response will be defined as the arrival of a traffic signal technician at the intersection who immediately upon arrival shall take appropriate corrective actions necessary to bring the intersection to a safe mode of operation. The Contractor shall have two traffic signal technicians available at all times to satisfy the 2 h emergency response maintenance requirement.

After the intersection is secured, the technician shall then correct the malfunction. This corrective action shall include, but shall not be limited to, the activities as follows:

1. Replacement of blown fuses or resetting of circuit breakers.

2. Repair or replacement of traffic signal controllers.

3. Replacement of flasher controllers.

4. Replacement of detector amplifiers and magnetometer amplifiers.

5. Replacement of green and yellow arrow bulbs.

6. Replacement of load relays.

7. Replacement of conflict monitors.

8. Adjustment or modular component replacement of electromechanical controllers and flasher units.

9. Disconnection of traffic signal coordination equipment.

10. Cabinet diagnosis of loop detection systems to identify deficient components.

11. Logging of back panel and cabinet equipment status for the purpose of malfunction diagnosis.

12. Resetting police panel switches.

13. Diagnosis of interconnect systems including connected city interconnection.

14. Connecting and disconnecting interconnected systems which are malfunctioning.

All work required to restore a blacked out signal shall be included in emergency response.

The Contractor shall provide, in addition to a 24 hour answering service or dispatcher, two telephone numbers which may be called in case of answering service failure.

All bulbs reported as malfunctioning between 6:00 a.m. and 6:00 p.m. shall be replaced the same day. Bulbs in green or yellow lenses which are reported after 6:00 p.m. shall be replaced by 10:00 a.m. the following day. If reports of bulb outages are received which do not specify the type of bulb which is out, the Contractor shall confirm the type. If a yellow or green circular indication is out, the bulb may be replaced at that time or on the next day as described above. The Contractor shall supply the Department with monthly dispatcher and answering service logs along with the monthly invoice.

The Contractor shall supply all completed Work Activity Reports as shown in Appendix B on the plans. The Contractor shall complete Appendix F as shown on the plans in case of conflict monitor failure. Reports shall be submitted with the monthly invoice.

If a malfunction information call is received for a location which is not included in this work, the dispatcher shall record the information as follows:

1. Name and telephone number of person calling.
2. Signal trouble intersection identification number.
3. Time the call was received.
4. Exact complaint.

This information shall be forwarded to the appropriate subdistrict office.

If a power outage occurs, the Contractor shall make the intersection safe. The traffic signal technician may leave the site provided the energy source is disabled to prevent the signal from initializing and after arrangements are made for stop signs to be erected. Stop signs shall be placed at approaches based on their preferentiality. A preferentiality list which shows which approaches will require stop signs is shown in Appendix A on the plans.

Such stop signs shall be at least 36 in. by 36 in. in size unless a smaller size is approved. The appropriate utility company shall be informed when power is restored. The utility shall be checked with hourly to confirm the status of the power source. The traffic signal shall be restored to normal operation within 1 h of notification that power has been restored.

The conflict monitor report form shall be filled out in duplicate before resetting a conflicted monitor. One copy of the form shall remain in the cabinet. The other copy of the form shall be attached to the Work Activity Report.

(b) Scheduled Maintenance

Electromechanical controller changeout and loop testing shall be performed by a traffic signal technician.

1. Electromechanical Controller Changeout

The Contractor shall annually remove all electromechanical pretimed controller units and their electromechanical flasher units, if applicable, for a complete cleaning, overhauling, and testing in a shop which is equipped with all necessary tools, scopes, meters, test panels, and replacement parts.

New contacts for electromechanical pretimed controllers will be issued at the beginning of the contract to be used in timers built up for the electromechanical changeout. These contacts shall replace all of the contacts in a refurbished unit, unless otherwise directed. The contacts removed from the timers will be returned to the Department upon completion of the contract. This work shall be performed in accordance with the checklists included in Appendix C shown on the plans. Completed checklists shall be submitted for each intersection in order to receive payment for this work. The Contractor will be permitted to clean and overhaul at an intersection only with prior approval. Traffic control may be required when placing signals on a flash phase.

2. Electromechanical Flasher Changeout

The Contractor shall annually remove all electromechanical flasher units from flasher locations for a complete cleaning, overhauling, and testing, in a shop which is equipped with all necessary tools, scopes, meters, test panels, and replacement parts.

New contacts for electromechanical flashers will be issued at the beginning of the contract to be used in flashers built up for the electromechanical flasher changeout. These contacts shall replace all of the contacts in a refurbished unit, unless otherwise directed. The contacts removed from the timers will be returned to the Department upon completion of the contract.

3. Conflict Monitor Changeout

Each conflict monitor in service shall annually be exchanged for the purpose of having the monitor tested by the Traffic Support Center.

The exchange of the monitors for this activity shall be in accordance with the same material handling procedures used for the other Department supplied materials. The procedure for routine changeout of conflict monitors shall be as shown in Appendix D on the plans. Traffic control may be required when placing signals on a flash phase in congested areas. The Contractor may elect to replace monitors at times other than daylight hours.

4. Loop Testing

Megohm, voltage, and resistance loop tests shall be conducted during April, May, or June for each loop detector lead-in at the cabinet terminals of all cabinets with detection. Such tests shall be conducted and recorded by a traffic signal technician. Such tests shall be recorded on the form shown on the plans and submitted to the District Office with subsequent monthly submittals. Such tests shall be performed with a megohm meter. Only the megohm lead-in resistance and voltage shall be recorded on this form. If loop systems are found defective, the associated phase may require placement on recall and the timings shall be adjusted as directed. Loops which fail the tests but are still operational shall be left working. The Contractor shall verbally inform the Department of loop failure and shall submit the loop testing table with the monthly invoice. Those loop testing tables which show failed loops shall have such failed loops highlighted.

5. Cabinet Bulb Turn On or Off

During directed cold weather periods, a controller convenience lamp shall be turned on at all times inside each non-flasher controller cabinet. During warmer weather periods, such lamps shall be turned off. The Contractor shall turn the lamp on in each cabinet between October 15 and November 15. The lamp shall be left on until March 15. The lamp shall be replaced if necessary in the case of bulb failure. The Contractor shall turn off all controller cabinet bulbs between March 15 and April 15.

6. Aerial Inspection and Bulb Replacement

The Contractor shall replace bulbs as required, inspect each traffic signal installation, and perform all work shown in Appendix G on the plans. The Contractor shall provide all equipment and labor to perform the inspection and repair or replace incidentals which have been found to be either missing, broken, or inoperative. A Department inspector will accompany the Contractor simultaneously during inspection. Such inspection shall include capability to accompany the Contractor in an aerial truck. All work located overhead which may be aligned, adjusted, repaired, or replaced with the use of hand tools shall be included in this work. The Contractor shall note which work was not performed. Such list shall be provided to the Engineer. The Engineer will then direct the Contractor make all repairs, replacements, or necessary adjustments. The Contractor shall perform this work during the first 4 months of the contract time. The Engineer shall be supplied with a schedule for approval. The Contractor shall provide a Type C certification for the bulbs.

(c) Non-Routine Maintenance

Non-routine maintenance shall include all activities which are not included as emergency response maintenance or scheduled maintenance.

A Department representative will inspect all work performed as non-routine maintenance activities, and will recommend full, partial, or no payment.

1. Anchor Bolt Repair

This work shall consist of repairing anchor bolts which have become damaged or broken. This may be accomplished by means of welding or use of a threaded coupling to achieve at least the same tensile strength as the existing anchor bolt.

2. Install Sign

This work shall consist of remounting all existing signs at the same locations on new signal structures. New hardware required to accomplish this work, with the exception of mid-mast arm mounting assemblies, shall be supplied by the Contractor. Only those signs for which the Department has responsibility shall be reinstalled. All non-Department signage shall be removed and stored at the location directed. The appropriate governmental agency shall be notified for pick-up.

3. Install Signal Detection Lead-in Cable

This work shall consist of replacing all existing cable which has been damaged as well as making all necessary connections.

4. Expansion Anchor Bolt for Pedestal and Controller Mounting

This work shall consist of drilling or other work necessary to install the expansion type replacement anchor bolts in existing foundations. Bolts shall be provided by the Contractor.

5. Loop Installation

This work shall consist of cutting the saw slot and installing the approved loop wire, 5/8 in. backer rod, splices, and loop sealant. Only diamond blades with water will be permitted in the sawing of the slot for work performed when the air temperature is above 40°F. All materials and equipment shall be provided by the Contractor.

6. Tighten Span Catenary and Tether

This work shall consist of removing excess sag in a span wire, catenary cable, A-frame wires, down guys, and tether cables.

7. Realign Signal Head

This work shall consist of correctly aligning a signal indication. Multiple indications connected by a common support such as 2-way spanners will be considered as one unit. The specific head which was adjusted shall be identified in the comments section of the work report form.

8. Install Signal Head

This work shall consist of the fabrication of a complete signal indication including wiring, balance adjusters, weatherheads, pipe arms, rigid brackets, visors, and lenses. Multiple heads with indications facing in different directions but mounted on the same assembly will be considered as one assembly. A 5-section signal head will be considered as one indication. Pedestrian or optically programmed indications shall be treated the same as signal indications.

9. Adjust Detector Housing to Grade

This work will consist of adjusting detector housing to grade. Patching material will be required where necessary. Such material shall match the type of surface surrounding the detector housing. This work shall be limited to the adjustment of detector housings by addition of an adaptor device only.

10. Installation of Detector Housing

This work shall consist of installation of a new detector housing with conduit connections, and the splicing of the loop detector lead-in cables to the loop detectors. All concrete and other pavement materials shall be included in this work.

11. Adjust Handhole to Grade

This work shall consist of adjusting a concrete handhole to grade. Patching material shall be included in this work where necessary. Such material shall match the type of surface surrounding the handhole.

12. Cabinet Foundation Expansion

This work shall consist of enlarging an existing traffic signal controller foundation to accommodate a larger cabinet. This work shall also consist of temporarily maintaining the operation of the existing controller and cabinet until the new cabinet is installed.

13. Install Tether Cable

This work shall consist of installing a new tether cable or replacing an existing one.

14. Install or Replace Traffic Signal Controller Cabinet

This work shall consist of the placement of a traffic signal controller cabinet on an existing foundation.

15. Install Direct Burial Cable

This work shall consist of all connections, splices, and waterproofing as required to install direct burial cable.

16. Signal Bulb Change

This work shall consist of restoring proper illumination of a signal face. The bulb, lenses, reflector, and visor shall be included in this work.

17. Check Loop System

If, during emergency maintenance, a failed loop system is isolated to the lead-in or loops, the Contractor shall check the individual loops in the detector housing. Individual identified failed loops shall be cut out of the loop system. The timer’s recall and memory settings may require adjustment.

18. Preformed Loops

This work shall consist of installing and testing preformed loops.

Inventory of Materials

The Department will furnish all major signal equipment and materials used in making repairs or replacements and for the performance of all types of maintenance on Department controlled signals. Such materials shall include, but may not be limited to, signal heads and components, signal support equipment, controllers, controller replacement components, detector amplifiers, conflict monitors, and load relays as listed in the signal parts inventory. All minor materials or parts not furnished by the Department such as electrical tape, wire connectors, or common hardware items shall be furnished by the Contractor.

The Contractor shall be accountable and responsible for all materials and equipment furnished by the Department. The Contractor shall monitor the levels of Department inventory. The Contractor shall give at least two business days notice prior to picking up or delivering materials. Light bulbs will not be provided.

All equipment and parts removed from traffic signal installations shall be returned to the District Traffic office, unless otherwise directed.

During the preconstruction conference, a list of the minimum required quantities of stockpiled material will be supplied by the Engineer. This list will define a base inventory of material required to perform all maintenance activities. The Contractor shall make written request for adjustments to these quantities if such adjustments are necessary.

The Contractor shall pick up this material at the District Office, the Traffic Support Center, or another site as directed. The Contractor shall transport the remaining inventory to the District Office when finished with the work. If material not provided in the inventory is required for emergency situations, the Department may provide this material which shall be picked up at the site designated.

Material records in accordance with 106.01 will not be required since some materials will be supplied by the Department. Other materials are anticipated to be relatively small in quantity or acquired over the counter in bulk purchases. The Contractor shall still use quality materials which shall be in accordance with the specifications and normally accepted industry standards. Materials may be checked by the Department and will be rejected if determined to be unsatisfactory.

The Contractor shall provide secured facilities for the storage of this material. Such material shall be maintained in a neat and orderly manner. An enclosed building with clean, dry storage space shall be provided for controllers, cabinets, and other equipment not intended to be exposed to the weather. Timers stored in vehicles may either be placed in the interior of vans or trucks or in sealed plastic bags if timers are left in utility bins. Timers shall not be stored in truck beds. The Contractor will be responsible for all inventoried material. The Contractor will be held accountable for lost, stolen, or damaged equipment.

The Contractor shall supply a semiannual inventory report for all material supplied by the Department in the categories as follows:

(a) quantities inventoried at the beginning of work
(b) quantities received during the work
(c) quantities used during the work
(d) quantities transferred to or from Department projects
(e) quantities inventoried at end of the work.

Signal Bulb Wattages

The following table shall be used as a guideline for proper bulb wattages.

8 in. Green, 8 in. Amber, 9 in. Walk/Don’t Walk	67 W
8 in. Red, 8 in. Amber Arrow, 8 in. Green Arrow	116 W
12 in. Energy Saving Grid Walk/Don’t Walk	67 W
12 in. Green, 12 in. Amber, other size Walk/Don’t Walk	116 W
12 in. Red, 12 in. Amber Arrow, 12 in. Green Arrow	150 W
Optically Programmable Bulbs, All Sizes	150 W
Cabinet Convenience Bulb; G, M, or P-1 Cabinets	67 W

Skilled Labor

Skilled labor shall consist of foremen, traffic signal technicians, or equipment operators.

(a) Traffic Signal Technician

A skilled technician will be defined as a skilled laborer who is familiar with the operation of equipment shown in the QPL of Traffic Signal and ITS Devices. Such technician shall be able to diagnose and repair malfunctions in such equipment.

Field repairs of solid state equipment will be limited to replacement of faulty equipment and returning such equipment to the Department in exchange for replacement equipment.

Traffic signal technicians shall understand how to install timing values into controllers. They shall also understand how time base coordinators/dial coordinating units regulate actuated controllers with background cycles within an interconnected signal system.

One set of operating manuals will be provided for the approved equipment at the preconstruction conference. The signal technician who responds to emergency maintenance shall secure copies of such manuals for reference purposes.

Other models of equipment by other manufacturers may be installed. The Contractor will be issued manuals for such new equipment.

(b) Unskilled Labor

Unskilled labor shall consist of common labor or escort service.

(c) Minimum Crew Size

Certain operations will require the minimum number of workers shown below. Workers shown in this listing below shall not include workers who are required to direct traffic.

1. Loop cutting:
   Minimum of two persons, at least one skilled laborer.

2. Pole, mast arm, or span knockdown:
   Minimum of three persons, at least one skilled laborer.

3. Pedestal knockdown:
   Minimum of two persons, at least one skilled laborer.

4. Replacement of signal cable, over 25 ft (7.5 m):
   Minimum of 2 persons.

5. Replacement of G and M cabinets:
   Minimum of two persons, at least one traffic signal technician.

6. Replacement of P cabinet:
   Minimum of three persons, at least one traffic signal technician.

7. Check loop system at detector housing:

Minimum of three persons, at least one traffic signal technician.

8. Loop testing at cabinet:
   One traffic signal technician.

(d) Equipment

A boom truck shall consist of equipment which shall be capable of lifting and setting poles or mast arms. An aerial truck shall consist of equipment which shall be capable of lifting 1 or more workers with materials for overhead work.

Method of Measurement

Emergency response maintenance will be measured by the month for each intersection with each type of installation. Aerial inspection and annual relamp, anchor bolt repair, and span catenary and fittings will be measured by the number of units serviced. Saw slot for roadway loop and sealer will be measured by the linear foot.

Basis of Payment

Emergency response maintenance will be paid for at the contract unit price per month for each intersection of the installation type shown in the Schedule of Pay Items. The cost of this work shall include all labor and equipment used in carrying out emergency response maintenance. No additional payment will be made for false emergency calls.

A Department representative may inspect all traffic signal installations and may recommend either full payment for proper completion of emergency response maintenance or a deduction for unfulfilled emergency responses. All intersections affected by the failure of an interconnected system will result in a deduction in payment for proper completion of emergency response maintenance responsibilities.

Payment will be made after presentation of a monthly invoice. Such monthly invoice shall show the work complete, the number of intersections for each installation type, and the unit price.

Aerial inspection and bulb replacement will be paid for at the contract unit price per each for aerial inspection and annual relamp, signal, or aerial inspection and annual relamp, flasher, as the case may be. Anchor bolt repair and span catenary and fittings will be paid for at the contract unit price per each. Saw slot for roadway loop and sealer will be paid for at the contract unit price per linear foot, complete and in place.

Payment will be made under:

Pay Item	**Pay Unit Symbol**
Aerial Inspection and Annual Relamp, Flasher	EACH
Aerial Inspection and Annual Relamp, Signal	EACH
Anchor Bolt Repair	EACH
Emergency Response Maintenance, _____ installation type	MOS
Saw Slot for Roadway Loop and Sealer	LFT
Span, Catenary and Fittings	EACH

The costs of dispatcher and answering service logs and work activity reports, travel time to and from an intersection, and traffic control setups and devices shall be included in the costs of the pay items. The cost of each visit required for turning on or turning off the cabinet lamp at each controller location shall be included in the cost of aerial inspection and annual relamp. The costs of couplings, studs, and patching of concrete shall be included in the cost of anchor bolt repair. The cost of tightening span, catenary and tether shall be included in the cost of span, catenary and fittings. The cost of non-routine maintenance shall be included in the costs of other pay items.

The Contractor will not be paid a renegotiated price for pay items for which the quantities used will be considered to be an excessive overrun or an excessive underrun.
