

DC11 – DESIGN CRITERIA FOR TRAFFIC SIGNALS

DC11-001 GENERAL. These criteria are established to provide uniform procedures to aid the Design Engineer in preparing traffic signal improvement plans for projects in the City of Gardner. The traffic signal system shall consist of the signal controller, signal poles, signal heads, cable, conduit, vehicle detectors and any other appurtenances required to provide a complete, operable traffic signal system. Components of the system shall conform to the City of Gardner *Technical Specifications for Public Improvement Projects*.

DC11-002 DESIGN CRITERIA. In addition to the following requirements, all work shall conform to the requirements of the Manual on Uniform Traffic Control Devices (MUTCD), latest edition.

Standard Phasing:

The following standard phasing shall be utilized, unless otherwise approved by the City Engineer:

- Phase 1 – eastbound left
- Phase 2 – westbound through
- Phase 3 – southbound left
- Phase 4 – northbound through
- Phase 5 – westbound left
- Phase 6 – eastbound through
- Phase 7 – northbound left
- Phase 8 – southbound through

Signal Heads:

Traffic signal heads shall be placed in accordance with the MUTCD. Additional guidelines are provided below to standardize the placement of signal heads:

1. A standard three-section head should be centered over each exiting lane for all through lanes of traffic.
2. When a left-turn lane is provided without left-turn phasing, no separate signal head should be provided for the left-turn movement.
3. When protected left-turn phasing is specified, the three-section head shall be centered over the left-turn lane. When dual left-turn movements are specified, a separate indication should be centered over each left-turn lane.
4. When protected/permissive left-turn phasing is specified, a four-section head should be centered over the left-turn lane. The head shall be accompanied by a LEFT TURN YIELD ON symbolic flashing yellow arrow.

All traffic signal and pedestrian indications shall be LED displays. In addition, backplates shall be provided for all traffic signal heads that are mounted to the mast arm. Signal heads that are mounted to the signal pole should not be equipped with backplates.

Emergency Preemption:

Opticom emergency preemption equipment shall be installed on the signal mast arm for all directions of traffic.

Street Lighting:

Streetlights shall be coordinated with the City Engineer to determine the need for combination mast-arm street lights at new or modified signal installations. Luminaire placement shall be in accordance with the City of Gardner *Technical Specifications and Design Criteria for Public Improvement Projects*. All clearances shall be coordinated with overhead utility providers.

Service Boxes:

Service boxes shall be provided whenever conduit changes direction and adjacent to signal poles and controllers. Use type IV double lid junction box on controller corner. Junction boxes shall be used adjacent to detector loop locations for the splicing of loop wire to the lead-in cable. Type I junction boxes shall be used where one or two conduit runs enter/exit the box. Type II junction boxes shall be used where more than two conduit runs enter/exit the box. Service and junction boxes shall be installed at least 2 feet from the back of curb to the center of the box and no closer than 2 feet to any pole. The distance between service and/or junction boxes shall not exceed 200 feet to facilitate the pulling of cable.

Conduit:

All conduit for traffic signal installations shall be high density polyethylene (HDPE) SDR9. Signal conduit that extends from signal poles to adjacent service boxes shall be two (2) 3-inch conduit while signal conduit that extends from the signal controller to the adjacent service box shall consist of four (4) 3-inch conduits. Signal conduit that extends from service box to service box shall be two (2) 3-inch conduits. In all cases, the cables shall not exceed 40 percent of the conduit cross-sectional area. Signal conduit for advance detectors or signal interconnect/fiberoptic cable shall be two (2)-inch conduit.

Street lighting cable is permitted in signal conduit runs and boxes only if the streetlight is attached to the traffic signal pole. The conduit sizes above are typical applications and shall be verified by the Design Engineer to ensure that no more than 40 percent of the conduit cross sectional area is filled by the cables.

Secondary Service:

The Design Engineer shall coordinate and verify the location of the proposed secondary service point with the appropriate utility company to ensure availability of service. A three (3) inch conduit with secondary service wire shall extend from the controller to the secondary service point (EVERGY only). A three (3) inch conduit with a pull string shall extend from the controller to the secondary service point (EVERGY only).

Signal Poles:

Signal poles shall be located a minimum of 6 feet from the back of curb to the center of the pole. When pedestrian signal heads are used, signal poles with push buttons shall be placed in accordance with ADA Guidelines. Pedestrian poles may be utilized to facilitate ADA compliant pedestrian access needs. Signal and pedestal poles shall be powder coated black per the City of Gardner *Technical Specifications for Public Improvement Projects* at designated intersections as determined by the City Engineer.

Controller Cabinet:

Controller cabinets shall be located adjacent to and behind the sidewalk. In locations where no curb exists, the controller shall be placed as far from the edge of pavement as practical but shall be a minimum of ten (10) feet from the edge of pavement, unless otherwise approved by the City Engineer. The controller cabinet shall not be placed on the lowest elevation corner of the intersection, unless otherwise approved by the City Engineer.

Wiring:

The number of conductors required for the various types of traffic signal equipment is summarized below:

Cable for both vehicle signal heads and pedestrian heads shall be 7-conductor cable conforming to International Municipal Signal Association (IMSA) Specification 19-1. One (1) 21-conductor cable shall be installed per mastarm pole for the vehicle signal heads regardless of the quantity of heads on the mast arm. Typical intersection would require four (4) 21 conductor cables. A spare 7-conductor shall be installed with the 21 conductors. One (1) 2-conductor cable per pushbutton shall be provided, from the controller with no splicing.

Detector lead-in cable shall be 4-conductor shielded cable. Detector loop wire shall be single conductor PVC/nylon with tube jacket.

Street lighting distribution cable shall be two (2) 1-conductor No. 8 AWG. Pole and bracket cable shall be No. 10 Thermoplastic High Heat-resistant Nylon-coated (THHN) 2-conductor stranded copper conforming to IMSA Specification 19-1. Street lighting cable for luminaires on signal poles should be spliced inside the signal pole, not the service box adjacent to the pole.

Microwave Detection:

When microwave detection is used, the detection system shall be Wavetronix/Matrix. The microwave detector shall be mounted to the mast arm that is attached to the traffic signal pole. The plans shall include notes requiring coordination with the manufacturer for the proper placement and configuration of the microwave detection system.

Overhead Signs:

Overhead street name signs shall be mounted to the mast arms using Sky-Brackets. There shall be a minimum of two (2) brackets per sign placed no more than three 3 feet apart with a maximum of one (1) foot from the edge of the sign. The overhead street name signs shall be placed between the signal pole and the first vehicle signal head. Lighted signs are required. The power feed shall be continuous from controller to sign.

Traffic Signal Interconnect:

At locations specified by the City Engineer, interconnection of the traffic signals through fiber optics may be required. Fiber optic cable shall be separate from copper signal conductors. A Fiber Optic Pull Box shall be placed outside of the traffic signal cabinet. One

hundred (100) feet of spare fiber shall be coiled in each pull box. Fiber Optic boxes shall be installed at least 2 feet from the back of curb to the center of the box and no closer than 2 feet to any pole. The distance between fiber optic boxes shall not exceed five hundred (500) feet to facilitate the pulling of cable.

DC11-003 PLAN REQUIREMENTS

This section governs the preparation of traffic signal improvement plans.

General:

The improvement plans shall include all information necessary to construct and verify the design of a traffic signal system. For private development projects, the plans shall be submitted as a separate set, which clearly shows other public street and stormwater drainage improvements (and utilities, if applicable) in a de-emphasized manner and shall include appropriate quantity sheets for Contractor provided equipment. The plans shall be arranged as required by the City Engineer. All plan sheets shall be signed and sealed by the Kansas Registered Professional Engineer responsible for preparing the plans. The signed and sealed plans shall be submitted to the Infrastructure Department, Engineering Division for review and approval prior to construction.

Private Improvements:

If any private improvements are shown on the public improvement plans, they shall be clearly differentiated from the public improvements. An appropriate note shall be included on the drawings stating that these private improvements will not be maintained by the City of Gardner.

Sheet Size:

The suggested sheet size for improvement plans is twenty-four inches by thirty-six inches (24" x 36") although sheets twenty-two inches by thirty-four inches (22" x 34") may be used. All sheets in a given set shall be the same size.

Types of Sheets in Plans:

The improvement plans shall consist of the following:

- Title Sheet
- Traffic Signal Plan Sheet
- Signal Interconnect Plan Sheet(s) (If Required)
- Wiring Detail and Timing Plan Sheet
- Summary of Quantities Sheet
- Standard Detail Sheets
- Pavement Marking and Signing Plan and Detail Sheets
- Traffic Control Detail Sheet

Each sheet shall contain proper project identification, the type of sheet, a sheet number, including the individual sheet number and the total number of sheets, and dates of when the plans were originally prepared and all revisions. Copies of the approved standard detail sheets can be obtained from the Infrastructure Department, Traffic Operations Center or at

Street centerline stations shall be marked at one hundred (100) foot intervals and at other pertinent points.

The plans shall clearly show the proposed placement of all traffic signal equipment including, poles, heads, Opticom equipment, cameras, signs, streetlights, junction and service boxes, conduit, loops and control centers. The items to be constructed or installed for the project shall be legibly noted and located by station and offset. Distances from proposed improvements to the back of curb shall also be provided.

A signal phasing diagram shall be displayed and shall follow the City's standard phasing.

A list of general notes shall include at least the following:

1. Existing underground (U/G), overhead (OH) utilities and drainage structures have been plotted from available information and therefore, their locations must be considered approximate only. It is the responsibility of the individual contractors to exactly locate each utility before actual construction.
2. All construction methods and traffic signal equipment shall conform to the latest edition of the City of Gardner Technical Specifications.
3. Contractor shall stake the location of all traffic signal poles, conduit, controllers, service boxes and junction boxes to be installed. The stations and offsets provided are to the center of the traffic signal equipment. Traffic Signal staff shall inspect the staking prior to any excavation and/or construction. Minor relocation of equipment to avoid conflicts may be allowed with the approval of the City's Traffic Signal Staff.
4. All existing curb and gutter, sidewalk, pavement, drainage structures or ground damaged during the traffic signal construction shall be replaced to match existing. This work will be considered SUBSIDIARY to the "Traffic Signal Installation" bid item.
5. Conduit entering service boxes, junction boxes and/or pole bases shall be continuous in the service boxes, junction boxes and/or pole base.
6. Coordinate Signal Turn-On with the City of Gardner.
7. All traffic signal indicators shall be Light Emitting Diode (L.E.D.).
8. All poles and cabinets shall be painted black.