SECTION 11

TRAFFIC SIGNALS AND LIGHTING (SG)

11-1 DESIGN CRITERIA - Traffic signals and street lights shall be designed and constructed in accordance with these Design Standards and the latest editions of the City of Grass Valley Construction Specifications and Standard Details, the State Standard Specifications, the State Standard Plans, and the CMUTCD.

All components of signals and street lights shall be powder coated black, where feasible, unless minor modifications are made to existing street lights, where any new components shall be made to match the existing signal or street light.

11-2 TRAFFIC SIGNALS - Traffic signals and appurtenances shall be designed in accordance with these Standards and the following requirements.

A. Vehicle and Pedestrian Signal Types -

1. Signal faces shall have LED displays, unless otherwise specified.

2. Protected left turn signals shall be all arrow.

3. Pedestrian signals shall include 16-inch countdown pedestrian heads with a walking person, upright hand, with countdown and auditory notification per the State Traffic Manual.

4. Accessible Pedestrian Signal (APS) push buttons shall be Campbell Company AGPS 915. The wiring must comply with section 13.02 of the ITE publication *Equipment and Materials Standards* chapter 2, "Vehicle Traffic Control Signal Heads," and be NEC rated for service at +105 degrees C. The conductor cable between the APS and the pedestrian signal head must be a no. 9, 20-conductor cable complying with MIL-W-16878D.

B. Vehicle Signal Alignment - The following vehicle signal alignments are typical. Variations may be required on a case by case basis.

1. For single left turn lanes with protected left turn movement, the left turn signal shall line up with the center of the left turn lane as close as possible.

2. For dual left turn lanes, the left turn signal shall line up with the line between the two left turn lanes as close as possible.

3. Through movement signal indications shall align as follows:

a. 1 travel lane - the center of the lane.
b. 2 travel lanes - the lane line in-between the two lanes
c. 3 or more travel lanes - one signal indication shall be provided on each lane line between through lanes.

C. Signal Phasing - Signal phasing shall start with phase 2 northbound and proceed in a clockwise direction unless directed otherwise due to coordinated corridor restrictions.

D. Protected Left Turn Phasing - Protected left turn phasing shall be provided under the following

conditions:

1. If any of the guidelines for protected left turn phases are met (or are expected to be met as a result of a development project) as outlined in the State Traffic Manual (e.g.; accidents, delay, volume, and misc.).

2. Where left turn lanes are provided.

3. Where the travel distance through the intersection for left turn vehicles is more than 100-feet, and the 85th percentile speed of opposing traffic is 45 mph or more.

4. Where there are three or more opposing through lanes.

5. Where the left turn queue recurrently occupies the #1 through lane, and where dual left turn lanes cannot be provided, and where the left turn lane cannot be extended.

E. Vehicle Detection -

1. Either thermal detection or video detection shall be provided for all new signals and signal modifications.

2. Loop detection may be required in conjunction with the video detection.

3. Existing loop detection may be replaced with the approval of the City Engineer.

4. Opticom emergency vehicle receivers are required for all new signals and signal modifications.

F. Traffic Signal Interconnect -

1. Traffic signal interconnect shall be provided for new signal installations, and for modification of existing signals which currently do not have interconnect. The interconnect cable shall have its own conduit and shall not share conduit with service conductors, signal conductors, or lead-in cables.

2. The interconnect shall connect the subject signal with at least one existing traffic signal. If the subject signal is between two existing signals, the interconnect shall connect all three signals.

G. Right Turn Lanes - Right turn lanes shall be provided at signalized intersections:

1. On all main street approaches.

2. On all minor street or driveway approaches with peak hour approach volumes of 60 vehicles or more.

H. City Supplied Equipment - City supplied equipment shall be picked up at an agreed upon location within ten (10) calendar days of notice to the City's Inspector. The Contractor is responsible to provide all labor and equipment necessary to load, transport, and install the equipment.

I. Contractor Supplied Equipment -

1. Attention is drawn to the following Contractor supplied and installed materials:

a. Equipment grounding conductors shall be AWG #8 bare solid copper wire minimum.

b. Two (2) Category 5e and one (1) UL Type SOOW, CSA Type SO, 600 Volt 18/3 Power Cable Color Code 3/C to top of designated pole with 10-feet of slack for each wire at the top of the pole.

c. 16-inch countdown pedestrian heads.

d. Solid state, two tone audible, momentary LED pedestrian push buttons. Contact the City for approved vendors and models.

J. Salvaged Equipment - Salvaged equipment shall become property of the City and shall be delivered by the Contractor upon 24 hours notice. The Contractor shall deliver salvaged equipment to the location designated by the City.

1. Where signals are being modified or relocated, existing emergency preemption equipment shall be relocated to the new signal poles.

2. Damaged conduits deemed to not be reusable shall be removed from existing pull boxes and ends plugged solid with grout. Existing conductors shall be removed from said conduits prior to plugging. Contractor shall properly dispose of said conductors.

3. Abandoned conduits deemed reusable shall have the line blown out, existing conductors shall be removed, a number 10 green locate wire shall be installed, and the ends of the conduits shall be sealed.

K. Signal Activation - Functional testing per Caltrans Standard Specifications shall be performed for five (5) working days prior to signal activation. All systems shall be in place before functional testing can begin.

1. On the day of signal activation, the Contractor shall be required to have in his possession at the job site all tools, equipment and parts necessary to repair a signal malfunction. These items shall include, but not be limited to, a bucket truck, replacement LED's, wire, etc.

2. Immediately prior to the activation of a new traffic signal, the Contractor shall install two (2) orange flags on the "Signal Ahead" signs. Flags shall remain in place for two (2) weeks.

3. Prior to activation of a new traffic signal, the Contractor shall provide a minimum of two (2) flaggers per intersection to control traffic. The number of flaggers may be increased at the request of the Public Works Inspector for large intersections. Each flagger shall wear appropriate safety gear and carry a stop paddle for controlling traffic. The flaggers shall completely stop traffic prior to the signal changing from red flash to full operation.

L. Trenching Within the Roadway - The designer should be aware of the following requirements regarding civil improvements when working in the roadway:

1. The conduit trenches shall be a maximum of 6-inches wide and 2-inches wider than the outside diameter of the conduit to be installed. There shall be one inch minimum clearance between the conduit and the trench wall. The trench shall be crumbed clean prior to placement of conduit.

2. Aggregate material in concrete shall be pea gravel. Concrete shall be thoroughly consolidated around the conduit, filling all voids.

3. Rock wheel trenching shall be located along the centerline of the bike lane stripe or stop bar/crosswalk striping whenever possible so that the trench cut will be hidden by the stripe. Pre-existing improvements requiring deviation from the centerline of the stripe shall be accomplished within 20-feet from the beginning to the end of deviation. Deviations along bike lane lines shall be to the curb side of the stripe unless directed otherwise by the City Engineer. Deviations greater than 20-feet shall require asphalt concrete repair per Item #6 below.

4. Saw cutting in the street, other than rock wheel trenching, will require pavement repair per the Design Standards Details and/or grinding between lane lines per City Standards found elsewhere in this document and the Construction Standards.

5. Should the Contractor fail to install the conduits in new roadways prior to the bottom lift of asphalt concrete, the City will require the installation of a Glass Grid pavement reinforcing fabric, or approved equal, prior to the final lift of pavement.

6. The Contractor is solely responsible to provide all labor and equipment necessary to locate existing underground facilities beyond the information provided by the U.S.A. markings including, but not limited to, metal detectors, wire locating equipment, and potholing.

7. Where combinations of sidewalk or curb and gutter are poured contiguous to existing, all adjoining existing concrete vertical faces shall be doweled per the City Construction Standards.

8. Curb ramps conforming to the latest CBC, Title 24 requirements, and the City Construction Standards shall be installed at all pedestrian crossing locations within the project area. Existing ramps that do not meet these requirements shall be removed and replaced.

11-3 STREET LIGHTING - Street lights shall be required for all lots and parcels being developed or constructed upon unless exempted by the City Engineer. In addition, street lights may be required for lots and parcels containing existing structures which are being improved or altered, depending on the nature and extent of the work.

A. Intersections - Intersections shall have at least one street light.

B. Cul-de-sacs - All cul-de-sacs shall have a street light within the bulb.

C. Spacing - Street light spacing shall be determined using the isolux diagram to achieve desired illumination. In general, maximum spacing between luminaires is 300 feet.

D. Illumination - The minimum maintained horizontal illuminance should be as follows: On arterials, 1.6 horizontal lux on the area normally bounded by the crosswalks, and 6.5 horizontal lux at the intersection of centerlines of the entering streets. All other streets, 1.1 horizontal lux on the area normally bounded by the crosswalks, and 3.2 horizontal lux at the intersection of centerlines of the entering streets. To determine the position and number of luminaires needed to provide a desired lighting level or to determine the lighting level achieved by a given pattern of luminaires, the isolux diagram for the luminaire may be used. The lighting level at any point may be approximated by adding the values shown by the isolux curve passing through the point from each contributing luminaire.

E. Location - Street lights shall be located on property lines whenever possible and at least five-feet from driveways or any above ground facility. Street lights shall normally be staggered on opposite sides of the street and on outer edge of curves.

F. Pull Boxes - All pull boxes, including their size, shall be shown and identified on the plans. Pull boxes shall be installed at the locations where more than two (2) conduit runs intersect, where conduit runs are more than 200-feet long, where shown on the plans, at critical angel points, and at such locations ordered by the City Engineer. Normally, a No. 5 pull box will be used unless otherwise noted on the plans.

G. Conductors - All conductors, including quantity and size, shall be identified on the plans. Unless otherwise specified, conductors shall be single conductor with THW insulation, solid or stranded copper, sized in accordance with these standards and the National Electric Code.

H. Conduit - All conduit runs, including the size, shall be shown and identified on the plans. The conduit size shall be determined according to the National Electrical Code, with the minimum size being 1½-inch diameter conduit. Larger size conduits may be required at the discretion of the City Engineer.

I. Electrical Equipment and Work - Control and switching equipment and fusing of all circuits shall meet the requirements of the National Electrical Code, the Basic Electrical Regulations, Title 24, Part 3, of the California Administrative Code.

J. City Parking Lots- All city parking lots shall have lighting to provide a minimum 0.6 lux

11-4 PREPARATION OF PLANS - Traffic signal plan sheets shall conform to the provisions of these design standards, including submittal requirements, AutoCAD files, etc. Traffic signal plans shall have one (1) title sheet followed by separate signal and lighting, interconnect, and signing and striping sheets for each intersection. Signing and striping sheets shall be submitted concurrent with signal and lighting sheets for review. Signal and striping plan sheets must be stamped and signed by a licensed Civil Engineer.

A. Title Sheet - The title sheet shall include the following:

1. Title of project, which shall include the location.

2. A vicinity map, with north arrow showing the limits of work. The vicinity map is not required to be to scale.

3. Pertinent signature blocks and revision block.

4. A legend for symbols not found in the Standard Plans (e.g.; utility lines, etc.). Below the legend, place the following note: NOTE: SEE STATE STANDARD PLANS FOR EXPLANATION OF OTHER SYMBOLS.

5. Controller/Service foundation detail, loop layout detail, and other special details. The service pedestal address shall be placed adjacent to these details in large, bold letters.

6. Applicable City of Grass Valley General Notes.

B. Signal and Lighting Sheet - The signal and lighting sheet shall be drawn at a minimum scale of 1-inch equals 20-feet, and shall include the following:

1. A north arrow.

2. Existing and proposed field conditions which include, but are not limited to, the following: underground and overhead utilities (including height of lines near signal poles), driveways, fire hydrants, poles, signs, fences, street lights, edge of pavement, curb and gutter, sidewalk, right-of-way line, P.U.E.s, roadway striping, medians, centerline, pull boxes, curb ramps, trees (particularly those needing trimming), adjacent topography, etc. Existing field conditions, appurtenances, etc., shall be dashed and screened. Proposed shall be solid and bold.

3. Pole and equipment schedule.

4. Conductor and conduit schedule. The schedule shall include rows showing "percent fill" values, and conduit quantity/size.

5. Complete traffic signal design, including but not limited to, the following: conduit runs, detector loops (with input designations), detector handholes, vehicle and pedestrian signals (with phase designation), luminaires, pedestrian pushbuttons (with phase designation), controller, service pedestal, service point, emergency vehicle detectors, signing, striping, interconnect, CCTV Camera, and WiFi equipment.

6. Phasing diagram. Designate type of flashing operation below the phasing diagram.

7. Phasing for emergency vehicle preemption. Typically, protected left turn phases are combined with the concurrent through movement during EV preemption.

C. Interconnect Sheet - The interconnect sheet may be drawn at a scale of 1-inch equals 20-feet or 1-inch equals 40-feet and shall include a north arrow.

D. Signing and Striping Sheet - The signing and striping sheet shall be drawn at 1-inch equals 20-feet or 1-inch equals 40-feet, and shall include the following:

1. A north arrow.

2. Existing signing and striping - dashed or screened.

3. Proposed signing and striping where line types shall closely approximate striping proposed.

4. Centerline stationing with either begin and end modification stationing or lineal feet of modification specified along with the detail.

E. Photometric Sheet - A photometric plan showing the horizontal illuminance of the site shall include a point by point foot-candle reading. Maximum grid spacing shall be 10-foot, zero-inches and 10-foot, zero-inches beyond the property line.