

**City of Ontario, California  
Engineering Department  
Traffic and Transportation Division**

**Traffic and Transportation Guidelines**



**August 2013**

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## 1.0 IMPROVEMENT PLAN DESIGN CRITERIA

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Engineered drawings, otherwise known as plans, submitted by private design engineers (the “Engineer”) to the City of Ontario for plan check shall adhere to these Traffic and Transportation Guidelines whenever the plans involve Signing and Striping, Street Lights, Traffic Signals, or Temporary Traffic Control.

The submitted plans will be checked by the City for conformance with the City’s standards and policies, and for overall acceptability of the proposed design. The following guiding documents are to be used by the Engineer in preparing the plans: the California Manual on Uniform Traffic Control Devices (CAMUTCD); the Highway Design Manual; the AASHTO Policy on Geometric Design of Highways and Streets; the Caltrans Standard Plans and Standard Specifications; the City’s Standard Drawings; and the City’s Special Provisions. Other pertinent documents may include Specific Plans, Master Plans, and the Conditions of Approval for the project.

Appendix A of this document contains a “Design Submittal Checklist” that must be fully filled out by the Engineer and included with the submitted plans as part of the submittal package. Street improvement plans, when part of the project, will also be provided with the plans submitted for review.

It is the responsibility of the Engineer to be knowledgeable in traffic engineering principles required for the design of traffic and transportation projects, and to complete a thorough quality assurance/quality control (QA/QC) review of the plans for errors BEFORE submitting them to the City for plan check. Plans submitted with numerous design and/or drafting errors, or drafted with poor quality workmanship, are subject to being rejected and returned without being reviewed.

Plans being re-submitted for a second or subsequent check shall include a new set of plans, the previous set of plans containing the City’s red lines and comments, the appropriate design submittal checklist and any other items that document any comments that have been exchanged between the Engineer and the City.

Any and all submittals that do not contain all of the required components as identified in these guidelines are subject to rejection, and may be returned for correction without being reviewed. The Engineer should contact the Traffic Engineering Section at (909) 395-2025 to determine whether there are any special requirements for a project.

### 1.1 General Drafting Standards

All plan sheets submitted shall be 24 inches by 36 inches with the standard City title block. **Unless requested, title sheets are not required.** No sticky backs or paste-ons will be accepted. At the time of final submittal, copies of the drawings created using CAD drawing programs shall be provided to the City on a CD or DVD, or other acceptable digital storage media used at that time. All drawings submitted should utilize the “e-transmit” feature and include any reference drawings, plot files and text files as necessary. Drawings created using programs other than Autodesk “AutoCAD” shall be submitted as DXF files. Signatures must be “wet-originals” on the final submittal.

Projects shall have a complete, master set of General Notes, Construction Notes, and/or Legend of Special Symbols for the whole project on the first sheet of the set. Subsequent project sheets shall require only those Construction Notes, and/or Legend of Special Symbols applicable to that sheet. In no case should a Construction Note or Symbol be defined differently on separate sheets of the same project. Abbreviations, Standard Notes or Symbols shown on the Caltrans Standard Plans shall not be redefined on a project. Undefined, nonstandard symbols, shall not be used.

Reference to other drawings shall be made using the City assigned drawing number only. If a drawing number has not yet been assigned, leave a blank space. Drawing numbers will not be assigned until the City asks for originals.

Show surface features such as meter boxes, power poles, sidewalk, drive approaches, existing signs, striping and markings, catch basins, gutters, etc. and both existing and proposed signal poles and street lights. Show and label the types and limits of any pavement whenever the pavement type is other than asphalt concrete.

Where a project spans multiple jurisdictions, a signature block for each affected agency shall be included on the title page, and on each page where there is shared jurisdiction on the project. Show all jurisdictional boundary lines on the plans.

Show a north arrow above the plan scale in the lower right hand corner of the drawing, oriented toward either the top or the right side of the drawing. North arrows shall be consistent with the type being used as a City standard at said time.

Use short dashed lines to indicate equipment and improvements which are existing or are to be installed by another plan sheet. Solid lines, even though drawn narrower, can be erroneously construed as requiring installation of items that may exist.

All submitted plans shall be produced by ink-plotting, or by other permanent print methods. Sepia mylars are not acceptable.

## **1.2 Signing and Striping Plans**

The following standards shall apply to all Signing and Striping Plans:

- The drawing scale shall be 1 inch equals 40 feet.
- Street names, not stationing, shall be used to describe the limits of the drawing or project in the title block. Stationing may be shown for reference only.
- Details of signs or striping should only be shown when they differ from the Caltrans details.
- Signing and striping plans are identified by "T-.." drawing numbers.
- Existing signing and striping to be removed by construction, such as street widening, does not need to be shown.
- Dimension all street and lane widths.
- Taper length dimensions, transitions and longitudinal dimensions shall be shown as needed to insure constructability.
- Provide lane width dimensions on either end of any transitions of lane width.

- Provide dimensions from the beginning and end of a transition to a physical feature that can be measured to in the field (BCR, ECR, street light, fire hydrant, limit line, etc.)
- In order to relate the proposed striping to the existing striping, show the existing striping with dimensions on cross streets, and at either end of the project's boundaries, even if separated by an intersection.

Construction notes for striping should indicate the type of work to be performed (install, paint, remove), a description of the installation (solid-double yellow, 4-inch white lane line, etc.), and if not a removal, the Caltrans detail number.

Example: (1) – *Paint solid double yellow centerline per Caltrans Detail 21.*

(2) – *Install thermoplastic 4-inch white lane line per Caltrans Detail 9.*

- Signing and striping, including legends and markings, installed at their ultimate location shall be thermoplastic, with the exception of speed limit marking that shall be in paint.
- Standard white lane lines shall include solid 50-foot long "Leader" lines at intersections.
- Lane use arrows in dedicated turn lanes shall be as follows:
  - In turn lanes less than 100 feet in length
    - place one Type IV arrow at the beginning (back) of the lane.
  - In turn lanes 100 feet in length or more
    - place one Type IV arrow at the beginning (back) of the lane and an additional arrow near the front of the lane.
- Lane use arrows shall be used whenever allowable movements from a particular lane may not be clear to the driver.
- Minimum lane widths are:
  - Single left turn lane – 10 feet
  - Dual left turn lanes – 12 feet inside (#1 lane), 10 feet outside (#2 lane)
  - Through lane against raised median with gutter – 14 feet
  - Through lane against raised median without gutter – 13 feet
  - Through lane against outer curb and gutter – 14 feet
  - Middle through lane – 12 feet
  - Right turn lane – 13 feet
  - Trap right turn lane – 14 feet
- A trap lane shall be provided whenever a travel lane is forced to turn left or right, and shall be consistent with Figure 3B-12 (CA) of the CAMUTCD. The channelizing line (8-inch white) shall be preceded by a minimum of 300 feet of 8-inch skip white (Caltrans Detail 37B). A Type IV arrow shall be placed at the beginning of the 8-inch skip white.
- Left turn lanes:
  - The 8-inch white channelizing line shall be a minimum of 50 feet in length and shall be increased in increments of 25 feet.
  - The width of the bay taper shall be 75% of the width of the turn lane(s).

- The approach transition shall be at least 100 feet in length.
- The reverse curve should become tangent with the left edge of the turn pocket 25 feet before the beginning of the 8-inch white channelizing line. The length of the reverse curve bay taper shall be at least 60 feet for a single left turn lane, and 120 feet for a dual left turn lane.
- The reverse curve is omitted in a two-way-left-turn-lane. Use a 50-foot gap between the end of the yellow line and the beginning of the 8-inch white line for a single left turn lane, or a 100-foot gap for a dual left turn lane.
- Intersections without crosswalks shall have the striping for the intersection end at a point 10 feet behind half-delta.
- Crosswalks shall be designed per City Standard Drawing 1307. Ladder and Diagonal stripes are not acceptable crosswalk markings. At locations with two wheelchair ramps, as per Caltrans Standard A88A, the crosswalks should be centered on the ramps.
- The Engineer should be realistic about trying to reuse/relocate existing signs within the area of construction.
- Signs should be installed on street light poles as much as possible.
- Where the sidewalk is adjacent to the curb, signs not on street light poles shall be installed on separate poles behind the sidewalk and away from any tree canopy areas.
- Existing signs not within the removal area shall be provided with a note/remark as to the type of sign and whether it is to be removed/relocated or protect-in-place.
- Refer to the CAMUTCD Table 2C-4 to determine the minimum distance for placement of advance warning signs
- There is a legal definition for, and a difference between parking and stopping:
  - Outside travel lane is equal to, or greater than 18 feet wide.
    - Use R26 (CA) signs (No Parking Anytime) to restrict parking.
  - Outside travel lane is less than 18 feet wide.
    - Use R26(S) (CA) signs (No Stopping Anytime)
    - Do not install R26(S) (CA) signs on the same post as a stop sign.

When the limits of the restricted areas need to be clearly defined, or they transition from No Parking to No Stopping, use the appropriate R28 (CA) Series signs; *i.e. an R28(S)(Lt)(CA) sign (No Stopping Anytime with an Arrow pointing left) or an R28(Rt)(CA) sign (No Parking Anytime with an Arrow pointing right.)*

- Divided roadways with raised medians:
  - Install “Divided Highway” (W6-1) and “Divided Highway Ends” (W6-2) signs prior to the beginning and end of the divided roadway sections. Omit the W6-1 and W6-2 signs at signalized intersections. Install Type H reflective markers per Caltrans Detail 26 adjacent to the raised medians

- Install “Keep Right” (R4-7) signs in the island nose at the beginning of the raised median section and at major intersections. On island noses without R4-7s install Type “K” markers.
- The entire curb face of an island nose separating directions of travel shall be painted yellow. White shall be used when the island divides traffic traveling in the same direction.
- Install “One Way” (R6-1 Series) signs on all island noses and in the median across from major driveways.
- Install Type V “Wrong Way Arrows” (per Caltrans Standard Plans) 100 feet apart in each approach lane at intersections with collector or arterial streets, and at minor “T” intersections without a median break. At other minor intersections install one Type V “Wrong Way Arrow” in each approach lane.
- On divided highways with three or more through lanes in one direction, install supplemental signing in the median. Lane drop, and merge warning signs in the median shall only be required if they apply to the lane adjacent to the median.
- At signalized intersections with pedestrian push button poles in the median, install signs a minimum of 3 feet behind the PPB post.

### **1.2.1 Street Name Sign Requirements and Installation Guidelines**

Street name signs are required on all development projects. The sign placement should be shown on the Signing and Striping Plans, or on the Street Improvement Plans if no separate Signing and Striping Plans are prepared for said project. The placement of street name signs should conform to applicable City Standard Drawings and the following guidelines: (See also Figure 9 Herein)

- Street name signs shall be placed at the near right-hand approach side on the higher classification roadway at its intersection with a lower classification roadway, or on the roadway with a higher traffic volume if both intersecting roadways are of the same classification.
- Street name signs shall be placed at the top of a tee intersection, as well as on the right-hand approach side of the through roadway.
- Street name signs shall be placed at the top of a tee intersection with a named public alley.
- Street name signs may be placed on either traffic sign posts or on street light standards if they are located within 8 feet of their intended location.

### **1.2.2 Advanced Street Name Sign Requirements**

Advanced street name signs as per the California MUTCD (G7-1(CA)) shall be installed on all minor and principal arterial roadways in advance of their intersection with all roadways.

### 1.3 Traffic Signal Plans

The following standards shall apply to all Traffic Signal Plans:

- The scale of the plan shall be 1 inch equal 20 feet. One sheet per intersection is desired, schedules and notes will be accepted on a separate sheet when necessary.
- Traffic signals are usually constructed at the intersection of a named public roadway, and the intersection of another roadway or pathway, that may be a named public roadway, private roadway, driveway, pedestrian crossing or bikeway crossing. The two crossing ways must be named accordingly, and said names must comply with the naming convention established by the City's Development Code. As such, the drawing title shall describe the intersection by listing the north/south name of the intersection first, followed by the east/west name.
- Traffic signal and interconnect plans are identified by "G-.." drawing numbers.
- Installation of traffic signal interconnect conduit extending beyond the limits of any signal drawings for the same project may be accomplished by the use of a note describing the installation.
- Show all underground and overhead utilities on all drawings.
- If applicable, indicate possible conflict with irrigation systems and corrective action by Contractor should damage occur.
- Label the assigned phase adjacent to all symbols shown on the plan for vehicular and pedestrian indications.
- Dimension all street and lane widths, and utility locations. Provide dimension between centerline and curb.
- In areas without sidewalk, provide for the installation of such within the curb return area to the back side of the pole caps, and across the front of the controller and service cabinets.
- See Section 1.2 Signing and Striping Plans for new or modified striping.
- Where signing and striping work is substantial, and causes confusion when placed on the traffic signal plan, a separate signing and striping plan shall be provided using a scale of 1 inch equal to 40 feet.
- On projects with separate striping plans, the signal plan shall reflect the signing and striping as it will be at the end of the project.
- All traffic signal installation or modification plans shall have the following schedules/tables provided for each location:
  - Pole schedule
  - Phase Diagram
  - Conductor schedule with the conduit percent fill shown



**Controller Unit Specifications**

- The proposed controller unit shall be compatible with any existing or future signal system designated for that area by the City. The controller unit shall be an Econolite ASC/3-2100.
- The controller cabinet shall be a Type "P" with the top of foundation 18 inches above finished grade.
- Controller cabinets shall be placed on the same corner as the service.
- The controller cabinet should be located as close as practicable to provide the following:
  - Located on an approach leg to the intersection.
  - Traffic movements at the intersection are visible and unobstructed by physical features.
  - Possible to park a maintenance truck close to the cabinet.
  - Sidewalks, wheelchair ramps, store entrances, etc., are not obstructed.
  - It should not obstruct pedestrian or driver visibility standards.
  - The precise location of the controller cabinet shall be indicated on the plans by indicating a lateral distance from the closest BCR/ECR, and dimension from the curb face to the front of cabinet. The designer is to take all measures, including potholing if necessary, to ensure there are no conflicting utilities at proposed cabinet location. Final location to be approved by City staff in the field prior to construction.

**Traffic Signal Standards**

- Median installations of traffic signal standards other than pedestrian push button posts should be avoided.
- Where a standard must be located in a median, the median should be at least 5 feet wide. The standard should include a pedestrian push button and should be set 3 feet behind the nose or the pedestrian aperture on the median.
- 1-A poles for use with five section signal heads shall have a height of 15 feet.
- Signal poles adjacent to a divided arterial street shall have a 35-foot shaft and a 15-foot luminaire arm. All other poles, other than 1-A poles, shall have a 30-foot shaft with a 12-foot luminaire arm. Main signal poles shall have a davit arm above the mast arm to accommodate a horizontally mounted street name sign.
- Signal poles, mast arms and equipment shall be designed for maximum case arm loading and 100 mph wind velocity.
- When installing a pole on a foundation for a future pole with a different bolt pattern, use a standard pole with an adaptor plate rather than a pole with a modified base plate.
- On divided arterials safety lights shall be installed on signal poles at the BCR and the ECR to backlight the intersections.

**Traffic Signal Conductors**

- Where new conductors are to be added to existing conduit, any existing conductors with THHN or THWN insulation should be replaced. Existing conductors with types of insulation other than THHN or THWN should be examined to see whether they should be replaced.
- Signal cable shall be used on all new installations and for modifications where all the control conductors to a pole shall be replaced.
- Signal cables shall not be spliced or looped. Signal cables shall be provided to each pole in the following manner; one 3-conductor cable for the pedestrian push button; one 5-conductor cable for the pedestrian indications; and either one 12-conductor cable for vehicle indications with overlaps, or a 9-conductor cable for all others.
- The conductor schedule for signal modifications shall be based upon the actual conductors existing at the time of the design and not upon the conductor schedule of the plan used for the construction.
- Safety lighting and internally illuminated street name sign conductors (where applicable) shall not be looped through the controller cabinet and shall use a cable with a minimum #10 AWG conductors for safety lighting and signal commons, and #12 AWG conductors for illuminated street names (when applicable).
- Signal Interconnect Cable (SIC) shall be Fiber Optic Cable.

**Traffic Signal Conduit**

- There shall be at least two 3-inch conduits entering a controller cabinet.
- The maximum allowable conduit fill is 28% for new conduits, and 35% for existing conduits, and shall be shown on the plans on the conductor schedule.
- For modification projects, all existing conduits should be examined to see if they need replacement.
- The possible location of bore pits should be considered when planning the location of conduit runs.
- Minimum new conduit sizes shall be 2-inch for advance detectors, 3-inch for all other applications, and 4-inch for signal interconnect runs.
- Interconnect conduit is to be run adjacent to signal conduits so as to share the same trench, and shall enter a separate #6E pull box adjacent to the controller cabinet prior to entering the cabinet.

**Conductor and Conduit Schedule**

- A conductor and conduit schedule shall be provided for all signal plans, preferably on the same sheet as the signal plan. Use numbers inside triangles to designate conductor runs.
- In the conductor schedule, number the conduit runs from the end of one leg to the end of the other leg so that the conduit runs into the controller cabinet are in the middle of the schedule. Each 3-inch conduit entering the cabinet should be

considered a separate run. Do not number conduit runs between signal poles and adjacent pull box.

### **Traffic Signal Pull Boxes**

- Pull boxes for signal interconnect runs shall be a minimum #6E. All other pull boxes shall be #5 minimum.
- Pull boxes to be installed in unimproved areas, including unimproved areas behind a curb, shall be traffic rated and shall have a pull box marker installed adjacent to the pull box.
- A #6 pull box should be used:
  - At the end of EACH signal conduit exiting the controller cabinet;
  - When four or more conduits enter the pull box; and
  - Adjacent to mast arm poles.
- Pull boxes should not be placed:
  - In painted medians (except where a raised median is planned);
  - In paved shoulder;
  - In the traveled way; and
  - In the boundaries of a wheel chair ramp.

### **Vehicle Detection**

- Vehicle detection for all new traffic signal installations shall be accomplished through the use of inductive loops. Modifications to existing traffic signals that are utilizing machine vision(video detection) may be required to convert to inductive loops at the discretion of the Engineer.
- Presence detection shall include lane-by-lane detection capable of discriminating between vehicles and bicycles; shall provide extension/hold for detected bicycles; shall contain a pre-formed parallelogram loop wired continuously from the loop to the cabinet; shall be installed across the entire width of each travel lane plus 12 inches of overhang; and shall be installed at a 45 degree angle to approaching traffic.
- Provide two 6-foot diameter loops in each left turn lane behind the presence loops.
  - Place the first loop 15 feet behind the presence loop, measured along the center of the lane, from edge-of-loop to edge-of-loop.
  - Where approach speeds are less than or equal to 40 mph, separate the two circular loops by 45 feet from edge to edge.
  - Where approach speeds are greater than 40 mph, separate the two circular loops by 55 feet from edge to edge.
- Badly damaged pavement shall be identified to be replaced before installing loop detectors.
- Assign the detector loop sets, or areas of video detection, to controller detector inputs as follows:

<b>Detection Area</b>	<b>Label on Plan</b>	<b>Input Channel</b>
Southbound L/T No. 1 Bike/Veh	1B-N-Ø1	1
Southbound L/T No. 2 Bike/Veh	2B-N-Ø1	2
Southbound L/T Count	1C-N-Ø1	3
Southbound L/T Advance	1A-N-Ø1	4
Southbound Thru No. 1 Bike/Veh	1B-N-Ø6	5
Southbound Thru No. 2 Bike/Veh	2B-N-Ø6	6
Southbound Thru No. 3 Bike/Veh	3B-N-Ø6	7
Southbound Thru Count	1C-N-Ø6	8
Southbound Thru Advance	1A-N-Ø6	9
Southbound Striped Bike Lane	4B-N-Ø6	10
Westbound L/T No. 1 Bike/Veh	1B-E-Ø3	11
Westbound L/T No. 2 Bike/Veh	2B-E-Ø3	12
Westbound L/T Count	1C-E-Ø3	13
Westbound L/T Advance	1A-E-Ø3	14
Westbound Thru No. 1 Bike/Veh	1B-E-Ø8	15
Westbound Thru No. 2 Bike/Veh	2B-E-Ø8	16
Westbound Thru No. 3 Bike/Veh	3B-E-Ø8	17
Westbound Thru Count	1C-E-Ø8	18
Westbound Thru Advance	1A-E-Ø8	19
Westbound Striped Bike Lane	4B-E-Ø8	20
Northbound L/T No. 1 Bike/Veh	1B-S-Ø5	21
Northbound L/T No. 2 Bike/Veh	2B-S-Ø5	22
Northbound L/T Count	1C-S-Ø5	23
Northbound L/T Advance	1A-S-Ø5	24
Northbound Thru No. 1 Bike/Veh	1B-S-Ø2	25
Northbound Thru No. 2 Bike/Veh	2B-S-Ø2	26
Northbound Thru No. 3 Bike/Veh	3B-S-Ø2	27
Northbound Thru Count	1C-S-Ø2	28
Northbound Thru Advance	1A-S-Ø2	29
Northbound Striped Bike Lane	4B-S-Ø2	30

Eastbound L/T No. 1 Bike/Veh	1B-W-Ø7	31
Eastbound L/T No. 2 Bike/Veh	2B-W-Ø7	32
Eastbound L/T Count	1C-W-Ø7	33
Eastbound L/T Advance	1A-W-Ø7	34
Eastbound Thru No. 1 Bike/Veh	1B-W-Ø4	35
Eastbound Thru No. 2 Bike/Veh	2B-W-Ø4	36
Eastbound Thru No. 3 Bike/Veh	3B-W-Ø4	37
Eastbound Thru Count	1C-W-Ø4	38
Eastbound Thru Advance	1A-W-Ø4	39
Eastbound Striped Bike Lane	4B-W-Ø4	40

- Replace bike/vehicle presence detection with conventional 6-foot diameter loop detection from the through lanes when there is a corresponding striped bike lane in the same direction of travel.
- Approach speed is the posted speed limit or the current 85th percentile speed of the approaching traffic, whichever is greater. For new intersections use the design speed.
- Advanced detection should be provided on all approaches to an intersection and should be located in accordance with the CA MUTCD Table 4D-101 (for speeds between the values shown, use the next highest value)

#### **Emergency Vehicle Preemption**

- Install Opticom Model 722 optical detectors and model 138 detector cables in all new and modified traffic signals. Install one optical detector for each approach at all signalized intersections. The placement of the optical detectors shall take into consideration horizontal and vertical curves in the roadway, and other obstructions to ensure proper communications with the approaching emergency vehicle.
- Discriminator modules shall be Opticom Model 752 and fully compatible with NEMA TS-1 and TS-2.

#### **Street Name Signs**

- The traffic signal shall include a street name sign mounted horizontally on a davit arm above the mast arm on the main signal pole. Unless specifically required to be illuminated, street name signs shall be reflective, as per city standards.

#### **Utility Clearance**

- It is the design engineer's responsibility to ascertain and provide for the minimum clearance requirements between the signal and/or lighting equipment and overhead utility lines, utility poles, and railroad tracks.

**Traffic Signal Electrical Service**

- The electric service (SCE) point of connection shall be determined and shown on the plan at the time of first plan submittal.
- The service enclosure shall be precisely located on the plans with corresponding dimensioning a minimum of 10 feet from the controller cabinet, shall be Type III-CF, and placed such that a street crossing between the Edison service point and the enclosure is not required. The placement of the enclosure shall take into consideration the possible impacts to intersection visibility.
- A modification of the existing service shall be required when adding circuits (even if future) for luminaires and IISNS (if applicable).
- The design shall provide separate lighting circuits, 30-amp circuit breaker for each 1200 watts or portion thereof, and the correct number of conductors in the service run for each circuit in the service.

**Vehicle Signal Heads**

- All vehicle signal faces shall have 12-inch LED indications and have back plates.
- All side mounted heads (vehicular and pedestrian) shall have terminal compartments.
- All mast arm mounted indications shall use MAS mountings.
- Left turn signal faces shall consist of conventional 12-inch red arrow, yellow arrow, and green arrow sections. Older existing configurations with mixed indications of green arrow, and circular yellow and red lenses shall be replaced with an all-arrow configuration as part of any modification project.
- Provide a near, right side indication whenever the distance from the limit line to the indications controlling that movement exceeds 150 feet.
- The distance from the limit line to mast arm mounted signal faces shall be at least 70 feet.
- Provide two mast arm mounted through signal faces whenever the number of through lanes exceeds two, located as close as practicable such that:
  - One face is in line with the lane stripe between the first and second through lanes, and one face is in line with the lane stripe between the second and third through lanes of a three-lane approach.
  - One face is in line with the lane stripe between the first and second through lanes, and one face is in line with the lane stripe between the third and fourth through lanes of a four-lane approach.
- Mast arm mounted left turn signal faces are normally located as close as practicable to the following:
  - One face in line with, but no further out than, the center of a one-lane left turn approach.
  - One face in line with the stripe between the two lanes of a two-lane left turn approach.

**Pedestrian Signal Heads**

- Pedestrian signal heads shall be GT1 LED Countdown type, 16 inch by 18 inch, with a full hand and man symbol. They shall be located such that there is minimum visibility interference from vehicles stopped at the crosswalk or limit line.

**Phase Diagram**

- A phase diagram shall be provided.

**Pole and Equipment Schedule**

- A pole and equipment schedule shall be provided for all signal plans, preferably on the same sheet as the signal plan. Use letters inside circles to designate poles.
- The precise location of poles shall be shown on the schedule by indicating lateral dimensions to either side of the BCR or ECR, as the case may be, and shall show the dimension from the curb face to the center of the pole. The minimum allowable setback shall be 5 feet from curb face to center of pole. The designer is to take all measures, including potholing if necessary, to ensure there are no conflicting utilities at proposed pole locations. The final location of all poles to be approved by City staff in the field prior to construction.

**Railroad Pre-Emption**

- A twelve-conductor signal cable shall be provided between the traffic signal controller cabinet and the railroad crossing cabinet. All other Railroad Pre-Emption design elements will be determined at the time of design in consultation with City, Railroad, and California Public Utilities Commission (PUC) staff.

**Pedestrian Push Buttons and Posts**

Pedestrian Push Button (PPB) posts shall be avoided to the extent possible by considering striping changes to the plans, or alternative pole locations. When needed, PPBs shall be shown on the plans using the correct Caltrans symbol. Install R9-3a signs, and corresponding pedestrian barricades at locations where marked crosswalks are not provided and pedestrian crossings are not allowed.

- At corners:

PPBs that are to be mounted on a signal standard should be within 5 feet of the crosswalk (or where a marked crosswalk will be if it has not yet been installed). If the signal standard cannot be located in this area, a separate PPB post should be installed.

In medians:

PPBs that are placed within a raised median shall be 2 feet behind the nose of the median, or 2 feet behind the farthest prolongation of the pedestrian opening through the median. There shall be no traffic signs mounted on any PPB post, and no PPBs are to be installed in raised medians narrower than 4 feet.

### **Traffic Signal Modifications**

- On modification plans, show design or model numbers for all existing special poles, especially concrete, where such information exists on City drawings or can be obtained in the field.
- Modify or replace existing pedestrian indications and PPB signs to comply with Special Provisions (i.e. convert to Caltrans Type A with International Symbols.)
- Call for installation of backplates where none exist. In some cases this will require modification of existing signal mounting hardware.
- In pole schedules on modification plans, provide notes/remarks indicating: (E) existing to remain, (N) new equipment or pole, (R) relocate equipment to new pole or pole to new location, (M) modify existing. If appropriate, note if all are existing or new.
- Where installing additional or new indications on existing poles, call for either new installation, replacement, or modification of signal mounting hardware; not two or more choices. The designer should make the choice based on present condition of equipment and/or ease of, or cost of, modifications.

### **Intersection Safety Lighting**

- Safety lighting circuits(120-volt), internally illuminated street name sign circuits(120-volt)(when applicable), and street lighting circuits(240-volt) shall be independent of each other.
- Intersection safety lights shall be of the LED type, 157-watt GE Luminaire Order No. ERM-0-C3-43-2-Gray.

## **1.4 Street Light Plans**

The following standards shall be applied to all Street Light Plans:

- The scale of the plan shall be 1 inch equals 40 feet, or 1 inch equals 20 feet.
- The drawing title shall list the name of the street upon which the lights are located on and a corresponding cross street name.
- Street Light plans are identified by "L-.." drawing numbers.
- Show all utilities.
  - If applicable, indicate possible conflicts with irrigation systems, and identify corrective action to be taken by Contractor should damage occur.
- Where Street Light improvements exist, or are proposed on private property (behind ROW line), indicate existence of, or need for, encroachment and maintenance easements. Appropriate easements must be provided prior to approval of plans for private developments. On City projects, coordinate acquisition with City personnel.
- Dimension all street and lane widths and utility locations. Provide dimension between centerline and curb.



- In areas without sidewalk, provide for the installation of such within the curb return area to the back side of the pole caps and across the front of the service cabinets.
- Street light standards, mast arms and equipment shall be designed for maximum case arm loading of 100 mph wind velocity.
- It is the design engineer's responsibility to ascertain and provide for the minimum clearance requirements between the lighting equipment and overhead utility lines, utility poles, and railroad tracks. The design engineer shall obtain approval from Edison for overhead clearance per CAL/OSHA Electrical Safety Order 2946 with a minimum clearance of 10 feet from overhead high voltage lines and street lights.
- Provide separate lighting circuit and 30-amp, 240-volt breakers for each direction or portion thereof from the service with a minimum of 4 circuits.
- Provide correct number of conductors in service runs for each circuit in the service with a #5 pull box in front of the service per the City Standard Drawings 5105 and 5106.
- The owner shall be responsible for all costs associated with the operation and maintenance of the street lighting/traffic signal facilities and appurtenances. A signed Consent and Waiver annexation form to the appropriate Landscape and Lighting Districts shall be filed with the City Engineer's office. This form and applicable fee can be obtained from the Engineering Department's Assessment and Consulting Services section by contacting General Services at (909) 395-2016.
- This form shall be fully executed, notarized by all the record owner(s) of the property, and recorded with the San Bernardino County Recorder's office. This original recorded document and a copy shall be submitted to the City Engineer's office, Engineering Services/Land Development Section, prior to the issuance of a building permit or final approval of the subdivision map, whichever occurs first, along with the payment of the applicable fee for annexing the property to the appropriate District.

### **Location of Street Lights**

- Intersections:
  - Two minimum on local residential and industrial intersections;
  - Four, one each on opposite corners, where one of the streets has a curb separation of 64 feet or greater.
- Between intersections with staggered spacing as follows:
  - Local residential curb separation 40 feet or less, 130 feet  $\pm$  15 feet;
  - Local industrial curb separation 48 feet or less, 180 feet  $\pm$  15 feet;
  - Collector street curb separation 64 feet or less, 160 feet  $\pm$  15 feet;
  - Standard arterial curb separation 76 feet or less, 122 feet  $\pm$  15 feet;
  - Divided arterial curb separation 94 feet or less, 170 feet  $\pm$  15 feet opposed;

- Divided arterial curb separation 128 feet or less, 120 feet ± 15 feet opposed.
- Attempt to place near lot lines, but allow clear sight distances for survey ties.
- Sharp curves, steep hills and other street conditions as deemed necessary by the City Engineer.
- Alleys, where warranted by extreme situations resulting in severe problems.

#### **Installation Required of Developers**

- Mandatory for all subdivisions and developments requiring a building permit in accordance with Sections A & B, except:
  - Remodels and additions less than 25% of the existing structures, where no street improvements are required but shall pay an in-lieu fee for a portion of a street light.
  - Existing Edison lights shall be replaced with City standard lights.

**See the next page for additional Street Light information:**

<i>Roadway Section</i>	<i>Lamp Group</i>	<i>Pole Spacing</i>	<i>Configuration</i>	<i>Old Lamp</i>	<i>Lamp Type</i>	<i>Std. Dwg. Pole Type</i>	<i>Watts</i>	<i>Mfg</i>	<i>Luminaire Order No.</i>
36/40-Foot Local Street Section	I	130'±15'	Staggered	70 HPS	LED	5101-Type B	55	BetalED	STR-LWY-2M-HT-03-D-UL-SV-525-43K-R-UTL
48-Foot Local Industrial Street Section	II	180'±15'	Staggered	100 HPS	LED	5101-Type A	49	GE	ERMIC-0-A7-B-2-GRAY
64-Foot Arterial/Collector Street Section	III	160'±15'	Staggered	150 HPS	LED	5101-Type C	46	Leotek	GCA1-40E-MV-NW-2M-GY-350-WL
76-Foot Arterial/Collector Street Section	IV	122'±15'	Staggered	250 HPS	LED	5101-Type C	70	BetalED	STR-LWY-2M-HT-04-D-UL-SV-525-43K-R-UTL
82-Foot Arterial/Collector Street Section	VI	162'±15'	Opposed	250 HPS	LED	5101-Type C	80	GE	ERMIC-0-A4-43-2-GRAY
84-Foot Arterial/Collector Street Section	V	130'±15'	Staggered	250 HPS	LED	5101-Type C	71	Leotek	GCA1-40E-MV-NW-2M-GY-350-WL
94-Foot Principal Arterial Street Section	VII	148'±15'	Opposed	250 HPS	LED	5101-Type C	104	BetalED	STR-LWY-3M-HT-0
72-Foot Principal Arterial Street Sections	VIII	175'±15'	Opposed	250 HPS	LED	5101-Type C	115	GE	ERMIC-0-A3
84-Foot Principal Arterial Street Sections	IX	160'±15'	Opposed	250 HPS	LED	5101-Type C	105.8	Leotek	GCA1-60E-MV-N
108-Foot Principal Arterial Street Sections	XI	140'±15'	Opposed	250 HPS	LED	5101-Type C	107	BetalED	STR-LWY-3M-HT
136-Foot Principal Arterial Street Section	XII	118'±15'	Opposed	250 HPS	LED	5101-Type C	127	GE	ERMIC-0-A6

\*Please reference the "Approved Material List LED Luminaires" document on the Engineering Department website under Design Documents.

## 2.0 ACCESS GUIDELINES

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The access management guidelines pertain to the following listed items:

- Traffic signal spacing
- Cross street spacing
- Median breaks
- Right turn lanes (deceleration lanes)
- Driveway spacing
- Spacing of opposing driveways
- Corner clearance standards at intersections

### 2.1 Traffic Signal Spacing

Traffic signals are allowed at one-quarter mile spacing. Any proposed signal at less than one-quarter mile spacing must be applied for, with the applicant solely responsible for the signal's cost. The applicant must provide a traffic study that shows that the additional signal can be accommodated without significantly disrupting the progressive flow of traffic in the circulation system by preserving the minimum "through-band" width of the affected street. The traffic study shall include a simulation analysis for any new signal that is proposed to be spaced less than one-quarter mile.

### 2.2 Cross Street Spacing (3 or 4 leg intersections with full access)

<i>Road classification</i>	<i>All land-use categories</i>
Principal Arterials	1320 feet
76 to 84-Foot Arterial/Collector Buildout ADT < 20k Buildout ADT >20k	660 feet 1320 feet
64-Foot Arterial/Collector	660 feet

### 2.3 Median Breaks

<i>Road classification</i>	<i>All land-use categories</i>
Principal Arterials <ul style="list-style-type: none"> <li>• eight or six lanes</li> <li>• four lanes</li> </ul>	<ul style="list-style-type: none"> <li>• Breaks at signal controlled intersections only</li> <li>• Left ingress can be considered on a case-by-case basis</li> </ul>
76 to 84-Foot Arterial/Collector	City may require full or partial raised medians on a case-by-case basis in order to control left turn in and/or out movements.

64-Foot Arterial/Collector	City may require full or partial raised medians on a case-by-case basis in order to control left turn in and/or out movements.
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**2.4 Right Turn Lanes (Deceleration Lanes) at Driveways**

<i>Posted or Prima Facie Speed Limit</i>	<i>Number of Right Turn Vehicles per Hour</i>
45 mph or less	80 – 125
Over 45 mph	35 – 55

If the speed limit has not been determined, use the design speed minus 5 mph.

The lower threshold of 80 right turn vehicles per hour is for higher volume roadways (greater than 600 vehicles per hour per lane), or on two-lane roads where lateral movement is restricted. The higher threshold of 125 right turn vehicles per hour is most appropriate on lower volume roadways, multilane highways, or driveways with an entry radius of 50 feet or greater.

The lower threshold of 35 right turn vehicles per hour is for higher volume two-lane roadways where lateral movement is restricted. The higher threshold of 55 right turn vehicles per hour is most appropriate on lower volume roadways, multilane highways, or driveways with an entry radius of 50 feet or greater.

**2.5 Driveway Spacing**

<i>Road Classification</i>	<i>Commercial and Multi-Family Residential</i>	<i>Industrial</i>	<i>Town Center</i>	<i>Single Family Residence</i>
Principal Arterial eight lanes six lanes four lanes	660 feet 330 feet 330 feet	660 feet 330 feet 330 feet	660 feet 330 feet 330 feet	Not allowed Not allowed Not allowed
76- to 84-Foot Arterial/Collector	330 feet	330 feet	330 feet	Not allowed
64-Foot Arterial/Collector	165 feet	165 feet	165 feet	165 feet (if build out volume is less than 8000 ADT)

Distances measured from centerline to centerline.

## 2.6 Opposing Side Driveway Spacing on Streets without Restrictive Medians

Opposing side street driveways on streets without restrictive medians shall be aligned or with a minimum spacing of 330 feet on 76- to 84-foot Arterial/Collectors, and 165 feet on 64-foot Arterial/Collectors measured from centerline to centerline.

## 2.7 Corner Clearance Standards at Intersections

<b><i>With Restrictive Median</i></b>		
<b><i>Position</i></b>	<b><i>Access Allowed</i></b>	<b><i>Minimum (feet)*</i></b>
Approaching intersection	Right in/right out	115
Approaching intersection	Right in only	115
Departing intersection	Right in/right out	230 (125)**
Departing intersection	Right out only	100
<b><i>Without Restrictive Median</i></b>		
<b><i>Position</i></b>	<b><i>Access Allowed</i></b>	<b><i>Minimum (feet)*</i></b>
Approaching intersection	Full access	230 (125)**
Approaching intersection	Right in only***	100
Departing intersection	Full access	230 (125)**
Departing intersection	Right out only***	100

\* Reduced minimums may be accepted when access to corner property cannot otherwise be provided. Subject to approval by city traffic engineer on a case-by-case basis.

\*\* At posted speed limit of 35 mph or less, may use the measurements in parentheses.

\*\*\* right in/right out, right in only, and right out only connections on roads without restrictive medians shall, by the design of the connection, effectively eliminate unpermitted movements.

For corner properties where access is possible on at least two sides, access from the lower classification street is preferred. Distances measured from the curb return.

## 3.0 ROUNDABOUT DESIGN

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The purpose of the Roundabout Design Guideline is to provide guidance for the geometric and aesthetic design of roundabouts. While these guidelines recommend certain limits for good roundabout design, they cannot direct the design engineer to a specific, optimal design.

Roundabouts need to be evaluated and designed on a case-by-case basis taking into consideration the physical characteristics of the location, orientation of the approaches to the circular intersection, proposed intersection operating conditions, planned land uses, plus the safety and mobility needs of all motorists, bicyclists, and pedestrians that will be using the facility.

### 3.1 Roundabout Layout Features

The City realizes that the use of roundabouts has become a desired alternative to the traditional intersection. The benefits of reduced delay and its traffic calming ability make it a good alternative. The City of Ontario has decided that roundabouts shall only be considered at intersections with single lane approaches.

Each roundabout creates a unique challenge to the designer, and no two roundabouts can truly be the same. Using the Federal Highway Administration (FHWA) technical publication *Roundabouts: An Informational Guide*, the City has chosen the Urban Single Lane Roundabout. The inscribed circular diameter of the proposed roundabouts shall range between 100 and 130 feet, and should be designed in 10-foot increments (100, 110, 120 and 130 feet). The center island shall have an 8-inch curb face, and may provide a traversable apron to accommodate truck traffic. The City has selected the design vehicle as the WB-50. Turning paths must be verified and provided to the City for approval of the roundabout. The circulatory roadway width shall provide a minimum of 2 feet between the outside edge of the design vehicle tire track and the curb line.

Some of the other features that the roundabout shall incorporate are raised splitter islands on all legs. All approaches shall provide a minimum 150-foot tangent from the yield line to the extended curb line of the first intersecting roadway. Also, there shall be no driveways within the roundabout or the 150-foot tangent approaches. Crosswalk locations shall be properly marked and shall be placed 25-feet behind the yield line, with splitter islands providing a 10-foot wide crosswalk cut. Adequate lighting shall be provided at the roundabout, crosswalks and approaches per City Standards. For additional guidance, see Figure 1: Roundabout Layout Detail.

### 3.2 Roundabout Landscape Features

Landscaping the central island of the roundabout can enhance the safety by making the intersection a focal point and by lowering speeds. For this reason, the City has developed some guidelines for the overall design of the central island. Using the FHWA technical publication *Roundabouts: An Informational Guide* for intersection sight distance, certain areas (or zones) within the central island have been identified as either "Restricted Landscape" or "Limited Use Landscape". These zones vary depending on the size of the roundabout, and are defined on Figure 2: Roundabout Landscape Detail.

The Restricted Landscape Zone, which encompasses the outer edge of the central island, was identified to ensure the necessary sight distances are satisfied for vehicles using the roundabout. This area should have a slope no greater than 2%, with a mature plant height not to exceed 24 inches.

The Limited Use Landscape Zone, which is the inner portion of the central island, will allow for placement of fixed objects and landscaping such as trees. All landscape features and fixed objects proposed in this location are subject to review and approval by the City of Ontario Engineering, Planning and Facilities Departments. This area should have a slope no greater than 6:1 per the requirements of the AASHTO *Roadside Design Guide*.

Satisfaction of these guidelines does not guaranty approval, and each roundabout shall be reviewed by the City on a case by case basis. In addition to the guidance offered by this document, the design engineer shall also adhere to the specific roundabout design procedures and practices found in the following publications:

- FHWA technical publication *Roundabouts: An Informational Guide*
- Caltrans Design Information Bulletin Number 80-01 (DIB 80-01)



## 4.0 CHOKER PLACEMENT

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The purpose of this section is to provide general guidance for the placement of chokers in residential tracts. While these guidelines, along with **Error! Reference source not found.3**, recommend certain criteria for the placement of chokers, the final locations are subject to the review and approval of the City Engineer.

The following should be considered during the design and placement of chokers:

- Chokers shall not be installed on any street with a 64-foot or greater Section.
- Chokers shall not be installed at knuckles.
- Chokers shall not be placed on one-lot deep entrance roadways.
- Chokers shall not be placed on streets terminating in a cul-de-sac where the tangent section from ECR to beginning of cul-de-sac is less than or equal to 100 feet.
- Chokers shall not be placed in alleys.
- Chokers shall not be placed on the top of “tee” intersections.
- Chokers shall not be placed on the roadway section connecting two offset intersections where the length of offset is less than or equal to 150 feet, centerline to centerline.
- All chokers shall be designed in accordance with City Standard Drawing 1110.
- Parking shall be restricted from the beginning of the choker transition to the beginning/end of the curb return, including any tangent section within the reduced pavement width area.

## 5.0 MONUMENT PLACEMENT

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The City of Ontario has developed the following guidelines to guaranty that intersection sight lines and pedestrian safety are preserved. The intended purpose of this guideline is to provide instruction to developers when it comes to the placement of monuments within the public street right-of-way. The following exhibits provide guidance on four common sample cases that were analyzed and schematically depicted. Below is a list of the assumptions for each case:

- Case 1 (See Figure 4) –Approach speed limit  $\leq 30$  mph, curb return radius =25 feet, and one of the following apply:
  - Approach has a trap right-turn lane
  - Approach has a shared through/right-turn lane
  - Approach has a dedicated right-turn pocket  $\geq 195$  feet
- Case 2 (See Figure 5) –Approach speed limit  $\leq 30$  mph, curb return radius =25 feet, and the following applies:
  - Approach has a dedicated right-turn pocket  $< 195$  feet
- Case 3 (See Figure 6) –Approach speed limit  $> 30$  mph, curb return radius =35 feet, and one of the following apply:
  - Approach has a trap right-turn lane
  - Approach has a shared through/right-turn lane
  - Approach has a dedicated right-turn pocket  $\geq 300$  feet
- Case 4 (See Figure 7) – Approach speed limit  $> 30$  mph, curb return radius =35 feet, and the following applies:
  - Approach has a dedicated right-turn pocket  $< 300$  feet

The above cases are applicable for any intersection, including traffic signal, all-way stop, or side street stop controlled. Monuments shall not be placed on any roadway with a posted speed limit  $> 40$  mph.

Figure 8 is included to show some of the exceptions and provide general guidance in situations not covered in the common sample cases.

The developer will be responsible to schematically provide the sightlines and distances X1, X2, Y1, Y2 on all plans where required by the City (in most cases the street improvement plans and landscape plans are adequate). Failure to provide this information will delay the acceptance of the plans. Cases not covered in this document shall be analyzed using the principles developed in these guidelines. Satisfaction of the guideline does not guaranty approval of monument locations. Final locations within the public street right-of-way are subject to review and approval by the City Engineer.

APPENDIX A  
FIGURES

Figure 1: Roundabout Layout Detail

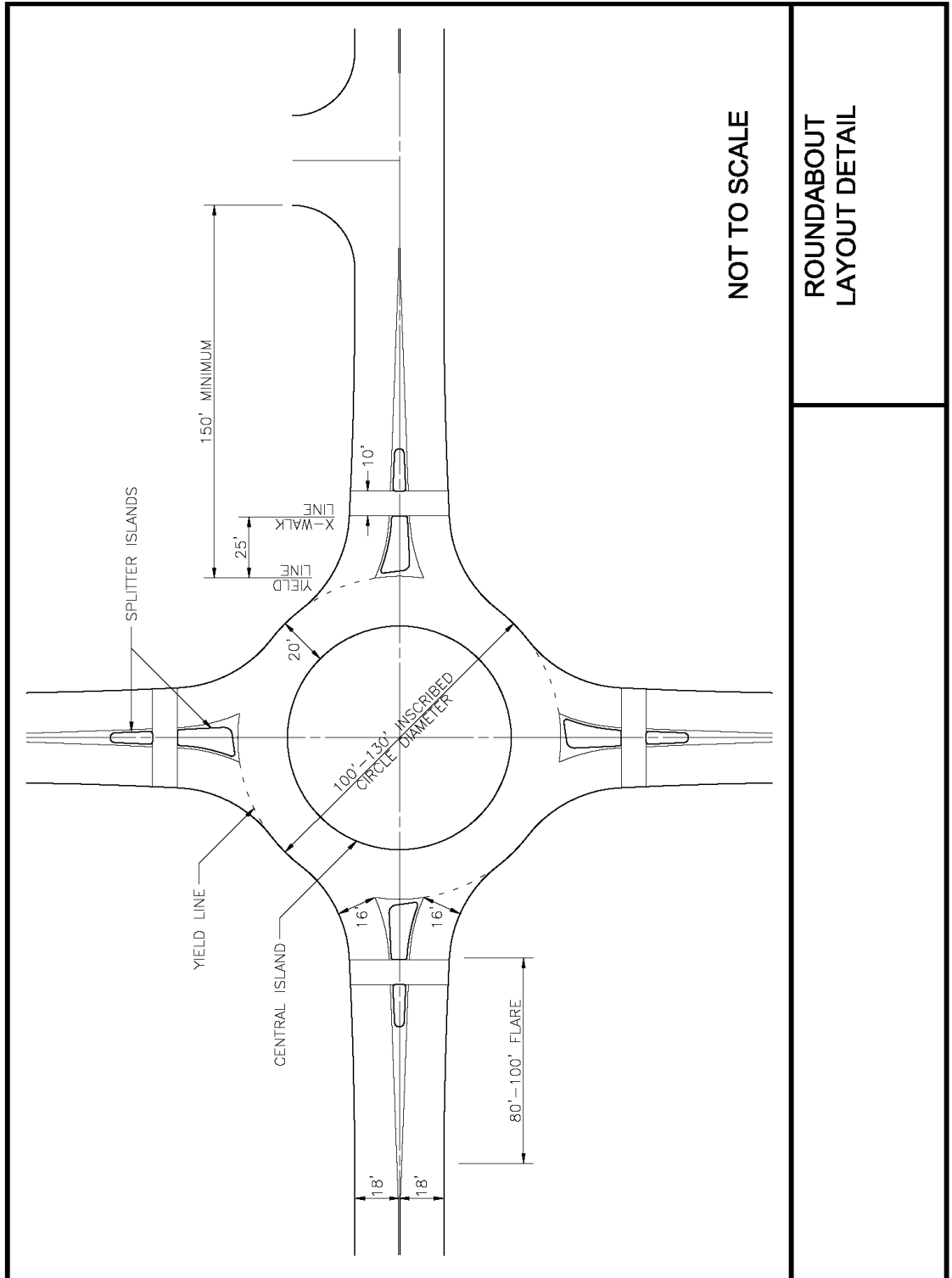


Figure 2: Roundabout Landscape Detail

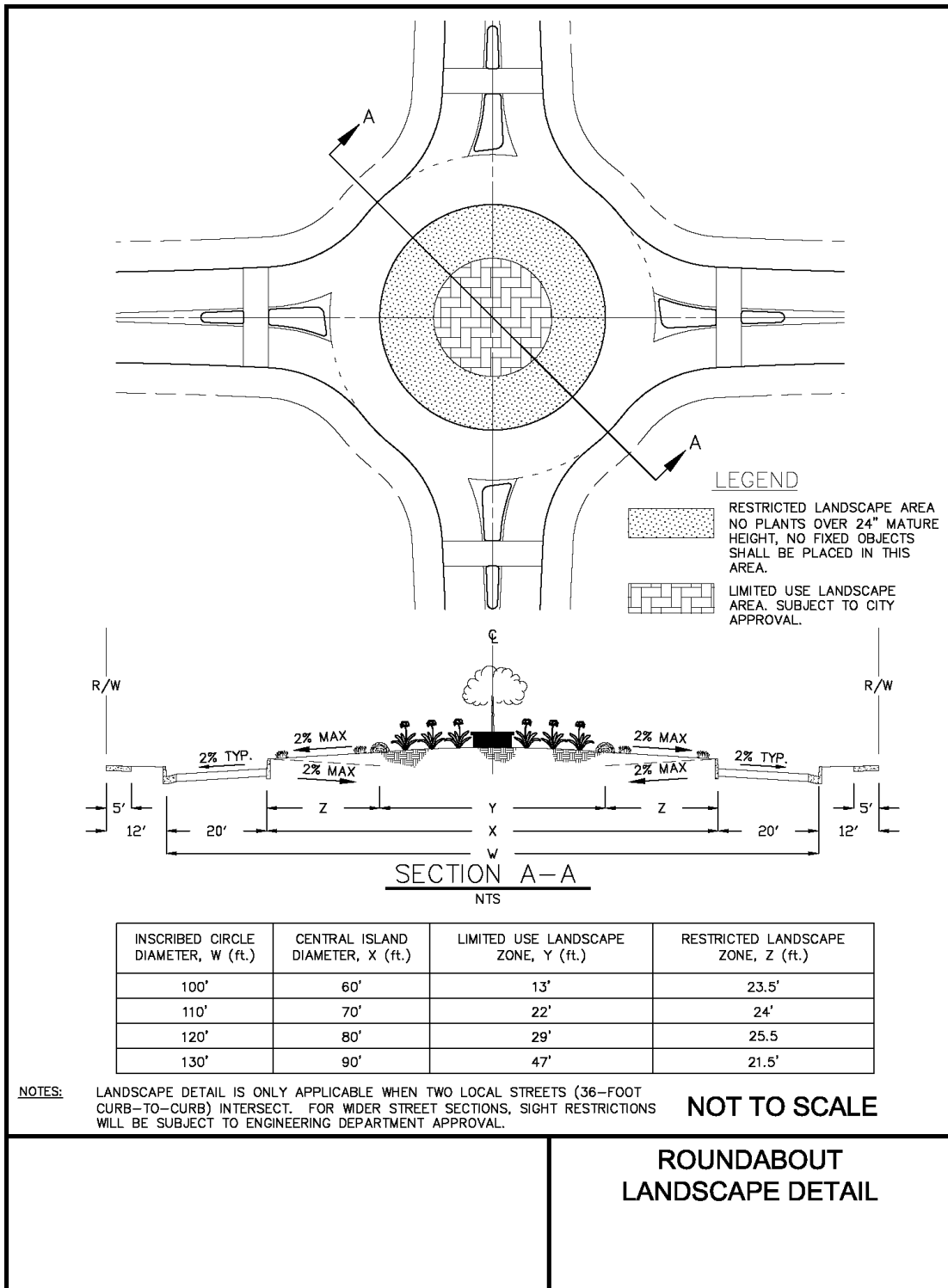


Figure 3: Choker Placement Guidelines

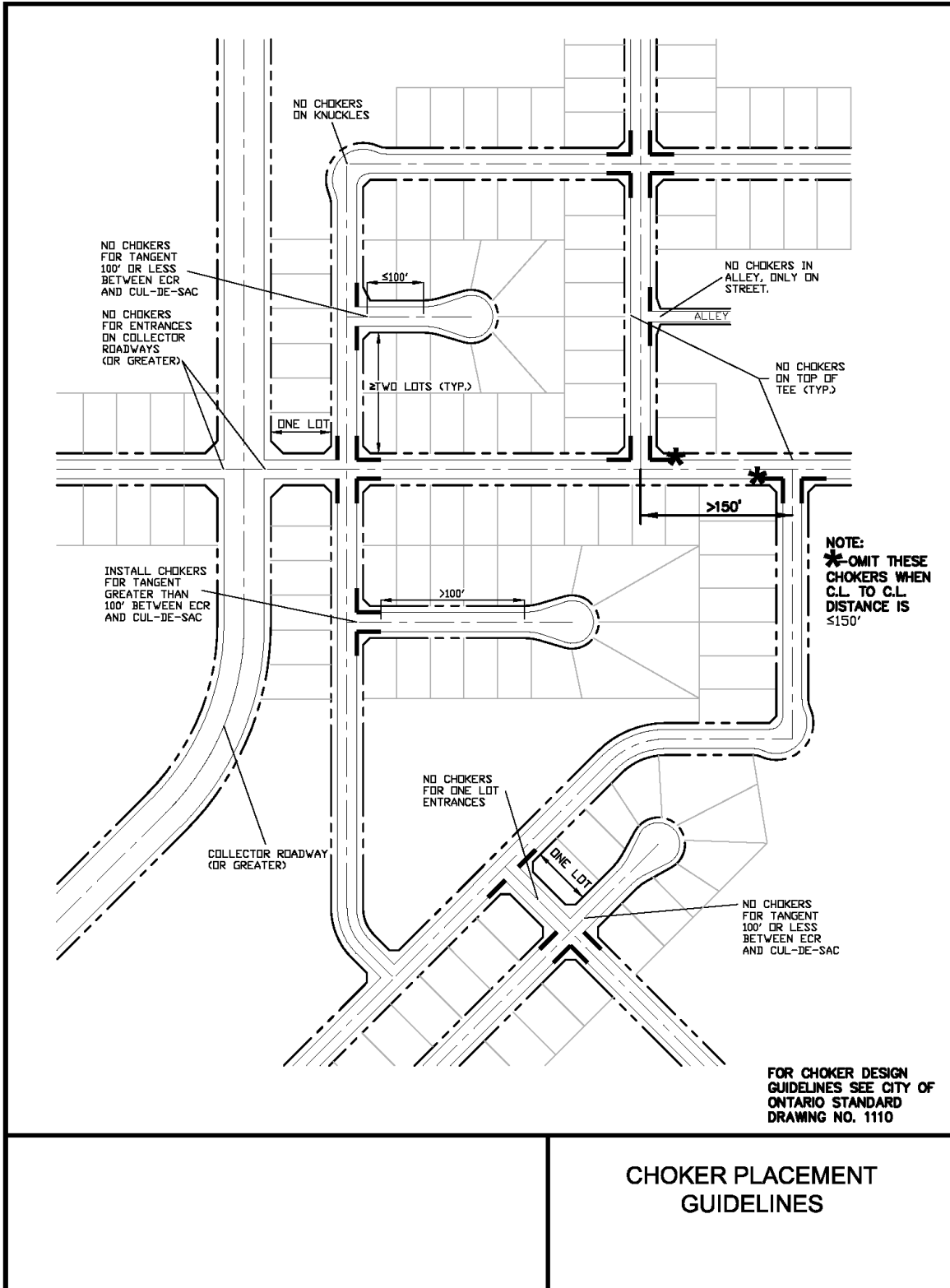


Figure 4: Monument Placement Case 1

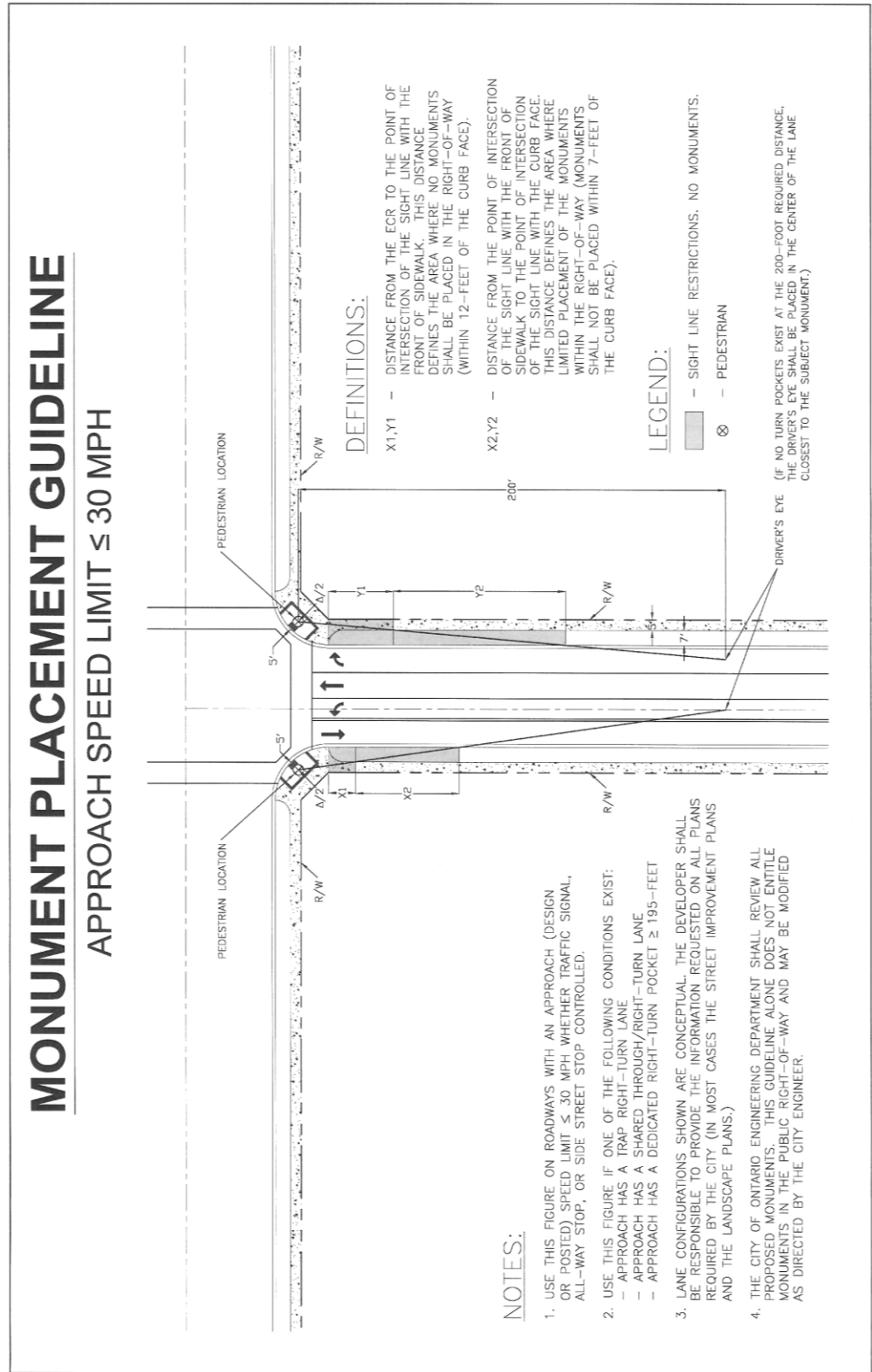


Figure 5: Monument Placement Case 2

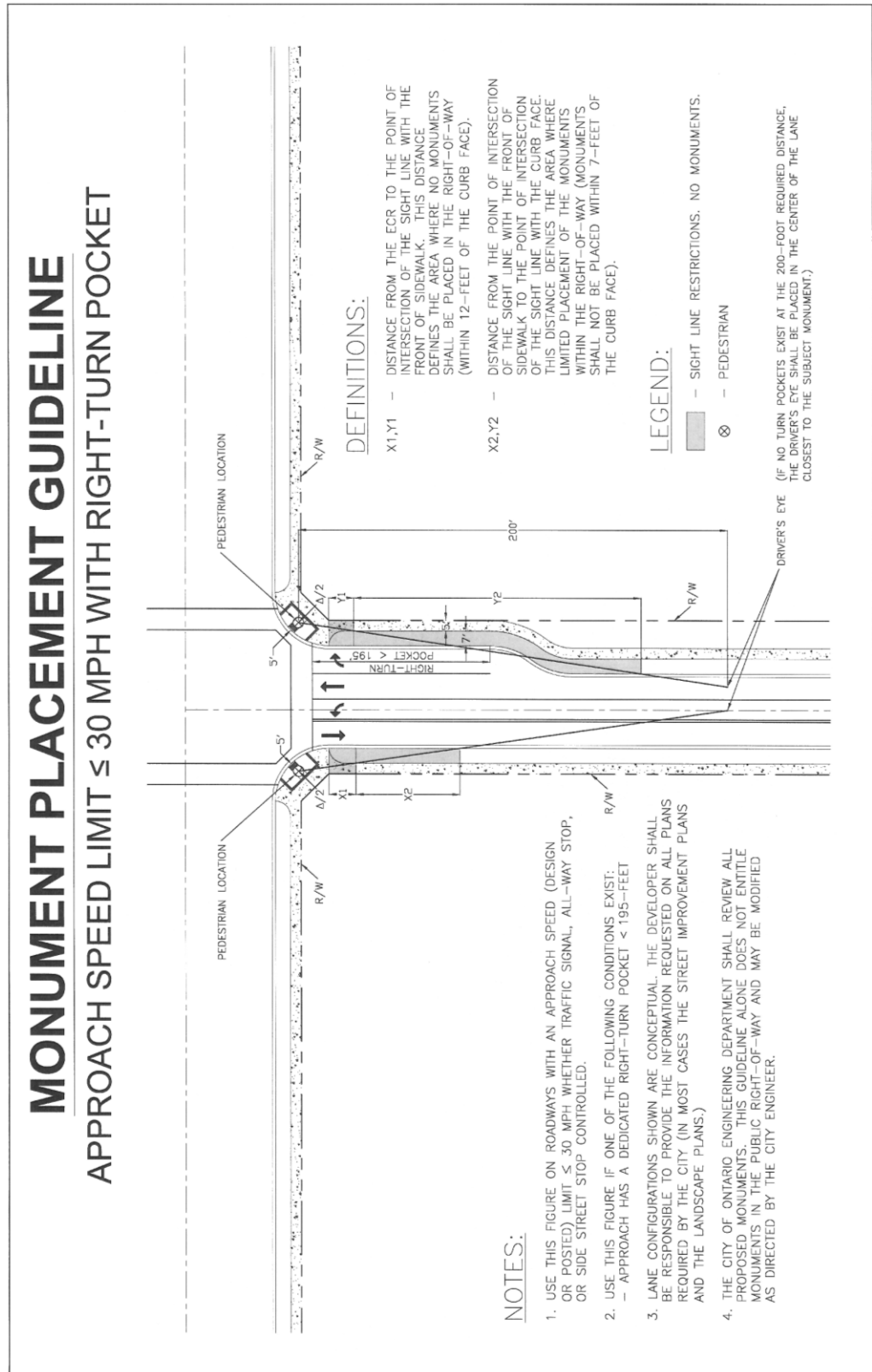




Figure 6: Monument Placement Case 3

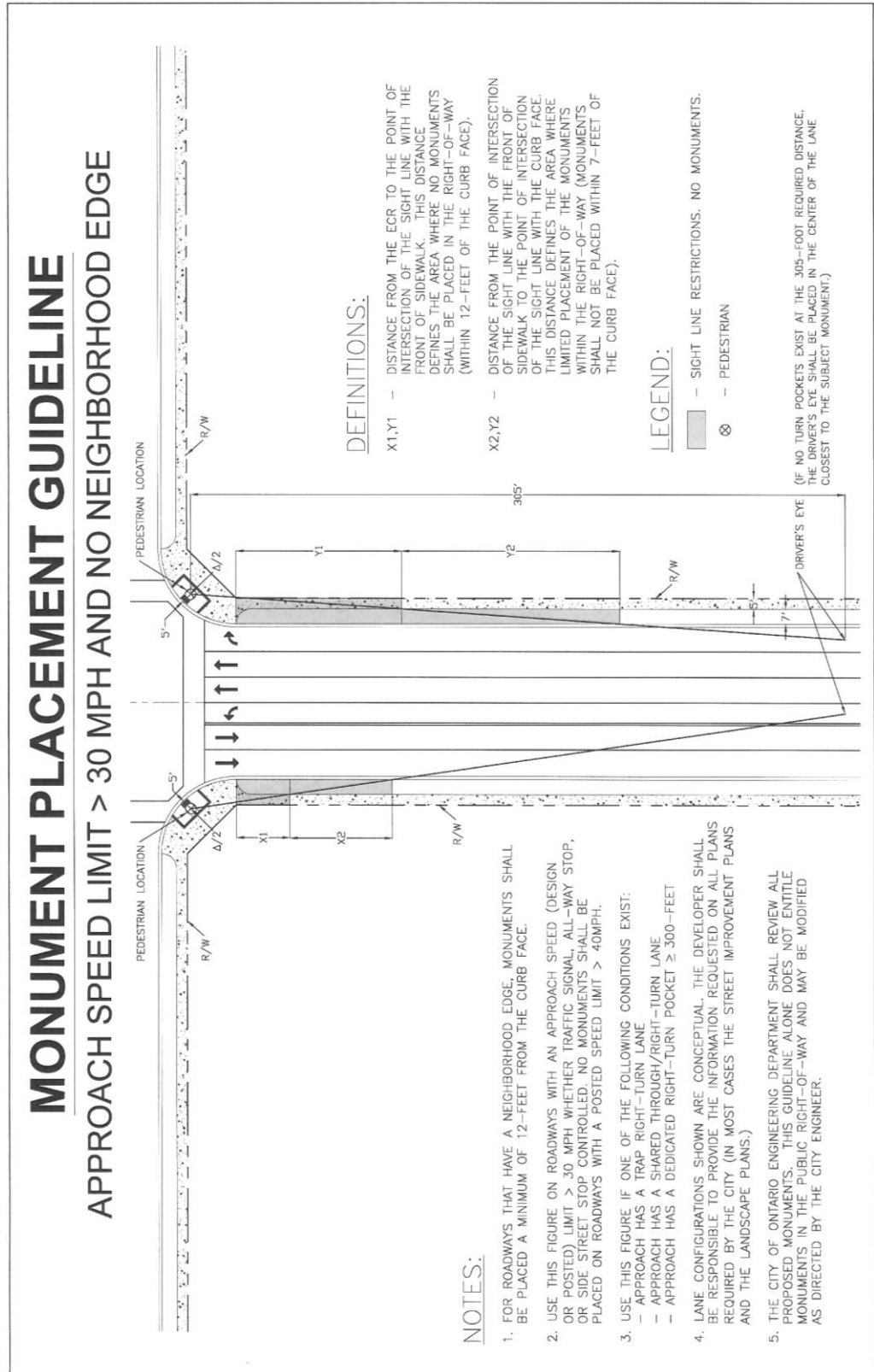


Figure 7: Monument Placement Case 4

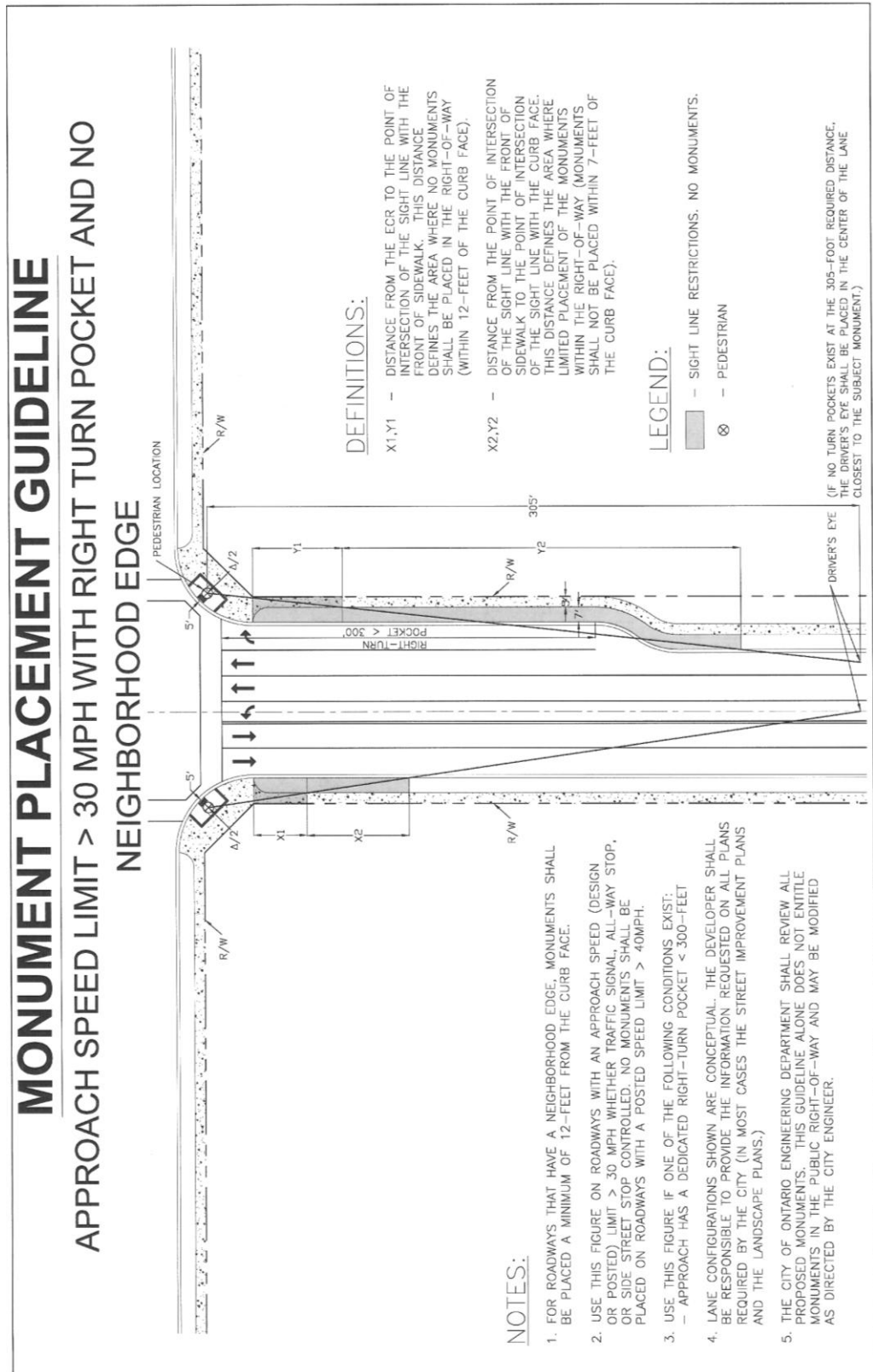


Figure 8: Monument Placement Special Cases

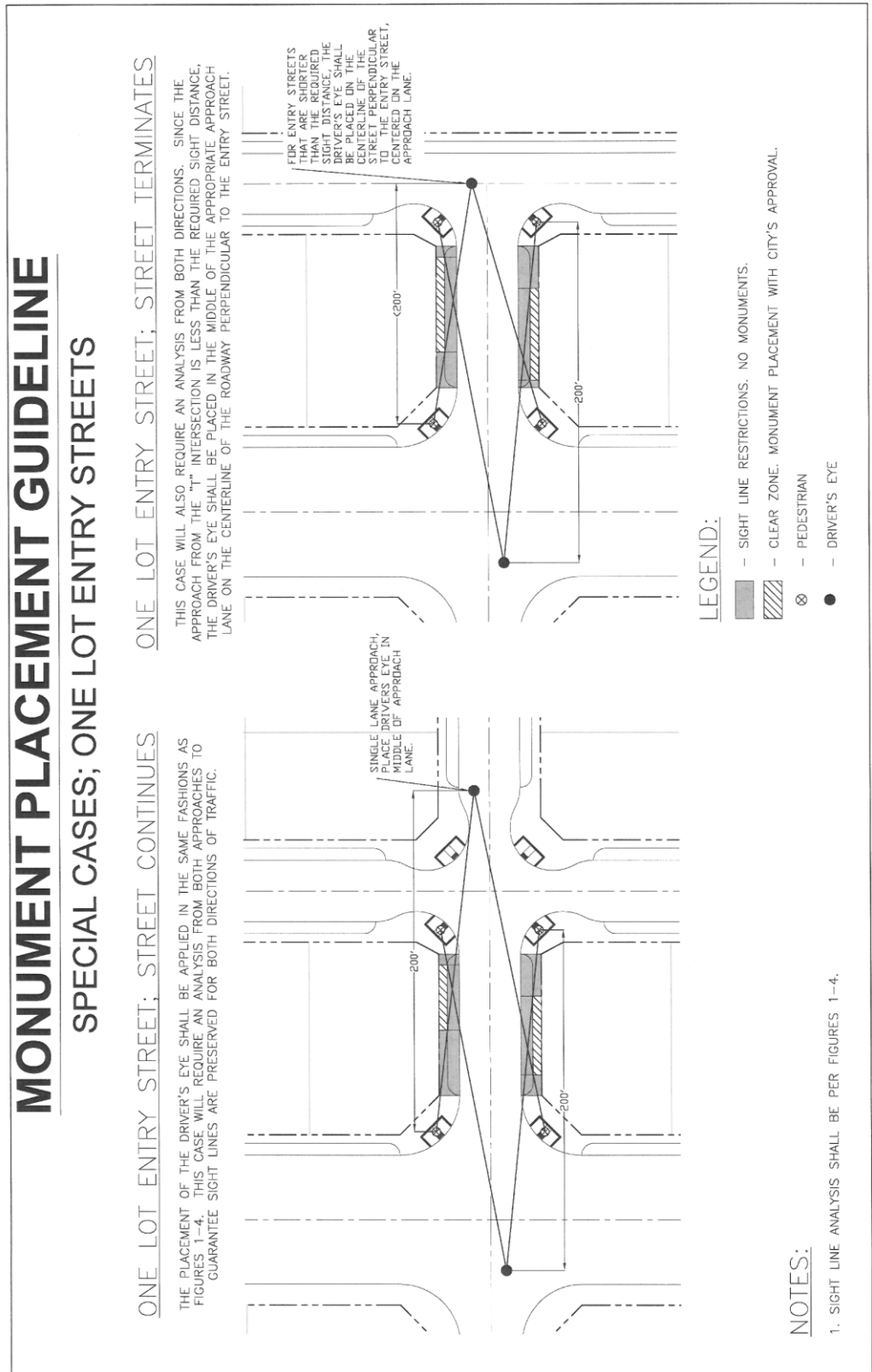
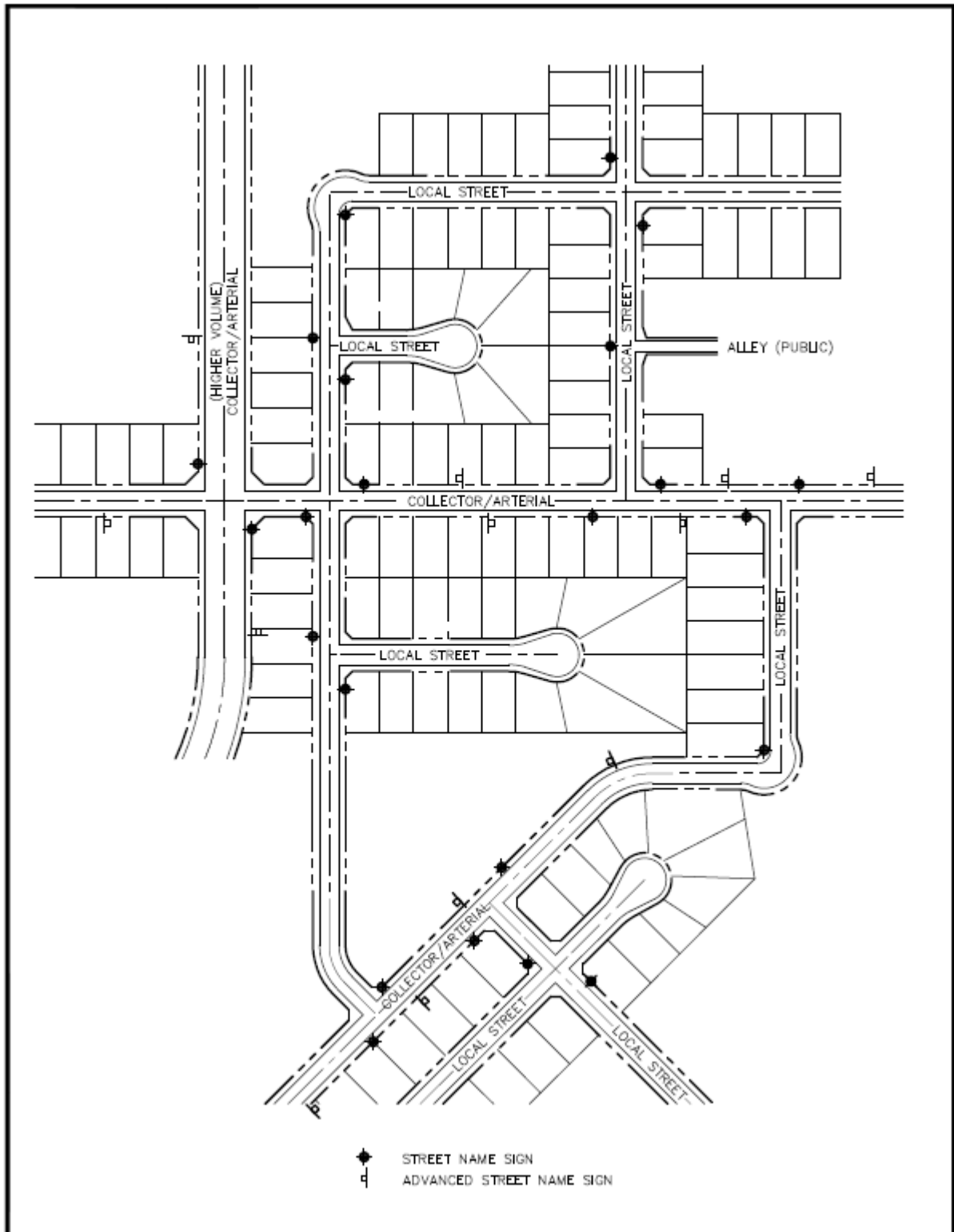


FIGURE 9 – STREET NAME SIGN LOCATIONS



APPENDIX B  
DESIGN REVIEW CHECKLISTS

# CITY OF ONTARIO

## SIGNING AND STRIPING DESIGN SUBMITTAL CHECK LIST

	Item	Yes	No	N/A
1.	Plans are in ink on mylar sheets			
2.	Plan sheets are 24 inch X 36 inch with the Standard City Title Block			
3.	Plan scale is 1 inch equals 40 feet			
4.	Sticky backs or paste-ons are not used			
5.	Drawing title indicates the north/south street first			
6.	Construction notes and legends of special symbols are consistent throughout the project			
7.	Construction notes properly identify type of work to be done and only notes and legends applicable to a particular sheet are shown on that sheet			
8.	North arrow is in the lower right hand corner and is oriented toward the top or right side of the drawing			
9.	Drafting standards per City Std. Dwg. 6002 and 6003			
10.	Plans approved by Engineer with name of, RCE number, signature, address, and stamp			
11.	Existing surface features are shown and the correct line type is used			
12.	The existing striping with dimensions are shown on cross streets and at project boundaries, and existing signs are shown and identified			
13.	Proposed striping and markings are shown graphically correct			
14.	Proposed signing and striping conform with Caltrans policy for use			
15.	All street and lane widths are dimensioned			
16.	Signs are installed on street lights where possible			
17.	Distance to advance warning signs is correct			
18.	Proper use of R26/R28 and R26(S)/R28(S) Series signs			
19.	Roadway sections with raised medians, including island noses, are properly signed and marked			
20.	Wrong-way arrows are used and shown on the plan properly			
21.	Interim striping and markings are shown to be painted			
22.	Lane widths are equal to or greater than the minimum lane widths stated in the design guide			
23.	Left-turn lanes are properly designed			

It is the engineer's responsibility to assure that the proposed plan is in conformance with the above items prior to submittal to the City

Plans Submitted By: \_\_\_\_\_ Date: \_\_\_\_\_

# CITY OF ONTARIO

## TRAFFIC SIGNAL DESIGN SUBMITTAL CHECK LIST

	Item	Yes	No	N/A
1.	Plans are in ink on mylar sheets			
2.	Plan sheets are 24 inch X 36 inch with the Standard City Title Block			
3.	Plan scale is 1 inch equals 20 feet			
4.	Sticky backs or paste-ons are not used			
5.	Drawing title indicates the north/south street first			
6.	Construction notes and legends of special symbols are consistent throughout the project			
7.	Construction notes properly identify type of work to be done and only notes and legends applicable to a particular sheet are shown on that sheet			
8.	North arrow is in the lower right hand corner and is oriented toward the top of the drawing			
9.	Drafting standards per City Std. Dwg. 6002 and 6003			
10.	Plans approved by Engineer with name of, RCE number, signature, address, and stamp			
11.	Existing surface features are shown and the correct line type used			
12.	Signs, striping and markings are shown as they will be at the end of the signal construction			
13.	Proposed signing and striping conform with Caltrans policy for use			
14.	Signal phasing, overlaps and preemptors are assigned correctly			
15.	Utilities are shown and identified			
16.	All street, lane widths and utility line locations are dimensioned			
17.	Controller cabinet and service location are in accordance with the design guide			
18.	Signal poles are correct height, and wind loading			
19.	Interconnect cable is kept separate from signal cables and meets the requirements of the design guide			
20.	Conduit sizes meet the City's minimum requirements			
21.	Pull box sizes meet the City's minimum requirements			
22.	Distance to advance detectors is correct			
23.	Service location has been approved by Edison			
24.	Lighting circuits are no larger than 1200 watts			
25.	Vehicle signal heads are properly located			
26.	Poles and conduits are properly identified			

It is the engineer's responsibility to assure that the proposed plan is in conformance with the above items prior to submittal to the City

Plans Submitted By: \_\_\_\_\_ Date: \_\_\_\_\_

# CITY OF ONTARIO

## STREET LIGHT DESIGN SUBMITTAL CHECK LIST

	Item	Yes	No	N/A
1.	Plans are in ink on mylar sheets			
2.	Plan sheets are 24 inch X 36 inch with the Standard City Title Block			
3.	Plan scale is 1 inch equals 20 or 40 feet			
4.	Sticky backs or paste-on's are not used			
5.	Drawing title indicates the major street first and then the cross street			
6.	Construction notes and legends of special symbols are consistent throughout the project per City standards			
7.	Construction notes properly identify type of work to be done and only notes and legends applicable to a particular sheet are shown on that sheet			
8.	North arrow is in the lower right hand corner and is oriented toward the top of the drawing			
9.	Drafting standards per City Std. Dwg. 6002 and 6003			
10.	Plans approved by Engineer with name of, RCE number, signature, address, and stamp			
11.	Existing surface features are shown and the correct line type used			
12.	Signs, striping and markings are shown as they will be at the end of the street light construction			
13.	Street names shown			
14.	Vicinity map correctly shown			
15.	Utilities are shown and identified			
16.	All street, lane widths, and utility line locations are dimensioned			
17.	Stations at beginning and end of improvements and at center of all street lights			
18.	Show all driveways existing and proposed			
19.	Show all existing improvements with dashed lines or gray tone, show new improvements to be constructed with solid lines			
20.	Show right-of-way existing and proposed, and improvements with dimensions from centerline			
21.	Show general notes for street light improvements			
22.	Existing power poles, trees, fire hydrant, pipelines, irrigation lines, or structures, etc. in right-of-way or immediately adjacent to right-of-way must be shown and labeled			
23.	No conduits shall be allowed to encroach onto private property			
24.	Show the location of all existing street lights on both sides of the street within 600' of the proposed project by stationing			
25.	Show lot lines per record maps			
26.	Street light plans are identified by "L-" drawing numbers			
27.	Type of street light pole and luminaires per City standards			
28.	Show all existing street light conduits and circuits			



# CITY OF ONTARIO

## STREET LIGHT

### DESIGN SUBMITTAL CHECK LIST

29.	Street lights shall be called out per City Std. Dwg. 5101, 5102 & 5103			
30.	Street light service shall be called out per City Std. Dwg. 5105 & 5106 and legend			
31.	All street light pull boxes shall be called out per City standard with #3½ pull box next to the street light and #5 pull box next to the service, with 4, or more conduits use a #5 pull box			
32.	Conduit sizes meet the City's minimum requirements of 1½" SCH 80			
33.	Engineer shall obtain approval of service locations and feed points from Edison			
34.	Schematic wiring diagram for each circuit shown and each street light per City Std. along with the feed point and circuit callout at each street light			
35.	Submit voltage drop calculations for the proposed circuits			
36.	Engineer shall obtain approval from Edison for overhead clearance per CAL/OSHA Electrical Safety Order 2946 with a minimum clearance of 10 feet from overhead high voltage lines and street lights			
37.	The owner shall be responsible for all costs associated with the operation and maintenance of the street lighting/traffic signal facilities and appurtenance, and a signed Consent and Waiver annexation form to the appropriate Landscape and Lighting Districts shall be filed with the City Engineer's office. This form, and applicable fee, can be obtained from the engineering Department's Assessment and Consulting Services section by contacting Mark Lassler at (909) 395-2124			
38.	The engineer shall attach a copy of the City of Ontario DAB Report page that calls out the requirements for the installation of street lights			

It is the engineer's responsibility to assure that the proposed plan is in conformance with the above items prior to submittal to the City

Plans Submitted By: \_\_\_\_\_ Date: \_\_\_\_\_

# CITY OF ONTARIO MASTER PROVISIONS

## SPECIAL PROVISIONS FOR TRAFFIC SIGNAL CONSTRUCTION PROJECTS

**ITEM: TRAFFIC SIGNAL SYSTEM (LUMP SUM)**

### **SP-1.0 DESCRIPTION OF WORK**

The Contractor shall furnish, install and/or modify a complete traffic signal system, including all traffic signal equipment, safety lighting and electrical systems in conformance with the approved plans and with these Special Provisions at the location(s) identified herein.

#### **SP-1.1 Location of Work**

The Contractor shall complete the work at the following location(see cover sheet).

**A cover sheet shall be included with:**

- 1. The intersection name.**
- 2. The design engineering firm name, address and phone number.**
- 3. The design engineer's name and registration number.**
- 4. Reference these Special Provisions as "City of Ontario, Special provisions for traffic signal construction projects dated July 2014, Pages SP-1 thru SP-40.**
- 5. Add reference to design engineer's section SP 3.0 with the number of pages.**

### **SP-2.0 SPECIFICATIONS**

The Specifications for this project are the provisions in Section 86, "Electrical Systems," of the Caltrans Standard Specifications and Standard Plans, 2010 editions, (also referred to collectively as "Standard Specifications," "Specifications," or "Special Provisions") as amended herewith where applicable, and as per the Contract documents.

#### **86 ELECTRICAL SYSTEMS 86-1 GENERAL**

Add to Section 86-1 "General" of the Standard Specifications the following:

##### **86-1.01A Brand Name Equal**

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On the Plans or in the Specifications, certain articles or materials to be incorporated in the Project may be designated under a brand name/manufacturer or the equal thereof. Such designations are intended to be descriptive, but not restrictive, and are to indicate the quality and characteristics of articles and materials that shall be satisfactory. The use of alternative articles or materials which are of equal quality and of the required characteristics for the purposes intended will be permitted, subject to the requirements listed below.

Unless the Contractor clearly indicates in the submitted bid that it is proposing to use an "equal" product, the bid shall be considered as offering a product referred to by brand name in these Specifications. The brand name, if any, of the proposed substitute product shall be listed on an attachment to the bid and shall indicate the product referred to by brand name in these Specifications that it is proposed to be substituting.

The awarding of a contract to a Contractor who has indicated in the bid that it is proposing to use an "equal" product shall not constitute an admission by the City of the equality of said product. The Contractor understands and agrees that in so awarding a contract, the City reserves the right to reject any such proposed substituted product. The Contractor further understands and agrees that in the event the City rejects a proposed "equal" product, the Contractor shall then supply either a product designated by brand name in the Specifications or a substitute which meets with the approval of the City.

With respect to all proposed substitutions of "equal" products, the Contractor shall submit all pertinent and appropriate data substantiating the request for said substitutions within thirty (30) days after the award of a Contract. In this regard, the Contractor shall note that the City is not responsible for locating or securing any information which is not included in said substantiating data. The burden of proof as to the equality or suitability of the proposed alternative products is borne entirely by the Contractor.

The Engineer shall be the sole judge as to the equality and/or suitability of proposed alternative articles or materials, and the decision of the Engineer shall be final and conclusive. Unless extended by mutual agreement of the parties, the Engineer shall notify the Contractor of the decision concerning the proposed substitution of "equal" items within thirty (30) days after submission of the substantiating data. All such decisions by the Engineer shall be in writing, and no proposed alternative product shall be deemed approved unless the Engineer has so indicated in writing.

### **86-1.04 EQUIPMENT LIST AND DRAWINGS**

Section 86-1.04, "Equipment List and Drawings," of the Standard Specifications, is hereby amended to read:

The Contractor shall submit for review and approval a list of the equipment and materials intended to be installed on the project, along with any corresponding drawings. The list must include:

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- Name of equipment manufacturer
- Dimensions
- Item identification number(s) and Serial Number(s)
- List of components
- Expected date of delivery of all equipment and materials
- Maintenance manuals and operation manuals for all new controller units, master control units, malfunction management units, optical preemption units, and any other peripheral or auxiliary units installed in the controller assembly, one set per each signal installation. The maintenance manual and operation manual may be combined into one manual. The manuals shall include, but not be limited to the following items:
  - Specifications
  - Design characteristics
  - General operation theory
  - Function of all controls
  - Trouble-shooting procedure (diagnostic routine)
  - Block circuit diagram
  - Geographical layout of components
  - Schematic diagrams
  - List of replaceable component parts with stock numbers
  - Complete instructions for implementation of all operator programmable functions
- Three (3) sets of controller cabinet schematic wiring diagrams, or cabinet prints; white background process using iron-sensitized paper; the offset lithograph process; the electrostatic process, or another process approved by the Engineer. One set on 24" x 36" size plan and two sets on 11" x 17" paper. The diagrams shall also be provided to the Engineer on a USB flash drive using the Autodesk "AutoCAD" drawing program (.dwg file extension) and PDF format with .pdf file extension.

The diagrams shall illustrate the relative placement of shelves, terminal blocks, interface panels, wiring, and all other equipment within the cabinet including emergency vehicle pre-emptors, and fiber splice boxes

- Each cabinet print sheet shall include a legend of the nomenclature used on that sheet, and shall contain the following specific information:
  - Sheet 1 shall illustrate the components and wiring on the left side of the cabinet, and intersection drawing. The intersection drawing shall be oriented so that north is to the top of the print, and shall indicate the general areas of detection with the controller input number of the area. The signal phasing and direction of the phase shall be shown in the center of the diagram. Signal poles and pedestrian movements need not be shown.
  - Sheet 2 shall illustrate the main panel, including where cables are attached and what component the cable is attached to.
  - Sheet 3 shall illustrate the right side of the cabinet, the police and auxiliary panels on the cabinet door, and the general cabinet layout.

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- The cabinet layout shall illustrate where each component is located within the cabinet.
- The controller cabinet schematic wiring diagrams shall be placed in a heavy duty plastic envelope, and attached to the inside of the door of each controller cabinet.

### 86-1.05 CERTIFICATE OF COMPLIANCE

Section 86-1.05, "Certificate of compliance", of the Standard Specifications is hereby amended with the addition of the following after the last paragraph:

#### Warranties, Guarantees and Instruction Sheets

Manufacturer's warranties and guarantees for materials used in the work shall be for a minimum of one year from the date of the acceptance of the project. The warranties and guarantees and instruction sheets and parts lists supplied with materials shall be delivered to the Engineer prior to acceptance of the project.

### 86-1.06 MAINTAINING EXISTING AND TEMPORARY ELECTRICAL SYSTEMS

Section 86-1.06A, "General", of the Standard Specifications, the first paragraph is hereby amended to read:

Existing electrical systems (traffic signal, ramp metering, highway and street lighting, flashing beacon, traffic monitoring, sign illumination and other facilities), or approved temporary replacements thereof, shall be kept in effective operation for the benefit of the traveling public during the progress of the work, except when shutdown is permitted, to allow for alterations or final removal of the systems.

The traffic signal shutdowns shall be limited to periods on Monday, Tuesday, Wednesday, or Thursday, between the hours of 9:00 a.m. and 3:30 p.m.

Forty-eight hour prior notification to the Traffic Engineering Section is required, prior to performing any work on existing systems.

Contacts:     Don Burden            (909) 295-2154  
                   Johnson Hua            (909) 295-2131

Section 86-1.06A, "General", of the Standard Specifications, the fourth paragraph is hereby amended to read:

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Where an existing system or temporary system is being modified, the work necessary to keep all or any part of the system in effective operation required shall be considered as part of the lump sum bid price and no additional compensation will be allowed therefore.

Section 86-1.06A, "General", of the Standard Specifications, the fifth thru the eighth paragraphs is hereby amended to read:

The local agency reserves the right to:

- Continue the operation and maintenance of existing electrical facilities.
- Continue to provide electrical energy to operate existing electrical facilities
- Repair or replace existing facilities damaged by traffic
- Pay for electrical energy to operate existing or new facilities undergoing the functional tests specified in section 86-2.14C.

The Contractor shall:

Verify the location and depth of existing detectors, conduits, pull boxes, and other electrical facilities before using tools or equipment that may damage those facilities or interfere with an electrical system.

Notify the Engineer immediately if existing facilities are damaged by the Contractor's activities, and repair or replace damaged facilities promptly. Damaged detectors are to be replaced within 24 hours. If the Contractor fails to complete the repair or replacement promptly, the City reserves the right to repair or replace said facilities and deduct the costs from the Contractor's compensation.

### **86-1.07 SCHEDULING OF WORK**

Section 86-1.07, "Scheduling of Work", of the Standard Specifications, is hereby amended with the addition of the following between the third and fourth paragraphs:

Traffic signals shall not be placed in operation until the Contractor has completed all work, including any corrections, to the satisfaction of the Engineer.

Section 86-1.07, "Scheduling of Work", of the Standard Specifications, is hereby amended with the addition of the following after the last paragraph:

The Engineer shall be contacted for approval at least 3 working days in advance of the intended turn-on of a new traffic signal system.

Representatives authorized by the respective equipment manufacturers to work on the various traffic signal system components shall be present to set up prior to the intended

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turn-on, during the turn-on, and for a reasonable period of time thereafter, as determined by the Engineer.

The Contractor is responsible to schedule the authorized representatives and all costs associated with said support are considered as part of the lump sum bid price and no additional compensation will be allowed therefore.

### 86-2 MATERIALS AND INSTALLATION

#### 86-2.03 FOUNDATIONS

Section 86-2.03A, "Foundations", of the Standard Specifications, the third from the last paragraph is hereby amended to read:

All foundations shown to be abandoned shall be completely removed. Foundations may be abandoned in place only upon a determination by the Engineer that it would benefit the project to abandon said foundation in place. If so authorized the top of the foundation and anchor bolts shall be removed, and conduits cut down to a minimum depth of not less than 1-foot below the sidewalk surface or original ground. The resulting hole shall be backfilled with material equivalent to the surrounding material.

#### 86-2.04 STANDARDS, STEEL PEDESTALS AND POSTS

Section 86-2.04B(3), "Standards, and Poles", of the Standard Specifications, the seventeenth subparagraph of the first paragraph is hereby amended to read:

17. All standards shall be round, regardless of the outside diameter.

#### 86-2.05 CONDUIT

Section 86-2.05, "Conduit," of the Standard Specifications, the second paragraph is hereby amended to read:

Interconnect conduit shall be a minimum 3 inch diameter. Sweeps in the interconnect conduit shall not exceed 45 degrees. All other conduits shall be of the sizes shown on the plans, as specified in this Section 86-2.05, or in the special provisions. In addition, the Contractor may, at his option and expense, use conduit of a larger size than that shown or specified provided the larger size is used for the entire length of the run from outlet to outlet. Reducing couplings shall not be permitted.

Section 86-2.05A, "Material", of the Standard Specifications, type numbers four and five are hereby deleted.

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Section 86-2.05B, "Use", of the Standard Specifications, Minimum trade size of conduit must be are hereby amended to read.

Minimum trade size of conduit must be:

1. 1-1/2 inches from electrolier to adjacent pull box.
2. 1-1/2 inch from pedestrian push button post to adjacent pull box.
3. 3 inches from signal standard with mastarm to adjacent pull box, 2 inches all others.
4. 3 - 4 inches from controller cabinet to adjacent pull boxes (two #6 pull boxes required each with two 3 inches conduits, unless otherwise shown on plan).
5. 2 inches from overhead sign to adjacent pull box.
6. 3 inches from service equipment enclosure to adjacent pull box.
7. 3 inches from controller cabinet to adjacent communications pull box.
8. 2 inches from service equipment enclosure to adjacent controller cabinet.
9. 1-1/2 inches if unspecified.

## 86-2.06 PULL BOXES

Section 86-2.06A, "Materials" of the Standard Specifications, the following paragraphs are hereby added after the first paragraph with the following:

Pull boxes, covers and extensions for installation in the ground or in sidewalk areas shall be of the sizes and details shown on the plans and shall be precast of reinforced concrete (PCC). The pull boxes shall be as manufactured by Christy Products of Cypress, California or an approved equal. The top of the pull boxes shall have a protective plastic coating as a part of the pull box. The plastic coating shall be formed around the top edges of the pull box so as to reduce chipping the concrete of the pull box rim and cover.

Pull box lids shall be fiberglass, and shall be easily removable.

Pull boxed installed in interconnect runs shall be #6 with an extension. Pull boxes installed adjacent to mast arm poles, or in which four or more conduits terminate will be #6, all others shall be #5.

All Pull boxes shall have a minimum of 1-foot of minor concrete around all outside edges. Pull boxes placed within existing sidewalk shall have the entire affected sidewalk panel or panels replaced from construction joint to construction joint, with neat perpendicular saw cuts along the construction joint. Pull boxes with less than five feet of distance between sides to side shall have concrete uniformly place between pull boxes the entire distance.

Pull boxes installed in unimproved areas shall be traffic rated and a pull box marker shall be installed adjacent to the pull box, and comply as defined below.



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Section 86-2.06B, "Cover Markings" of the Standard Specifications, is hereby added to with the following:

Pull box lid cover markings shall be:

- TRAFFIC SIGNAL COMMUNICATIONS – for any pull boxes that contain only fiber optic cables or traffic signal interconnect cables.
- TRAFFIC SIGNAL - for any pull boxes that contain traffic signal field wiring that includes DLCs, signal preemption, video detection, communications cables, etc.
- STREET LIGHTING – for any pull boxes that contain only street light wiring or cabling.

The lids shall be protected during the course of construction. Any damage to the pull boxes or lid at the time the project is accepted shall be rejected and a new pull box or lid installed in its place.

### 86-2.08 CONDUCTORS

Section 86-2.08E, "Signal Interconnect Cable", of the Standard Specifications, is hereby deleted and replaced with the following:

The City standard for signal communications is Fiber Optic Cable.

Fiber Optic Cable shall consist of 6-strand single mode fibers that shall be designated and terminated in the controller cabinet assembly. A splice box for all 6 strands of fiber shall be used for each fiber interconnect cable entering the controller cabinet assembly and shall be attached to a fiber modem by means of an **Singlemode PC Duplex SC-SC Patch Cable** of sufficient length to reach equipment. There shall be a minimum of 6 feet of slack at each controller cabinet assembly and pull box.

Splices in signal interconnect fiber are only permitted at the splice panels to be located within the controller cabinet assembly or fiber system splicing handhole.

Where copper cable is needed to maintain communications with a legacy system, such as Aries, the Signal Interconnect Cable shall be REA PE 22 cable that consists of twelve pair of No. 19 AWG copper conductors. Conductors shall be twisted in pairs, designated and connected in the controller assembly, and color coding shall distinguish each pair as follows:

- Red/Blue Pair - LOCAL RECEIVE
- Green/White Pair - LOCAL TRANSMIT
- Orange/White Pair- TELEPHONE

### 86-2.09 WIRING

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Section 86-2.09B, "Installation", of the Standard Specifications, is hereby amended with the addition of the following after the last paragraph:

A white nylon marker tie with a label area of 1 inch x ½ inch, shall be placed near the end of all detector loop cables. The marker tie shall indicate the detector input number to the controller in black indelible ink. Near the end of all interconnect cables a white nylon marker tie with a label area of 1 inch x ½ inch shall be placed indicating the intersection where the cable is from (Master side) or where the cable is to (further from Master).

Section 86-2.09C, "Connectors and Terminals", of the Standard Specifications, the second paragraph is hereby amended to read:

Except detector loop lead-in cable, all stranded conductors smaller than No. 14 shall be terminated in crimp style terminal lugs. Conductors in detector loop lead-in cable shall be terminated in crimp style spade connector.

Section 86-2.09D, "Splicing", of the Standard Specifications, item numbers four, five and six of the first paragraph are hereby deleted.

Section 86-2.09E, "Splice Insulation", of the Standard Specifications, the following paragraph is hereby added after the last paragraph:

Insulate splices using "Epoxy splice kit" meeting all requirements of the 3M, Scotchcast resin splice kit line.

### **86-2.10 BONDING AND GROUNDING**

Section 86-2.10, "Bonding and Grounding", of the Standard Specifications, the following paragraph is hereby added after the last paragraph:

At each multiple service point and controller cabinet location, a ground electrode shall be furnished and installed. Ground electrodes shall be a one-piece length of copper clad steel rod not less than 5/8-inch in diameter not less than 10 feet in length. Ground electrodes in the foundations shall be enclosed in a 1-inch diameter PVC Schedule 40 conduit, shall be angled to exit the foundation approximately 1 foot below grade and shall be installed in accordance with the provisions of the Code. The service equipment or controller cabinet shall be bonded to the ground electrode by use of a ground clamp and a No. 6 or larger copper wire, forming a continuous ground system.

### **86-2.14 TESTING**

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Section 86-2.14A, "Materials Testing", of the Standard Specifications, is hereby deleted and replaced with the following:

It shall be the Contractor's responsibility to arrange to have any and all traffic signal controller assemblies, complete with optical preemption components, wiring diagrams and manuals, delivered for testing to a testing facility approved by the City.

The current approved testing facility is:

Computer Service Company  
12907 East Garvey Avenue  
Baldwin Park, CA 91706.

Telephone: (951) 738-1444.

Traffic signal controller assemblies, including controller units, fully wired cabinets, and auxiliary equipment, shall meet the operational and functional requirements of the plans and specifications when tested in accordance with California Tests 658 and 659, and shall be unaffected by transient voltages when tested in accordance with California Test 667.

As part of the testing requirements, the Contractor shall ascertain that the traffic controller manufacturer has a current quality control procedure that includes the following:

- Acceptance testing of all supplied components
- Physical and functional testing of all modules
- A minimum 100-hour burn-in of all modules
- Physical and functional testing of all controller units and all auxiliary equipment
- A minimum 24-hour burn-in of all controller units and all auxiliary equipment
- A minimum of 24 hours operation of every complete controller assembly
- Physical and functional testing of the complete controller assembly
- A Certificate of Compliance with the approved procedure and a test report signed by a responsible managing employee shall accompany each controller assembly submitted to the testing facility.
- Each new controller unit and auxiliary equipment and any new modification shall be environmentally tested and operated for 24 hours at -18°C. and at 71°C. A report of the test results shall be prepared which shall indicate all problems and corrective actions taken. The test report shall be submitted to the City for approval before the unit is supplied to the Contractor for installation.

Testing and quality control procedures must comply with NEMA TS Standards for Traffic Control Systems. The Contractor shall not place any equipment into service until all required testing is satisfactorily complete and certification is provided to that effect. All costs associated with testing, and any required re-testing resulting from initial failed testing, shall be considered as part of the lump sum bid price and no additional compensation will be allowed therefore.

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## 86-3 CONTROLLER ASSEMBLIES

### 86-3.01 CONTROLLER ASSEMBLIES

Section 86-3.01, "Controller Assemblies", of the Standard Specifications, is hereby deleted in its entirety and shall read:

#### 86-3.01A Controller Assembly General

A controller assembly shall be provided and shall consist of a complete mechanism for controlling the operation of traffic control signals, including the controller unit and all necessary auxiliary equipment, mounted in a fully wired cabinet, and all equipment required to provide the operation shown on the plans and these special provisions.

Details of operation for the controller assembly shall be in include twelve phases operations with 4 overlaps available with 64 channels of detection and 4 evp channels for preemption. The controller assembly shall be programmed in the field in accordance with the traffic phases, preferential phase sequence and concurrence, signal indications, signal indication sequence, detection requirements and other details shown on the plans or as specified in the special provisions.

Each controller unit, with auxiliary equipment, shall operate various traffic signal devices, as shown on the plans, to provide right of way, change, clearance and other indications, with duration and sequence as determined by traffic demand or preset programming.

#### 86-3.01B Interval Sequence

The color sequence of vehicle signal indications shall be green-yellow-red, except that in response to a preemption actuation it may be green-yellow-green. During any interval, there shall be no visual flicker of vehicle or pedestrian signal indications.

#### 86-3.01C Flashing Operations

All controller assemblies shall be equipped for flashing operation of signal lights. Flashing operation, when required by railroad pre-emption, flashing control, or other causes, shall be set for flashing red on all approaches unless otherwise specified. Pedestrian signals shall be extinguishable during flashing operations.

The flash transfer relay may be used to energize the flasher and shall transfer signal light circuits from the controller unit to the flasher and shall cause the flashing indications specified above.

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When the controller, remote flash command or other automatic command is used to make changes from flashing to stop-and-go operation, the change shall be made at the beginning of the major street green interval. Automatic changes from stop-and-go operation to flashing operation, except due to monitoring device or pre-emption operation, shall be made at the end of the major street red interval.

Flashing mechanism shall be independent of the controller unit and shall remain in operation upon shutdown of the controller unit or removal of the controller unit from the cabinet.

### **86-3.01D Pre-emption**

A pre-emptor shall pre-empt normal controller unit operation when activated by the pre-emption circuit or by a test switch. The pre-emptor shall cause the signals to display the sequence of indications shown on the plans. Once the pre-emption sequence is begun, it shall continue to the end regardless of the condition of the pre-emption circuit or test switch. If a railroad pre-emptor is actuated at the time power is restored, after a supply voltage interruption, which would have caused the controller assembly to stop cyclic operation, the controller assembly shall cause no-signal indications to be displayed until the end of pre-emptor actuation.

The controller unit shall resume normal operation when the pre-emptor actuation ceases, and shall operate normally when the pre-emptor is removed. When the pre-emption circuit or test switch is returned to its normal condition, the controller unit shall go through the phase sequence shown on the plans as if calls had been received and remembered on all phases. Pedestrian "WALK" or WALKING PERSON indications shall appear with the first corresponding green indication.

### **86-3.01E Controller Assembly Testing**

See Section 86-2.14 "Testing" in these Special Provisions for testing requirements.

### **86-3.01F Type 90 Controller Assembly**

Each Type 90 controller assembly shall contain a traffic signal controller unit equivalent to an Econolite Kobalt controller and shall conform to the requirements in NEMA Standards for Traffic Control Systems, as described in Publication No. TS2-92 and shall comply with TS2 Types 1 and 2, and these Special Provisions.

The controller shall be fully compliant with the NTCIP communications protocol and include the necessary telemetry interface modules to be integrated into the City's

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CENTRACS Advance Transportation Management System (ATMS) and/or the City's legacy ARIES system.

The controller unit shall be modular in design and shall be keyboard, touch screen and tablet programmable to provide a minimum of twelve phases and four overlaps with full density functions on all phases.

The controller unit display shall be a high contrast touch screen color display. The display shall provide simultaneous indications for Ring 1 and Ring 2, showing which phase is timing and count down the timing of each interval.

The default status display shall differentiate between vehicle calls originating in the field and calls created internally by the controller. The detector status display shall show unprocessed detector calls and differentiate between delays, extensions, and disconnected calls. When operating as a TS2 Type 1 controller, detectors not assigned to call a phase will not, as a default, display constant calls.

All controller unit circuits and all logic or timing circuits external to the controller unit shall consist entirely of solid-state electronic circuitry.

The controller unit shall be capable of non-interconnected coordination. The coordination function shall be internal to the controller unit and shall provide the following functions as a minimum:

- 120 coordination event plans, each with its own cycle, offsets, split timing, coordinated phases, vehicle and pedestrian recall and phase omits.
- Offset and split entries displayed in percent or seconds.
- Automatic permissive periods.
- Fixed or floating force-off.
- Crossing arterial coordination
- Quick-sync feature.
- Separate control for non-interconnected coordination and time of day functions.
- 200 schedule programs, configurable for any combination of months, days of the week, and days of the month.
- Fixed or floating exception day programs that override the day plan event on a specific day.
- 50 day plan events that can use any of the 100 action plans.
- 100 action plans that can be used by any of the 50 day plans.
- 16 phases, 8 configurable concurrent groups in 4 timing rings.
- 16 vehicle overlaps that can be configured as normal, green/yellow, PPLT/FYA or Econolite.
- Dynamic max operation.
- Extendable walk and pedestrian clearance.
- Advanced Walk.
- Bike input and green timing.

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- Adaptive red clearance.
- Ten preemption sequences. Each may be configured as priority, first-come-first-serve, or bus preemption operation.
- ECPI interlock to provide added monitoring.
- Railroad gate-down input and timing.
- Conditional delay when entering preemption.
- Multiple exit preemption options, Exit to selected exit phase, Exit to coordination (no transition), Exit to interrupted pedestrian phase.
- Designate any two non-conflicting phases as hold phases during emergency vehicle preemption.

Additional Cabinet accessories.

In all cabinets

- Two fiber optic patch panels located under the top shelf of the type P cabinet using rack mounting style mounts for 2- six count SC patch connections or Four fiber optic patch panels located under the top shelf of the type R cabinet using rack mounting style mounts for 4- six count SC patch connections.
- Two **Ruggedcom model RS900L-H1-P-C2-C2-V1-XX** dual fiber modems using SC connectors to the patch panel for the 6 strand, single-mode fiber optic cable and connecting to one SIC copper cable, compatible with the City's CENTRACS Advanced Transportation Management System.
- Any and all equipment and work necessary to connect and integrate this location with the City's CENTRACS traffic control system through fiber cable.
- When fiber interconnection is not available, in addition to the above equipment the contractor shall install a ENCOM wireless radio model number COMMPAK BB58 INT at the intersection to the satisfaction of the engineer, providing these features. Operating at the 5.8 GHz frequency, with up to 54 Mbps (802.11 a/g). Each radio can perform as master, remote • or repeater. Operational in point-to-point, point-to-multipoint and multipoint-to-multipoint configurations. 600 milliwatt transmitter allows for range of up to 60 miles. Delivers consistent low latency communications with power over Ethernet. STRATOS configuration, diagnostic and management utility application shall be provide. With a 3 year warranty.
- An additional ENCOM wireless radio model number COMMPAK BB58 INT at an intersection determined by the engineer and to the satisfaction of the engineer, providing the same features as above, to complete the interconnection for this intersection.

At locations that require attaching to Aries Legacy system this is in addition to the above fiber requirements.

- If necessary to interface with an Aries Legacy system, the Contractor shall also furnish two **Ruggedcom model RS900L-H1-P-TX-TX-V1-XX** dual copper modem's for communications through SIC copper cable.
- Any and all equipment and work necessary to connect and integrate this location with the City's ARIES traffic control system through 12pr. twisted cable.

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- Other auxiliary equipment as required, as specified in the special provisions or as shown on the plans.

### **86-3.02 BATTERY BACKUP SYSTEMS**

Section 86-3.02, "Battery Backup System", of the Standard Specifications, is hereby deleted in its entirety and shall read:

#### **86-3.02A(1) Summary**

The contractor shall furnish and install a battery backup system at each signal location. The system shall include a battery backup unit, separate cabinet, bypass switch, cable assemblies, battery disconnect unit, and wire from service to BBS to cabinet. The battery backup unit shall be Model 24M11-WBE as manufactured by Dimensions Unlimited, Inc. The bypass switch with 30A relay shall be Dimensions Part Number 511020-1. The cable assembly shall be Part Number 611524, 24-Volt for a four-battery installation and a cable length of nine feet.

The Contractor shall install a surge arrestor in the service pedestal meeting the requirements in the Special Provisions or Standard Specifications. The batteries, shall provide 2 continuous hours of operation through four 12 Volt, 105 Amp-Hour each installed in PVC protective battery cases and shall be housed in the separate BBS cabinet mounted on the left side of the signal cabinet. The battery disconnect unit shall be 24-Volt equivalent to the Universal Battery Disconnect Model UBD101 and shall have no current draw once the batteries are at 21 volts, unit to prevent the batteries from discharging completely.

#### **86-3.02A(2) Submittals**

See Section 86-1.04 "Equipment List and Drawings" in these Special Provisions for submittal instructions.

#### **86-3.02A(3) Quality Control and Assurance**

The City may request testing of the external BBS cabinet assembly prior to installation. After complete installation, the Contractor is to perform functional testing for 30 minutes of continuous, satisfactory operation with utility power turned off in the presence of the Engineer. The installed batteries must be warranted by the manufacturer for 2 years to operate within a temperature range of -13F to +140F.

#### **86-3.02B Materials**



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Batteries shall:

- Be deep cycle, sealed, prismatic, lead-calcium based, absorbed glass mat, valve-regulated lead-acid type
- Be group size 24
- Be commercially available and stocked locally
- Be marked with a date code, maximum recharge data, and recharge cycles
- Be new and fully charged when furnished
- Be free from damage or deformities
- Have a 12-Volt voltage rating
- Have a carrying handle
- Have 2 top-mounted threaded-stud posts that include all washers and nuts required for attaching the corresponding BBS battery harness
- Include rubber insulating protective covers for protecting the lugs, posts, and wiring: red for positive terminal and black for negative terminal

### 86-3.02C Construction

The external cabinet shall be mounted to the left side of the controller cabinet and constructed as shown on City of Ontario Standard Drawing 5202. The typical side-mounting location of the external cabinet is flush with the bottom of the controller cabinet and approximately equidistant from the front and rear door edges.

The external cabinet must be ventilated by using louvered vents, a filter, and a thermostatically controlled fan. The fan must operate on standard 120-Volt AC from the same line output as the controller cabinet. A 2-position terminal block must be provided on the fan panel along with 10 feet of connected hookup wire.

The external cabinet surface must be anodized aluminum. Do not use anti-graffiti paint.

The external cabinet must include all bolts, washers, nuts, and cabinet-to-cabinet coupler fittings necessary for mounting it to the controller cabinet assembly.

Fasteners for the external cabinet must include:

- Six 18-8 stainless steel hex head, fully-threaded, 3/8-inch – 16 x 1-inch cabinet mounting bolts
- 2 washers per bolt designed for 18-8 stainless steel, 1-inch OD round, 3/8-inch flat-type bolt
- K-lock nut per bolt consisting of 18-8 stainless steel K-lock washer and a hex-nut
- 2 – 2-inch x 30-inch aluminum strap 1/8 inch thick w/3 holes each for mounting

External cabinet to controller cabinet couplings must include a conduit for power connections between the 2 cabinets. Couplings must include:

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- 2-inch nylon-insulated steel chase nipple, T & B 1947 or equivalent
- 2-inch sealing, steel locknut, T & B 146SL or equivalent
- 2-inch nylon-insulated steel bushing, T & B 1227 or equivalent

The cabinet wiring shall be No 10 AWG, 600-Volt, with the following coloring scheme. A black wire from the breaker in the service cabinet to a surge arrestor as per Section 86-3.04D(3) "Surge Arrestor" to the bypass switch in the BBS cabinet. A red wire shall run from the bypass switch to the controller cabinet. A white wire shall run from the neutral bar in the service cabinet to the neutral bar the controller cabinet. A white wire shall run from the neutral bar in the controller cabinet to the bypass switch in the BBS cabinet. A green wire shall run from the ground buss in the service cabinet to the ground buss at the controller cabinet. A green wire shall run from the grounding bus in the controller cabinet to the bypass switch in the BBS cabinet. The cabinet manufacture shall install a landing bar to which the BBS wires shall be landed.

### 86-3.04 CONTROLLER CABINETS

Section 86-3.04A "Cabinet Construction" of the Standard Specifications is amended to stipulate the following limitations or additional requirements:

The cabinet and doors shall be fabricated of 0.125-inch minimum thickness aluminum with continuously welded exterior seams only; the stainless or cold rolled steel options are not acceptable.

The exterior of each aluminum cabinet shall have a clear anti-stick graffiti proofer coating (GPA-200) as manufactured by SEI Chemical of Northridge, California. The interior surfaces of each aluminum cabinet shall retain their unfinished natural appearance, and be smooth and free of any burrs or other rough edges. All coatings shall be commercially smooth, substantially free of flow lines, paint washout, streaks, blisters, and other defects that would impair serviceability or detract from general appearance.

The cabinet door lock shall be operable by a Corbin #2 key. The door shall have a switch which will activate intersection alarm 1 when the door is open. Unless specifically shown on the plans differently, when facing the cabinet door, the cabinet door hinges shall be on the right. When the door is closed and latched, the door shall be locked. The handle shall swing toward the hinge side of the door when opening, and shall have a provision for padlocking in the closed position. The handle shall have a minimum length of 7 inches and shall be provided with a 5/8 inch, minimum, steel shank. The handle shall be fabricated of cast aluminum or of zinc-plated or cadmium-plated steel.

A minimum of two aluminum shelves shall be provided to support the controller unit and auxiliary equipment in the type P cabinet and a minimum of three aluminum shelves

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shall be provided to support the controller unit and auxiliary equipment in the type R cabinet. The shelves shall extend across the entire width of the cabinet and shall not affect the lowering of the main panel.

Section 86-3.04B "Cabinet Ventilation", of the Standard Specifications is amended to stipulate the following limitations or additional requirements:

Each controller cabinet shall be provided with louvered vents in the cabinet door. Filters shall be placed over the louvers and over the cabinet fan intake inside the cabinet to prevent any unfiltered air from entering the cabinet. Filters shall be self sealing, they shall be constructed of 100% polyester media, and shall have three distinct stages of filtration with graduated density. A non-migrating tackifier shall be sandwiched between the second and third layers. The main cabinet filter shall have a wire frame. The cabinet shall be completely sealed to assure that all air passing in or out of the cabinet must pass through a filter.

Section 86-3.04C, "Cabinet Wiring", of the Standard Specifications is amended to stipulate the following limitations or additional requirements:

Field terminals for signal feeds shall be screw type with barrier block.

All logic ground I/Os available in the controller shall be brought out to terminal boards to facilitate utilizing all functions, including interconnection operation, in the future.

Any connections or wire terminations which are not readily accessible without the removal or displacement of the equipment upon which they are mounted, shall be soldered, or held in place with self-locking nuts.

It shall be possible to lower the main panel and access the back of the panel without removal or disturbing the shelves, the equipment upon the shelves, or the equipment cables.

All equipment cables shall be routed around the interior wall of the controller cabinet, and either brought around the front of the shelf or brought under the shelf where the appropriate equipment is sitting. Cables shall be brought out from behind the main panel on the side closest to the equipment they will be connecting to. Slack shall be provided in the cables to allow adjustment of the equipment's position upon the shelf. Cables shall not be routed to a piece of equipment from more than one direction. The SDLC cables shall be used for the controller, MMU, and detector racks. Any excess cable length between the detector interface panels and the detector racks shall be stored under the detector racks and secured with cable ties as appropriate. Equipment cables will not be allowed to hang freely across the interior of the controller cabinet, obstruct the view of the intersection controller or master controller displays, or interfere with the removal of the equipment from their shelves or lowering of the main panel.

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All NEMA defined I/Os shall be terminated on the main panel. The manufacturer defined "D" connector I/Os shall be brought out to terminal interface panels to facilitate utilizing the additional system functions.

Detectors shall be assigned as follows.

Detection Area	Label on Plan	Input Channel	Input Phase	Detector Model With Bike Lane	Detector Model without Bike Lane
Southbound No. 1 L/T Bike/Veh	1B-N-Ø1	1	Ø1	C-1201-B	C-1201-B
Northbound No. 1 Thru Bike/Veh // Northbound Striped Bike Lane	1B-S-Ø2 / BL-S-Ø2	2	Ø2		
Westbound No. 1 L/T Bike/Veh	1B-E-Ø3	3	Ø3	C-1201-B	C-1201-B
Eastbound No. 1 Thru Bike/Veh // Eastbound Striped Bike Lane	1B-W-Ø4 / BL-W-Ø4	4	Ø4		
Northbound No. 1 L/T Bike/Veh	1B-S-Ø5	5	Ø5	C-1201-B	C-1201-B
Southbound No. 1 Thru Bike/Veh // Southbound Striped Bike Lane	1B-N-Ø6 / BL-N-Ø6	6	Ø6		
Eastbound No. 1 L/T Bike/Veh	1B-W-Ø7	7	Ø7	C-1201-B	C-1201-B
Westbound No. 1 Thru Bike/Veh // Westbound Striped Bike Lane	1B-E-Ø8 / BL-E-Ø8	8	Ø8		
Southbound No. 1 & 2 L/T Presence	1P-N-Ø1	9	Ø1	C-1200-SS	C-1200-SS
Northbound No. 1 & 2 Thru Bike/Veh	1P-S-Ø2	10	Ø2		
Westbound No. 1 & 2 L/T Bike/Veh	1P-E-Ø3	11	Ø3	C-1200-SS	C-1200-SS
Eastbound No. 1 & 2 Thru Bike/Veh	1P-W-Ø4	12	Ø4		
Northbound No. 1 & 2 L/T Bike/Veh	1P-S-Ø5	13	Ø5	C-1200-SS	C-1200-SS
Southbound No. 1 & 2 Thru Bike/Veh	1P-N-Ø6	14	Ø6		
Eastbound No. 1 & 2 L/T Bike/Veh	1P-W-Ø7	15	Ø7	C-1200-SS	C-1200-SS
Westbound No. 1 & 2 Thru Bike/Veh	1P-E-Ø8	16	Ø8		
Southbound No. 1 L/T Advance	1A-N-Ø1	17	Ø1	C-1201-SS	C-1201-SS
Northbound No. 1 Thru Advance	1A-S-Ø2	18	Ø2		
Westbound No. 1 L/T Advance	1A-E-Ø3	19	Ø3	C-1201-SS	C-1201-SS
Eastbound No. 1 Thru Advance	1A-W-Ø4	20	Ø4		
Northbound No. 1 L/T Advance	1A-S-Ø5	21	Ø5	C-1201-SS	C-1201-SS
Southbound No. 1 Thru Advance	1A-N-Ø6	22	Ø6		
Eastbound No. 1 L/T Advance	1A-W-Ø7	23	Ø7	C-1201-SS	C-1201-SS
Westbound No. 1 Thru Advance	1A-E-Ø8	24	Ø8		
Reserved	Reserved	25	Ø1	C-1200-SS	C-1200-SS
Northbound Thru No. 3 & 4 Presence	2P-S-Ø2	26	Ø2		
Reserved	Reserved	27	Ø3	C-1200-SS	C-1200-SS
Eastbound Thru No. 3 & 4 Presence	2P-W-Ø4	28	Ø4		
Reserved	Reserved	29	Ø5	C-1200-SS	C-1200-SS
Southbound Thru No. 3 & 4 Presence	2P-N-Ø6	30	Ø6		
Reserved	Reserved	31	Ø7	C-1200-SS	C-1200-SS

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Detection Area	Label on Plan	Input Channel	Input Phase	Detector Model With Bike Lane	Detector Model without Bike Lane
Westbound Thru No. 3 & 4 Presence	2P -E-Ø8	32	Ø8		
Southbound No. 2 L/T Bike/Veh	2B-N-Ø1	33	Ø1	C-1201-B	C-1201-B
Northbound No. 2 Thru Bike/Veh	4B-S-Ø2	34	Ø2		
Westbound No. 2 L/T Bike/Veh	2B-E-Ø3	35	Ø3	C-1201-B	C-1201-B
Eastbound No. 2 Thru Bike/Veh	4B-W-Ø4	36	Ø4		
Northbound No. 2 L/T Bike/Veh	2B-S-Ø5	37	Ø5	C-1201-B	C-1201-B
Southbound No. 2 Thru Bike/Veh	4B-N-Ø6	38	Ø6		
Eastbound No. 2 L/T Bike/Veh	2B-W-Ø7	39	Ø7	C-1201-B	C-1201-B
Westbound No. 2 Thru Bike/Veh	4B-E-Ø8	40	Ø8		
Northbound No. 4 Thru Bike/Veh	3B-S-Ø2	41	Ø1	C-1200-B	C-1201-B
Northbound No. 3 Thru Bike/Veh	2B-S-Ø2	42	Ø2		
Eastbound No. 4 Thru Bike/Veh	3B-W-Ø4	43	Ø3	C-1200-B	C-1201-B
Eastbound No.3 Thru Bike/Veh	2B-W-Ø4	44	Ø4		
Southbound No. 4 Thru Bike/Veh	3B-N-Ø6	45	Ø5	C-1200-B	C-1201-B
Southbound No. 3 Thru Bike/Veh	2B-N-Ø6	46	Ø6		
Westbound No. 4 Thru Bike/Veh	3B-E-Ø8	47	Ø7	C-1200-B	C-1201-B
Westbound No. 3 Thru Bike/Veh	2B-E-Ø8	48	Ø8		
Southbound No. 2 L/T Advance	2A-N-Ø1	49	Ø1	C-1201-SS	C-1201-SS
Northbound No. 2 Thru Advance	2A-S-Ø2	50	Ø2		
Westbound No. 2 L/T Advance	2A-E-Ø3	51	Ø3	C-1201-SS	C-1201-SS
Eastbound No. 2 Thru Advance	2A-W-Ø4	52	Ø4		
Northbound No. 2 L/T Advance	2A-S-Ø5	53	Ø5	C-1201-SS	C-1201-SS
Southbound No. 2 Thru Advance	2A-N-Ø6	54	Ø6		
Eastbound No. 2 L/T Advance	2A-W-Ø7	55	Ø7	C-1201-SS	C-1201-SS
Westbound No. 2 Thru Advance	2A-E-Ø8	56	Ø8		
Northbound No. 4 Thru Advance	4A-S-Ø2	57	Ø1	C-1201-SS	C-1201-SS
Northbound No. 3 Thru Advance	3A-S-Ø2	58	Ø2		
Eastbound No. 4 Thru Advance	4A-W-Ø4	59	Ø3	C-1201-SS	C-1201-SS
Eastbound No. 3 Thru Advance	3A-W-Ø4	60	Ø4		
Southbound No. 4 Thru Advance	4A-N-Ø6	61	Ø5	C-1201-SS	C-1201-SS
Southbound No. 3 Thru Advance	3A-N-Ø6	62	Ø6		
Westbound No. 4 Thru Advance	4A-E-Ø8	63	Ø7	C-1201-SS	C-1201-SS
Westbound No. 3 Thru Advance	3A-E-Ø8	64	Ø8		

Section 86-3.04D(2), "Convenience Receptacle," of the Standard Specifications, is hereby amended with the addition of the following after the last paragraph:

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A minimum of two filtered convenience receptacles shall be mounted in a readily accessible location in the controller cabinet on the left and right upper walls.

### 86-3.04D(5) Control Panel Assembly

A control panel assembly shall be provided inside the cabinet door. It shall be readily accessible when the door is open. The control panel assembly shall consist of:

- A switch which shall be wired to energize the controller unit timing circuits while the signal lights are off or are being operated by flasher. The switch shall be labeled and rated for load current.
- A "Signal-Flash" switch which, when placed in the "Flash" position, shall provide flashing operation as specified in Section 86-3.03, "Flashing Operations." When said switch is placed in the "Signal" position, the controller unit shall resume control.
- The "Stop Time" switch shall be a three position toggle switch. When placed in the "OFF" position the controller unit shall not stop time. When placed in the "ON" position the controller unit shall stop time. When placed in the "Auto Stop Time" position, will cause the controller unit to stop time when the "Flash-Automatic" switch in the police panel is placed in the "Flash" position.
- The vehicle and pedestrian test switches shall be single pole, double throw, on/off/momentary on, toggle switches. The "ON" position shall be normal operation, the "OFF" position shall not allow any calls from the field to enter the controller, the "MOMENTARY ON" shall place a momentary call into the controller. The toggle switches shall be as specified in Section 86-3.04E(1), "Toggle Switches." The switches shall be installed so that pushing down on the toggle to the bottom position shall be the momentary on position. The test switches shall have a label indicating the operation of the three switch positions. There shall also be the following label above the test switches "For normal operation place switch in UP position."

### 86-3.04D(6) Police Panel Assembly

A police panel assembly, located behind the auxiliary door, shall be provided. The key hole for the police panel shall be provided with a cover to prevent foreign materials from entering the police panel. The police panel assembly shall consist of:

- A "Flash-Automatic" switch which, when placed in the "Flash" position, shall cause the controller assembly to go into the flashing mode and remove power from the signal bus. When placed in the "Automatic" position, it shall cause the controller assembly to resume operation.
- A "Lights-Off" switch which, when placed in the "OFF" position shall extinguish the signal indications.
- A "Manual Control" switch, which when placed in the "ON" position with the police panel door open, activates the "Manual Control Enable" input to the controller unit, and allows "Interval Advance" inputs to the controller from a manual pushbutton

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connected to a 6 foot cord retractable this cord. The cord shall have a plug that will not allow the door to close until the cord is unplugged and stored inside the police panel. The manual control switch shall be protected by door-actuated switch interlock on the police panel door which will disconnect the manual control enable when the police panel door closes regardless of the manual control switch position. The "Manual Control" switch shall also activate controller alarm 3.

- A door-actuated switch which activates intersection alarm 2 when the police panel door is open.

A removable, rigid metal cover shall be provided on the back of the police panel to cover the switch terminals.

### **86-3.04E Components**

Section 86-3.04E(3), "Circuit Breakers", of the Standard Specifications is hereby amended with the addition of the following:

The main cabinet breaker shall be rated at 30 amps and shall protect all circuits within the cabinet except the cabinet fan, the lighting fixture and the GFCI. Those items not protected by the main cabinet breaker shall be protected by a 15 amp breaker. A second 15-amp breaker for additional protection of the peripheral control equipment shall be placed between the cabinet filtering and the peripheral control equipment.

### **86-3.04E(5) Monitoring Device**

A monitoring device shall consist of an Eberle Design Inc. Model MMU-16LEip solid-state malfunction management unit installed external to, and electrically independent of, the solid state controller unit. The malfunction management unit shall meet the requirements of NEMA Standards Publication TS2-2003 and be downward compatible with existing NEMA TS1-1989 controller assemblies. The unit shall be keyboard programmable. The unit shall log high and low voltage conditions in addition to faults. A backlit LCD screen shall be provided for viewing of event logs. In the event of conflicting green, yellow or walk signals on the AC field terminations, simultaneous indications of active green, yellow, walk, or red field signal outputs on the same channel, the absence of voltage on all four of the field signal outputs of a channel, or the absence of a minimum 2.8 second period of an active yellow field signal output, the monitoring device shall cause the signal system to go into flashing operation. The flashing operation shall lock-in and shall release only upon operation of a reset switch. Operation of the monitor shall energize the stop timing circuit of the controller unit. The monitor shall communicate to the controller through the SDLC interface on the controller. The incoming AC line voltage shall be monitored and the occurrence and duration of voltage dips, surges, and long term over-voltage conditions shall be logged. The monitor shall also have a signal sequence history log and shall be capable of displaying up to 30 seconds of signal status prior to the fault trigger event.

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Conflicting green is defined as occurring when 25 Volts rms, or more, at 60 Hz appears for 500 milliseconds, or more, on any green circuit that is in conflict with the green circuit called for by a normally functioning controller unit. Conflicting greens lasting less than 200 milliseconds, or a conflicting voltage of less than 10 Volts rms shall not cause the device to place the signal in flashing operation.

All power supplies that provide voltage to logic circuits, except detector logic circuits, shall be monitored. If any voltage drops to a level where equipment does not work properly, the signal shall go into flashing operation.

Operation of a signal monitoring device shall disable all functions of the "Flash Automatic" switch in the police panel. When the controller assembly is equipped with railroad preemption equipment, the signal shall be wired to provide a flashing red on all phases upon operation of the monitoring device, and power shall be removed from the railroad preemption equipment.

The cabinet shall be wired so that it is possible to remove the monitoring device without causing the intersection to go into flashing operation so long as the cabinet door remains open, and such that the intersection will go into flashing operation with the monitoring device removed and the door closed.

### **86-3.04E(6) Solid-State Switching Devices**

Solid-state switching devices shall be provided with LEDs to monitor each lamp circuit input from the controller and output to the field conductors. The LEDs shall be visible when viewing the installed switching device and during a flash condition the output LEDs shall latch showing the last outputs.

### **86-3.04E(7) Solid-State Logic**

Solid-state logic or timing circuits, external to a controller unit, shall be built on edge connected plug-in, printed circuit boards. Logic circuits shall be built-up by plugging logic circuit boards into wired connectors. When logic circuit boards are used, they shall be installed in a chassis. Each chassis shall be covered, shall be provided with a MS type connector and shall be shelf-mounted.

### **86-3.04E(8) Special Timing**

Each special timer shall have a range from 0 to 30 seconds or the range shown on the plans. Timing of the interval shall be adjustable in one second maximum increments. Calibration accuracy shall be to the smallest selectable setting if the line voltage is at any value from 105 to 130 Volts while the ambient temperature is between 0 degrees F and 160



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degrees F. Each special timer shall be a plug-connected solid-state digital device with an indicator light to show when the timer is operating.

### **86-3.04E(9) Time Switch**

Time switches to control specified functions shall be solid-state. The time switch shall provide a minimum of 3 circuits with digital LED or LCD readout to indicate time of day and day of week settings. The time switch shall provide a minimum of 28 ON/OFF set points, in one minute maximum increments, at any time during the 7-day week, and with 5-minute minimum ON/OFF capability. The ON feature shall be a minimum of one minute to a maximum of 6 days, 23 hours and 59 minutes. The time switch shall be rated at 120 Volts, 60 Hz and 5 amperes per circuit. Operating instructions for the time switch shall be provided and affixed to the inside of the enclosure door.

### **86-3.04E(10) Flasher**

The flasher shall be a solid-state device with no contact points or moving parts. The flasher shall provide 2 output circuits each equipped with LEDs to monitor the circuit. The circuits shall permit alternate flashing of signal faces and shall be capable of carrying a minimum of 15 amperes per circuit at 120 Volts. The LEDs shall be visible when viewing the installed flasher.

The coil of the flash transfer relay shall be energized only when the signals are in flashing operation.

### **86-3.04E(11) Heavy Duty Relays**

Heavy duty relays shall be designed for continuous duty. Relays shall operate during ambient temperatures from 64 degrees F to 160 degrees F. Each relay shall operate in the 8-pin Jones-type socket shown on the plans.

Relays shall be provided with double-pole, double-throw contacts. Contact points shall be of fine silver, silver-alloy, or superior alternative material. Contact points and contact arms shall be capable of operation for 250,000 cycles with 20 amperes of tungsten load per contact at 120 volts, 60 Hz AC.

Coils shall have a power consumption of 10 volt-amperes or less and shall be designed for continuous duty on 120 Volts, AC.

Heavy duty relays shall be enclosed with a removable, clear plastic cover.

### **86-3.04E(12) Light Duty Relays**

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Light duty relays shall be enclosed with a removable, clear plastic cover and shall be permanently marked with the coil voltage.

Relays with coils rated at 120 Volts, or more, shall be the 3-pole, double-throw type, with a contact rating of 2 amperes at 120 Volts AC. Relays shall be provided with a plug for mounting in a standard 11-pin socket.

Relays with coils rated at 24 Volts, or less, shall be the 2-pole, double-throw type, with a contact rating of 2 amperes at 120 Volts AC. Relays shall be provided with a plug for mounting in a standard 8-pin socket.

Relays used to switch logic voltages shall have contacts designed for the voltage and current to be switched, except that the minimum contact rating shall be one ampere at 120 Volts AC.

### **86-3.04E(13) Toggle Switches**

Toggle switches shall have poles as required and shall be rated at 200 percent of circuit current for circuits of 10 amperes or less and 125 percent of circuit current for circuits over 10 amperes.

Circuit breakers used as toggle switches shall be UL or ETL listed for switching operation.

### **86-3.04E(14) Telemetry Interface Unit**

A telemetry interface panel, equipped with a surge arrester to reduce the effects of voltage transients in the interconnect cable, shall be furnished and installed in an easily accessible location. The panel shall be provided with two jumpers to allow connection of a 620 ohm resistor across the command and read-back lines. A telemetry interface cable shall be included with each interface unit. Each interface unit shall provide terminal blocks as necessary to allow system command and local read-back. Shall be installed when the cabinet is to be used with the city's Legacy Aries system.

### **86-3.04E(15) Lighting Fixture**

Each traffic actuated cabinet shall be provided with LED lighting fixture(s) mounted on the inside top of the cabinet near the front edge. Fixture shall be provided ample light to see each piece of equipment that is install within the cabinet. The LED shall operate from a normal power factor UL or ETL listed ballast/driver.

The "ON-OFF" switch for the lighting fixture shall be a door-actuated switch that turns the light on when the door is open, and off when the door is closed.

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### **86-3.04E(16) Card Guides**

Card guides shall be designed to provide support and guidance for printed circuit cards. The guides shall provide continuous support and guidance for a minimum of 90 percent of the length of the card to be inserted. Support shall be provided on 2 sides of the card. The guides shall not allow the card to be inserted into the edge connector at more than one degree off normal.

### **86-3.04E(17) Radio Interference Suppressors**

Radio interference suppressors shall provide a minimum attenuation of 50 decibels over a frequency range of 200 kilohertz to 75 megahertz when used in connection with normal installations. The interference suppressor shall be hermetically sealed in a substantial metal case filled with a suitable insulating compound. Terminals shall be nickel-plated, 10-24 brass studs of sufficient external length to provide space for connecting 2 No.8 conductors, and shall be so mounted that the terminals cannot be turned in the case. Ungrounded terminals shall be properly insulated from each other and shall maintain a surface leakage distance of not less than 1/4 inch between any exposed current conductor and any other metallic part, with an insulation factor of 100-200 mega-ohms dependent on external circuit conditions. Suppressors shall be designed for 125 percent of the total connected load and in no event less than 25 amperes on 120 Volts, 60 Hz single-wire circuits, and shall meet standards of the UL or ETL, and the EIA.

### **86-3.04E(18) Printed Circuit Boards**

Printed circuit boards shall be designed to facilitate identification of components. Identification shall be made either by part identification markings or by providing a pictorial diagram in the maintenance manual for the unit showing physical location and identification of each component. Printed circuit boards shall be NEMA FR-4 glass cloth base epoxy resin board, 1/16-inch minimum thickness. with organic solder masking and gold plated contacts. Intercomponent wiring shall be copper track, with a minimum weight of 2 ounces per square foot, and with adequate cross section for the current to be carried. Printed circuit design shall be such that components may be removed and replaced without permanent damage to board or tracks.

## **86-3.05 ADDITIONAL REQUIREMENTS FOR CONTROLLER ASSEMBLIES**

The following requirements shall apply to all controller assemblies:

### **86-3.05A Control Priorities**

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The devices, controls and equipment shall have the following priorities over the others. Each device, control or item of equipment shall override the operation of those items listed below it and shall yield its operation to those items listed above it.

- Power failure
- Power restart
- Flashing
- Railroad pre-emptor
- Emergency vehicle pre-emptor
- Phase selector
- Interconnect
- Time switch
- Normal controller unit operation

### **86-3.05A Operating Voltage**

All controller units shall operate over the range of voltages from 100 Volts to 135 Volts at 60 Hz. The voltage for pedestrian push buttons shall not exceed 25 Volts.

### **86-3.06 ADDITIONAL REQUIREMENTS FOR CONTROLLER ASSEMBLIES WITH CLOSED-CIRCUIT TELEVISION (CCTV) INSTALLED IN CONTROLLER CABINET.**

The following requirements shall apply to all controller assemblies with **Closed-circuit television (CCTV)** installed in controller cabinets:

#### **86-3.06A Closed-circuit television (CCTV)**

Closed-circuit television (CCTV), shall be model SW720P-H.264-HD30-ENG as manufactured by Wireless Technology, Inc., 2064 Eastman Avenue Suite 113, Ventura, CA 93003-7787, Phone: (805) 339-9696, Fax: (805) 339-0932, Web: [www.gotowti.com](http://www.gotowti.com)

#### **86-3.06B Quality and manufacturing**

The manufacturer providing the specified product shall be certified to comply with the requirements of ISO 9001-2008. Equipment shall be current standard production units and shall have been in production for a minimum of six months.

#### **86-3.06C System description**

A fully assembled, factory tested and certified unit with the following features:

- A 1080P high definition day/night, color/monochrome CCD camera with a x30 optical zoom lens and support for multiple video streaming formats.

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- A low maintenance, hydrophilic coated, energy saving, directly heated, non-fogging camera faceplate window.
- A high accuracy, wide dynamic range, variable speed pan and tilt mechanism with continuous 360 degree rotation in both axes and automatic image flip.
- An environmentally rugged housing suitable for harsh environments, that is compatible with the temperature, power, vibration and shock requirements of NEMA TS-2, as well as the environmental dust and water resistance requirements of IEC 60529 IP66 and IP67 ratings.
- Ethernet streaming video and control, as well as support for RS-485 serial data control and analog NTSC compatible video output to support legacy systems.

### 86-3.06D Product Specifications

The camera system shall meet or exceed the following design and performance specifications.

#### 86-3.06D(1) Image Sensor and Lens

##### Image Sensor and Lens

- Image Sensor Type: EXMOR CMOS Image Sensor
- Image Sensor Size: 1/2.8"
- Image Sensor Pixel Resolution: 2096 horizontal x 1561 vertical
- Effective Pixels: 1920 Horizontal x 1080 vertical
- Analog Video Output Format: NTSC, 1Vpp at 75 Ohms, unbalanced
- Maximum Lens Aperture: F1.6 at full wide angle – F4.7 at full telephoto
- Optical Zoom Range and Focal Length: x1 to x30 (4.3mm ~ 129mm)
- Digital Zoom Range: x1 to x12 with smooth transition from optical to digital
- Extended Digital Zoom and Focal Length: 94mm ~ 1128mm
- Optical Zoom Speed: 1.6s with focus tracking off - 4.6s in 30P/60P mode
- Horizontal Angle of View: 63.7 degrees (wide angle) to 2.3 degrees (tele)
- Minimum Focus Distance: 10mm (wide angle) to 1200mm (tele)
- Auto Focus: Selectable between Auto/Manual
- Manual Focus Speed: approximately 3.2 seconds – near to far
- Shutter Speed: Adjustable from 1 second to 1/10,000 second. Settings below 1/60 second increase integration time to improve low light sensitivity with video frame store to provide continuous video output.
- Auto Iris: Electronically controlled from F1.6 to F14 and Closed, to provide optimum sensor illumination for constant video output.
- Gain Range: 28 steps
- Gamma: 0.45 or Straight
- Color Balance: Auto White Balance with adjustable red and blue levels.
- Signal to Noise Ratio: >50dB
- Synchronization: Crystal

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### 86-3.06D(2) H.264/MJPEG ENCODING ENGINE

The camera system shall integrate the H.264/MPEG-4/MJPEG encoding with functions as specified below;

- Video Encoding: H.264 (Baseline/Main/High Profile, up to Level 4.1), MPEG-4 (Simple Profile) and MJPEG standards
- Video Streams: Two independently configurable streams; (2) H.264 streams, (1) H.264 and (1) MJPEG or (1) MPEG-4 and (1) MJPEG.
- Video Stream Configuration Properties;
- Codec
- Video Stream 1: H.264, MJPEG or MPEG-4
- Video Stream 2: H.264, MJPEG or MPEG-4
- Image Resolution: 1080p, 720p, D1, 2-CIF, VGA, CIF
- Streaming Mode: CBR or VBR
- Image Settings: (GOP (M, N)), Quality Value
- Frame Rate: 30, 15, 7, 4, 2, 1
- Data Rate: Adjustable from 64k to 12Mbps in VBR mode and 64k to 16Mbps in CBR mode.
- Connection Types: Uni-cast, multi-unicast or multi-cast
- Video Latency: <250ms
- Network Protocol Layers: RTP, RTSP, UDP, TCP, IP, HTTP, IGMPv2, ICMP, ARP as a minimum

### 86-3.06D(3) Camera Housing Module

The Camera Housing Module shall integrate a housing as specified below;

- Outside surface of camera housing window provided with high temperature vacuum deposited hydrophilic coating to reduce window cleaning maintenance.
- Inside surface of camera housing window provided with electrically conductive coating to allow energy saving direct heating of window glass to prevent fogging.
- Proportionally controlled closed loop window heater drive circuit with outside temperature sensor unit to provide fog free window operation under all environmental conditions.
- Temperature sensor and microprocessor controlled image sensor heater to provide reliable operation of zoom lens down to -34 degrees Celsius.

### 86-3.06D(4) Pan and Tilt Drive Assemblies (both axes)

The Pan and Tilt Drive Assemblies (both axes) shall be integrated as specified below;

- Drive Range: 360 degrees continuous rotation (both axes)
- Drive Speed: Variable from 0.0003 Degrees/Second to 100 Degrees/Second

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- Drive Resolution: 0.005625 Degrees
- Drive Repeatability: 0.05 Degrees typical
- Preset to Preset Time: Selectable between 2 seconds and 5 seconds for 180 degree motion in both axes
- Operator Motion Speed: Pan and Tilt speeds are proportional to both operator speed commands and camera zoom setting.
- Brakes: Electrically operated pan and tilt motor brakes with a minimum holding torque of 300 oz./in shall be provided to maintain the camera position when power is removed from the camera.

### **86-3.06D(5) Operational Features**

The Operational Features shall be integrated as specified below;

- Presets: Minimum of 64 presets, each preset to store variable data for pan position, tilt position, zoom setting, focus setting and 24 characters of titling text to be displayed when the preset is recalled. Preset titling to remain on screen until subsequent preset or camera control commands are received.
- Tours: Eight tours of up to 32 presets each shall be supported. Presets may be assigned to the tours in any order and may be used multiple times within one tour.
- Panning Tours: Any or all of the eight tours may be used as “panning” tours by selecting exactly two presets for the tour. The first preset selected for the tour shall set the counter-clockwise panning limit and the tilt angle for the tour, and the second preset selected shall set the clockwise panning limit for the tour. The positioning system shall pan smoothly from one preset to the other and back again until a subsequent camera command is received.
- Sector Zones: Up to 16 sector zones with user settable right and left pan limits may be programmed with one line of up to 20 characters of ID titling per zone.
- Privacy Zones: Any Sector Zone may be utilized as a privacy zone by setting the video mode to “OFF” within that zone.
- Low Pressure Warning Indicator: Provide low pressure warning indicator on video display for cameras supplied with pressurized camera housing option.
- Internal Temperature Warning Indicator: Provide an internal temperature warning indication on the video display.
- Program Memory: Unit must be field upgradable using FLASH or other type of non-volatile memory to store programming.

### **86-3.06D(6) Camera Power and Signal Interface**

The Camera Power and Signal Interface shall be integrated as specified below;

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- Video output shall be configured as 75 Ohm, 1Vpp, unbalanced signal labeled as “video” and “video shield” in documentation.
- Two levels of transient protection shall be included using a gas discharge tube followed by 40A 2kW transient voltage suppressor.

Control Data signals shall be provided for bidirectional differential data conforming to EIA RS-485 signal levels and drive capabilities.

- The camera shall also be compatible with EIA RS-422 drivers and receivers (Note that EIA RS-232 support is provided by LCU).
- The camera shall support up to 32 cameras on one control data bus.
- “+TX”, “-TX” shall designate the control data lines connected to the RS-485 output drivers within the camera.
- “+RX”, “-RX” shall designate the control data lines connected to the RS-485 receiver inputs within the camera.
- “Data Shield” shall designate the data reference signal.
- Two levels of transient protection shall be included using gas discharge tubes followed by 40A 300W transient voltage suppressors.

Control Data protocol support include Cohu, Pelco D and NTCIP codes without the use of additional protocol convertor hardware.

- Power input and operational performance shall be in conformance with the following specifications and shall be documented by an outside independent laboratory.
- Power input shall be less than 100 Watts with all options installed and operating.
- AC Mains operating voltage and frequency shall be 85VAC to 265VAC and 60Hz +/- 3Hz.
- Power interruption immunity shall be per NEMA TS-2 paragraph 2.1.4.
- Power transient immunity shall be per NEMA TS-2 paragraph 2.1.6.

Mechanical:

- Interface connector shall be weatherproof and corrosion resistant MS style 18 Pin type with gold plated contacts or AMP style 16 pin type with gold plated contacts.
- Camera weight shall be 20 pounds or less.
- Nominal camera dimensions shall be 14”H x 13”W x 9.5”D or less.
- Camera housing shall be constructed of rugged, corrosion resistant materials such as powder coated aluminum, stainless steel and UV resistant, shock resistant polymer materials suitable for use in all outdoor environments and under all shock and vibration conditions.

Environmental

- The camera shall undergo independent laboratory testing to certify conformance with the following environmental and mechanical specifications:
- Operational temperature range shall be from -34 degrees Celsius to +74 degrees Celsius and shall be tested with high line and low line operating voltages per NEMA TS-2 paragraphs 2.1.2, 2.1.3 and 2.1.5.



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- Immunity to vibration shall be tested according to NEMA TS-2 paragraphs 2.1.9 and 2.2.3 using a 0.5g amplitude signal from 5Hz to 30Hz applied in each of 3 mutually perpendicular axes for 30 minutes.
- Immunity to shock shall be tested according to NEMA TS-2 paragraphs 2.1.10 and 2.2.4 using a 10g amplitude, 10ms duration shock pulse in each of three mutually perpendicular axes.
- Immunity to water spray (IPx6 rating) shall be tested according to IEC 60529 section 14.2.6 using a 25 gallon per minute water stream through a 12.5mm nozzle at nine feet for three minutes.
- Immunity to water immersion (IPx7) shall be tested according to IEC 60529 section 14.2.7 using an immersion depth of 1 meter measured at the bottom of the camera and a duration of 30 minutes.
- Immunity to external icing shall be tested according the NEMA 250-2003 section 5.6.
- Immunity to corrosion shall be tested according to NEMA 250-2003 section 5.10 and the procedure specified in ASTM-B117 Marine.
- Electromagnetic radiation shall be within the limits set by FCC Regulations 47 CFR Part 15 for Class A devices.
- Pressurization
- The camera housing tube shall be supplied pressurized to 5psi or greater using dry nitrogen.
- A 15psi pressure relief safety valve shall be installed in the camera tube housing to prevent the camera tube housing from being over-pressurized.
- The camera tube housing shall be provided with pressure and temperature sensors to allow remote monitoring of these parameters.
- An under pressure warning shall be displayed on the video image when the camera housing tube pressure drops below a preset limit.
- An altitude adjustment parameter shall be supported to allow compensation for local elevation during installation.

### 86-3.06D(7) ENG Brakes

The ENG Brakes shall be integrated as specified below;

- An ENG brake shall be included such that for electronically controlled pan and tilt brakes which prevent the camera from moving in the pan or tilt axis when it is powered off or when the unit is not being directed to change its pan or tilt position (SW720-H.264-HD30-ENG Model)

## 86-4 TRAFFIC SIGNAL FACES AND FITTINGS

### 86-4.01 VEHICLE SIGNAL FACES

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Section 86-4.01, "Vehicle Signal Faces" of the Standard Specifications, is hereby amended with the addition of item 7:

The City does not use 8-inch indications, all signal indications (circular and arrows) shall be provided with 12-inch sections.

### **86-4.01E Backplates**

Section 86-4.03, "Backplates", of the Standard Specifications, the first paragraph is replaced with:

Where shown on the plans, backplates shall be furnished and installed on signal faces. All backplates used on metal signal heads shall be louvered. Dimensions, materials and installation details shall be as shown on the plans. Background light must not be visible between the backplate and the signal face or between sections.

### **86-4.03 PEDESTRIAN SIGNAL FACES**

Section 86-4.03, "Vehicle Signal Faces" of the Standard Specifications, is hereby amended with the addition of the following:

Pedestrian signals shall be of the Gelcore Light Emitting Diode (LED) Countdown type, Part No. PS7-CFF1-01A-18 or approved equal.

### **86-4.04 SIGNAL MOUNTING ASSEMBLIES**

Section 86-4.06, "Signal Mounting Assemblies", of the Standard Specifications, replace the paragraph that begins with, "For Type SV-1-T mountings..." with the following:

Vehicle signal faces with 5 or more sections shall be provided with an additional terminal compartment at the top of the assembly, and shall be bolted to the standard in the same manner as the lower terminal compartment for side mounted head assemblies may require an extension 1½" pipe to clear mastarm on pole, for 1-A pole installations of vehicle signal faces with 5 or more sections shall be provided with a 15 foot 1-A pole and mounting shall be done using a top mounting per Caltrans signal slip fitter detail for top mounting on Caltrans standard plan ES-4D, and the lower terminal compartment bolted to the lower section of the pole.

## **86-5 DETECTORS**

### **86-5.01A(2) Sensor Unit Construction**

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Replace Reserved with the following:

Each controller assembly shall be equipped with four detector racks, with , 24-2 channel sensor units for detection, 6-2 channel sensor units with additional count outputs, and 2-2 channel emergency vehicle preemption discriminators. Count detectors shall have the word "Count" on the face plate to differentiate them from the detectors with only the standard outputs. Detector racks shall be protected on the top from water intrusion.

The detector 1-8, 26, 28 30, 32, and 33-48 shall be able to receive the green output read back to the detector card for the bike extension timing function of the card.

Type and quantity of Reno detector cards shall be provided shall be as follows unless stated otherwise in the engineers equipment need for project statement.

When Bike preformed Loops are used all lanes

8 - Model C-1200-SS Standard Detector cards

12 - Model C-1201-SS Count Detector cards

12 - Model C-1201-B-SS Bike Detector cards for preformed loops

When Type D Loops and Bike preformed Loops are used for left turn and thru bike lanes

8 - Model C-1200-SS Standard Detector cards

12 - Model C-1201-SS Count Detector cards

8 - Model C-1201-B-SS Bike Detector cards for preformed loops

4 - Model C-1200-B-SS Bike Detector cards for Type D loops

Each output circuit of the unit shall be provided with a high intensity red LED to indicate a call output, delay timing, extension timing, pending state or failed loop.

The vehicle detector shall continuously check the integrity of the loop. The detector shall be able to detect shorted or open circuit loops, or sudden changes in inductance exceeding 25% of the nominal inductance. If a fault is detected, the LED shall emit a particular repeating sequence of flashes followed by a pause to identify each type of fault.

Sensor units shall conform to the requirements in Section 6 of the NEMA Standards Publication No. TS2-1992. The units shall be NEMA Type-C, 2-channel, rack mount type detectors. Sensors shall be Model C-1200-SS, Model C-1201-SS, Model C-1200-B-SS (Bike Detection), and Model C-1201-B-SS (Bike Detection) as manufactured by Reno A&E of Reno, Nevada.

## **Section 86-5.01A(4) Installation Details**

Section 86-5.01A(4), "Installation Details", of the Standard Specifications, is hereby amended with the addition of the following:

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Loop conductors shall be twisted six turns per foot from the point that the conductors enter together the saw cut leading to the pull box, until spliced to the detector lead-in cable. The contractor may at his option install 6-foot diameter round loops in-lieu of 6-foot x 6-foot square loops, where shown on the plans. So that optimum sensitivity is obtained at the sensor unit, the loops shall be joined in the pull box in series, and physically adjacent loops shall be wound with opposite rotation. Rotation reversal may be accomplished at the pull box by reversing the leads. The sealant for filling slots shall conform to hot-melt rubberized asphalt sealant:

## **Section 86-5.01A(5) Preformed Inductive Loops**

Section 86-5.01A(5), "Preformed Inductive Loops", of the Standard Specifications, is hereby amended with the addition of the following:

Presence detection shall include lane-by-lane detection capable of discriminating between vehicles and bicycles; shall provide extension/hold for detected bicycles; shall contain a preformed parallelogram loop wired continuously from the loop to the cabinet; shall be installed across the entire width of each travel lane plus 12 inches of overhang; and shall be installed at a 45 degree angle to approaching traffic.

## **Section 86-5.01A(6) Type D Inductive Loops**

Section 86-5.01A(6), "Type D Inductive Loops", of the Standard Specifications, is hereby amended with the addition of the following:

Presence detection shall include lane-by-lane detection capable of discriminating between vehicles and bicycles; shall provide extension/hold for detected bicycles; shall contain a Type D loop wired continuously from the loop to the first pullbox; shall be installed 1 foot from the crosswalk and centered in the width of each travel lane; and shall be installed per Type D loop detector configuration on Caltrans standard plan ES-5B. The Type D loop shall be installed with 5 turns and the loop conductors shall be twisted six turns per foot from the point that the conductors enter together the saw cut leading to the pull box, until spliced to the detector lead-in cable.

## **86-5.01D Emergency Vehicle Detector System**

### **86-5.01D(1) General**

The term "modulated light signal detector" applies to a complete installation consisting of one optical detector, and connecting cable for each approach and the discriminator modules necessary to provide the proper preemption inputs to the controller.

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### 86-5.01D(2) Optical Detector

Each optical detector shall be a weatherproof unit capable of receiving optical energy from two separately aimable directions and providing a separate output for each. The horizontal angle between the two directions shall be variable from 180 degrees to 5 degrees. Each such detector, when used with standard emitters, shall have a range of at least 1800 feet for Class II signals.

The reception angle for each photocell assembly shall be a maximum of 8 degrees in all directions about the aiming axis of the assembly.

All internal circuitry shall be solid state, and electrical power shall be provided by the associated discriminator module.

Each optical detector shall be contained in a housing, which shall include two rotatable photocell assemblies, an electronic assembly, and a base. The base shall have an opening to permit its mounting on a mast arm or a vertical pipe nipple. The mounting opening shall have female threads for 3/4 inch conduit. A cable entrance shall be provided which shall have male threads and gasket to permit a waterproof cable connection. Each detector shall weigh not more than 2 1/2 pounds and shall present a maximum wind load area of 36 square inches. The housing shall be provided with weep holes to permit drainage of condensed moisture.

### 86-5.01D(3) Cable

Optical detector cable shall meet the requirements of IPCEA-S-61-402/NEMA WC 5, Section 7.4, 600-Volt control cable, 167 degrees F., Type B, and the following:

- The cable shall contain 3 conductors, each of which shall be No. 20 (7X28) stranded, tinned copper with low-density polyethylene insulation. Minimum average insulation thickness shall be 25 mils. Insulation of individual conductor shall be color coded: 1-yellow, 1-blue, 1-orange.
- The shield shall be either tinned copper braid or aluminized polyester film with a nominal 20 percent overlap. Where the film is used, a No. 20 (7X28) stranded, tinned, bare drain wire shall be placed between the insulated conductors and the shield and in contact with the conductive surface of the shield.
- The jacket shall be black polyvinyl chloride with minimum ratings of 600 Volts and 176 degrees F and a minimum average thickness of 45 mils: The jacket shall be marked as required by IPCEA/NEMA.
- The finished outside diameter of the cable shall not exceed 0.35 inch.

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- The capacitance, as measured between any conductor and the other conductors and the shield, shall not exceed 48 pico-farads per foot at 1000 Hz.
- The cable run between each detector and the controller cabinet shall be continuous without splices.

### 86-5.01D(4) Discriminator Module

Each discriminator module shall be rack mounted and designed to be compatible and usable within a NEMA TS1 or NEMA TS2 Type 1 controller assembly.

Each discriminator module shall be capable of operating four channels, each of which shall provide an independent output for each separate input and able to operate on IR only operation, GPS only operation, or simultaneous IR and GPS operation

Each discriminator module, when used with its associated detectors, shall be capable of receiving Class II signals, establishing the validity of received signals, and providing a NEMA defined output for each channel to the appropriate input of the controller unit. The discriminator outputs shall provide inputs to the controller unit as follows:

Controller Input	Preempt Direction
EVP-3	Northbound
EVP-4	Southbound
EVP-5	Eastbound
EVP-6	Westbound

### 86-5.01D(5) Auxiliary Interface Panel (AIP)

Auxiliary Interface Panel (AIP) shall be prewired in traffic signal cabinet prior to shipping by cabinet manufacture. With all wiring to operate the discriminator module in IR only operation, GPS only operation, or simultaneous IR and GPS operation. The AIP shall be wired to allow the following features and/or capabilities when needed:

- Green sensing or green light verification
- Auxiliary infrared detector inputs
- Additional preempt outputs
- Turn signal dependent operation (For GPS operation)
- Separate outputs for high and low priority
- Clock sync input (In IR operation)
- Clock sync output (For GPS operation)
- Confirmation light outputs with the phase selectors.

## 86-5.02 PEDESTRIAN PUSH BUTTON ASSEMBLIES

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Section 86-5.02, "Pedestrian Push Button Assemblies", of the Standard Specifications, add the following to the first paragraph:

The assembly shall be equivalent to the Campbell Model MPS-57-Rnd-G, and the housing shall be green powder coated aluminum. The pedestrian push button shall be Polara "Bull Dog" with a nonlatching LED, or an equivalent approved by the City. The pedestrian push button shall also be capable of working with econolite's extended walk function using a push and hold for additional walk time.

Section 86-5.02, "Pedestrian Push Button Assemblies", of the Standard Specifications, the sixth paragraph is hereby amended to read:

Pedestrian push button signs shall be porcelain enameled metal only, structural plastic is not allowed.

### 86-6 LIGHTING

**86-6.02 RESERVED** is replaced with **LED LUMINAIRES**

Intersection safety lights shall be LED type, watt as shown on plan, manufacturer shall be GE Lighting. Contractor shall submit to the city the cut sheets for all LED luminaires to be use on this signal project.

### 86-6.09 INTERNALLY ILLUMINATED STREET NAME SIGNS

Section 86-6.09 "Internally Illuminated Street Name Signs," of the Standard Specifications, the entire section is hereby deleted and amended to read:

**Reflective Street Name Sign as manufactured by Safeway Sign Company Model number SSGT and shall meet the descriptive requirements as stated below, except illumination requirements, as approved by the City.**

The sign panels shall be rigid mounted in a frame, with white diamond grade reflective legend, symbols, arrows, and border on each face, the background shall be green.

The sign and panels shall be designed and constructed to prevent deformation warping, or failure when subjected to 100 mph wind loads as set forth in the AASHTO publication, "Standard Specifications for Structural Supports of Highway Signs, Luminaires, and Traffic Signals", and amendments thereto. A Certificate of Compliance conforming to these Special Provisions shall be submitted by the manufacturer with each lot of reflective street name signs. The certificate shall state that the reflective street name signs meet the wind load requirements as described above.

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The signs shall be attached to a 10-foot arm mounted 8 feet above the signal mast arm mounting, and extending from the shaft of the pole parallel to the signal mast arm. Each 10-foot arm shall have an end cap, a cable guide, and 3 sign mounting tabs with bronze bushings. The tabs shall be welded to the arm and shall be positioned 2', 6' and 8' from the outside end of the arm. The tabs shall be of such length that the center of the mounting hole in the tab shall be 4" below the center line of the arm. The hanging street name sign lower mounting assembly shall be mounted directly to the tabs with a 1/2-inch stainless steel bolt. The mounting is similar to that shown in Caltrans Standard Plan ES-33, view FF.

At locations with an existing pole, the arm shall be mounted using a clamp on type assembly as manufactured by Valmount Corp. The clamp on assembly shall have a minimum of four bolts, and a set bolt to assure the mast arm will not change position after it is installed and aligned. The mounting clamp assembly and arm shall be designed and constructed to prevent deformation or failure when subjected to 80-mph wind loads as set forth in the AASHTO publication, "Standard Specifications for Structural Supports of Highway Signs, Luminaires, and Traffic Signals," and amendments thereto. A Certificate of Compliance conforming to these Special Provisions shall be submitted by the manufacturer with each lot of mast arms. The certificate shall state that the arm and mounting assembly are designed to accommodate the internally illuminated street name sign mast arm assembly and meets the requirements as described above.

At locations where a new pole is installed, the arm shall be attached to a mounting plate on the pole using four high strength cap screws. The mounting plate attachment shall be designed and constructed to prevent deformation or failure when subjected to 100-mph wind loads as set forth in the AASHTO publication, "Standard Specifications for Structural Supports of Highway Signs, Luminaires, and Traffic Signals," and amendments thereto. A Certificate of Compliance conforming to these Special Provisions shall be submitted by the manufacturer with each lot of mast arms. The certificate shall state that the pole is designed to accommodate the internally illuminated street name sign mast arm assembly and meets the requirements as described above.

Signs shall be Type A.

## **Section 86-6.11B(1) Photoelectric Unit**

Section 86-6.11B(1) Photoelectric Unit, of the Standard Specifications, is hereby amended with the addition of the following before the first paragraph:

Photoelectric control shall be Type V for all new highway safety lighting and, when used, internally illuminated street name signs.



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## **SP 3.0 ADDITIONAL OR SPARE EQUIPMENT, ADDITIONAL WORK TO BE REQUIRED**

*This area shall be added to as additional sheets to be field out by the design engineer with any additional requirements and/or equipment necessary for this project. The design engineer shall use the follow format and list the SP3.0 section's as reference on the cover sheet.*

*The Contractor shall furnish the following additional or spare equipment:*

*Add here any requirements for spare or additional equipment:*

*Use the following format*

*SP 3.1 Traffic Signal Controller*

*SP 3.2 Malfunction Management Unit*

*SP 3.3 Detector Cards, Load Switches, BIUs*

*Etc.*

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## **SP 4.0 PAYMENT**

Payment for completing the Traffic Signal System shall be the lump sum bid per location for the **ITEM "TRAFFIC SIGNAL SYSTEM"** and no additional compensation shall be allowed therefore.