Plan Preparation

Traffic signal plans are required for new signals, relocation of signal hardware, changes in signal hardware other than routine maintenance, interconnection, overhead signs, electric signs, variable message signs, beacons, traffic monitoring cameras, detection or changes in traffic islands, curb lines, signal phasing and significant relocation of pavement marking features.

Traffic signal plans generally shall be prepared by the Signal Design Section or the ATSAC Design Section for projects involving City streets. Exceptions are as follows:

- B-Permit plans prepared by consultants;
- Projects for which a City approved agreement specifies another entity;
- Projects under the permanent jurisdiction of another governmental agency, such as Caltrans for State highways; and
- Projects for which the Bureau Head or higher authority has approved preparation by another entity.

Plan Approval

All plans for which the location is wholly under the jurisdiction of the City shall be signed as follows:

- By the Section Head of the Signal Design Section or ATSAC Design Section, unless that person is absent; and
- By the Division Head of the Design Division or ATSAC Design and Construction Division, unless that person is absent; and
- By the Bureau Head responsible for those divisions, unless that person has delegated approval authority to the Division Head whose division initiated the plan.

Plans prepared by another entity or governmental agency that affect streets under the jurisdiction of the City of Los Angeles shall require the signature of the Bureau Head responsible for the Design Division, or the Division Head if approval authority has been so delegated.

The practice of Traffic engineering requires that related design plans be signed and stamped by Civil Engineers registered in the State of California. Accordingly, the final approval authority for the Department shall be so registered. In addition, any B-Permit consultant or other person submitting plans shall be so registered and shall sign and stamp said plans.

B-Permit consultants submitting plans shall meet two other requirements. First, they must have a Business License in the City of Los Angeles. Second, they must indicate on the plan that the plan has been reviewed by a person who
is either registered as a Traffic Engineer in the State of California or who has a Professional Traffic Operations Engineer Certificate issued by the Institute of Transportation Engineers.

Plan Review

Traffic signal plans are to adhere to the national Manual on Uniform Traffic Control Devices, the California Traffic Manual, the California Vehicle Code, LADOT Standard Plans and text herein. In using these sources optional or “may” conditions are to be determined using engineering judgement. Recommended or “should” conditions are to be incorporated, unless there is a compelling reason to deviate. Mandatory or “shall” conditions are to be followed without exception. Recommended and mandatory conditions in the Standard Plans and text that exceed national and State standards do not apply to plans approved prior to the adoption date of this section of the Manual of Policies and Procedures.

In preparing or reviewing signal plans the Signal Design Section or ATSAC Design Section shall be responsible for ensuring that plans adhere to the above, while incorporating critical information and concerns communicated by the DOT District office or other sections of the Department, particularly the Signal Timing Section on matters related to signal phasing. In considering all input the plan shall represent the best recommendation of the Signal Design Section or the ATSAC Design Section. Design and operational issues should be coordinated at the Associate III, Section Head or Division Head levels, if necessary, for resolution. The operational preference of the DOT District office generally should prevail for discretionary operational matters. Their concurrence shall be indicated by showing their initials along with the concurrence date in the title box. If the in-progress plan shows significant or operational changes after it is initialed by the DOT District office, or others who previously reviewed the plan, then it requires rerouting for concurrence, with a new date shown on the plan.

Plans more than three years old prior to installation should be newly reviewed for: any change in field conditions; appropriateness of proposed signal design previously approved; and application of current design standards. Where changes are necessary, a superseding plan or revision shall be prepared.

To the extent feasible, projects initiated for other purposes should incorporate, operational or safety improvements desired by the Department. Such projects might include street widening, street lighting, storm drain, B-Permits and ATSAC. The extent of the additional work, deadlines or other factors occasionally may present difficulties in including them with the initial project. In these cases an assured project shall be identified to include the improvements or another plan shall be initiated to include them.

Signal Plan Implementation

Approved signal plans are to be implemented as shown in the table below:

<table>
<thead>
<tr>
<th>Initiation of Project</th>
<th>Implementation By</th>
</tr>
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<tbody>
<tr>
<td>Department-Initiated</td>
<td>DOT Field Forces</td>
</tr>
<tr>
<td>Street Resurfacing</td>
<td>DOT Field Forces</td>
</tr>
</tbody>
</table>
For work generally to be performed by DOT field forces, elements such as trenching, detector installation, etc. may be contracted out at DOT's discretion. For work to be performed entirely by contractors on City streets, DOT and the Bureau of Contract Administration must inspect and approve the signal work.

On occasion and at its discretion, the Department may use programmed funds so identified in DOT's budget or in the CIP to perform all or part of the work by contract rather than by DOT field forces. If the work is for routine construction of limited scope, then a low-bid contract can be awarded through the Department of General Services. Projects of larger scope, which require the plan processing services of the Bureau of Engineering and the contract inspection services of the Bureau of Contract Administration, should be awarded through the Board of Public Works.

Plan Format

All traffic signal plans shall use the latest version of AutoCAD, as menu-enhanced for use by LADOT, except for those plans exempted by the Bureau Head for emergency purposes. Traffic signal plans prepared by other agencies having partial or total jurisdiction over the location should use the prescribed AutoCAD format. However, if the City is not conversant with LADOT's format and prepares the plans in another format, then LADOT staff shall initiate AutoCAD replacement plans immediately upon approval of the non-conforming plans for all locations maintained by DOT field forces. Right-of-way, roadway features, striping and other traffic control devices relevant to the traffic signal plans shall be layered to reflect "existing," "to-be-removed" and "proposed" conditions for each stage of construction, using specified line thicknesses and spacing.

The symbols shown in scale on Standard Drawing S-50.1 shall be used in the sizes shown. A sample drawing illustrating the format and a diskette of the menus, layering, symbols, line thickness and pen assignments, shall be available to consultants and other agencies.

All signal plans shall be prepared to a scale of one inch equals 20 feet or 1 to 250 scale for metric drawings, except where a different scale is approved by the Section Head, often due to the large expanse of an intersection complex. All overhead static and variable message signs should be drawn to a horizontal scale of one inch equals 40 feet, or 1 to 500 scale for metric drawings, so as to identify the general location, street lighting and related geometric features along the route near the installation. In addition, on a cross-section scale of approximately one inch equals 5 feet, or 1 to 62.5 scale for metric drawings, the plan shall include details of the sign. These details shall include panel size, size and type of legend, background and legend colors, type of reflective sheeting, legending, relative position of panel and legend with respect to curb line and striping, type of mounting, type of overhead standard, type of illumination, relevant specifications and any reference to standard drawings.

Plans should be drawn on 24 inch by 36 inch mylar 3.0 mils (0.003 inch) thick, with a specified border, title block, signature block, "As-Built" block, "Signal Standard Schedule" and "Conductor Schedule." In addition, if the work is to be done by contract, a "Notice to Contractor" listing of notes, an "Estimated Materials Furnished by LADOT" table and an "Estimated Salvaged Materials To Be Returned to LADOT" table shall be included.
Up to three minor oversights may be individually corrected on the mylar copy of an AutoCAD plan if the change has been made on the diskette.

**Base Plan Contents**

Base plans shall show at least 50 feet of each leg of the intersection and all intersections or functions operated by the same controller.

Base plans shall accurately depict:

- All roadway features (existing, removed and proposed), including curb lines, legal center lines, property lines, edges of pavement, edges of paved sidewalks, curb returns, curb ramps, driveways and bus pads.
- Striping (existing, removed and proposed).
- Nearby underground utilities, sub-structures, basements and vaults (associated with the after condition).
- Nearby above-ground structures (including bus shelters), above-ground cable and permanent street furniture (associated with the after condition).
- All existing or proposed bushes and trees greater than four feet in height and within 50 feet of any signal standard, with the outer perimeter of the foliage accurately shown.
- Existing, removed and proposed below and above-ground signal equipment.
- Regulatory signs which govern pedestrian and vehicular moves at the intersection.
- Other field conditions which might affect a design decision.

**Field Checks**

Field checks shall be conducted for each plan that is prepared. Field checks shall confirm, to the extent feasible, all base plan contents. Conditions generally should be visually documented for reference purposes on a video cassette or by photographs. Visual documentation should include:

- Viewing at 50 feet and 250 feet (approximately) on each approach to the intersection
- Two close-ups at each corner of existing signal hardware, surface conditions and above-ground features
- Special conditions (such as trees) which might affect a design decision.

**Plan Coordination**

The Signal Design Section or the ATSAC Design Section shall be responsible for ensuring that the traffic signal plan is coordinated and compatible with the striping plans, signal system operation and street lighting proposals. In this regard, the plan shall be coordinated with other involved sections of the Department, as necessary, such as the Geometric Design Section, and the Signal Timing Section.

**Special Projects**

The Signal Design Section is responsible for understanding how the improvements shown on an individual plan or set of plans are integral to the goals and requirements of larger projects, such as major land development projects or
Major detours. This knowledge ultimately will lead to improved design decisions. If the information is not directly submitted, the Section is responsible for seeking the information from project managers or other sources, as necessary.

**Complex Designs**

Complex, unusual, novel or trial designs or methods of operation for major projects should be reviewed by senior management staff before proceeding beyond the preliminary stage. If the project design is initiated outside of the Design Division, then the Design Division Head shall ensure that an internal review and concurrence by a departmental street improvement committee has taken place. This procedure will help to ensure that new designs are properly scoped, well developed and not problematic.

**Plan Processing**

All signal plans and related documentation submitted for DOT review by consultants or other agencies shall be submitted to the Plan Processing Control Desk of the Design Division which will route the plans to the Signal Design Section.

Signal plans submitted by Caltrans or another agency that are part of a larger joint project, shall be submitted first to the Interagency Coordination Section for evaluation. If acceptable, the Interagency Coordination Section shall subsequently submit them to the Plan Processing Desk or brief the design staff and/or Department management, as appropriate.

The Signal Design Section shall seek documentation supporting any operational changes proposed in the plan from consultants submitting plans. Proposed operational changes require justification using realistically projected traffic volumes associated with the immediate phase of land (re) development and yet should anticipate the operational needs for ultimate build-out of the final phase of related land development.

Plans that are being submitted for approval by consultants shall include two mylar originals and a diskette. One of the mylar originals is to be returned to the consultant after plan approval. It is the responsibility of the consulting project engineer to ensure that the contents of the diskette are consistent with those on the mylar plan and that any minor oversights that have been manually corrected on the mylar copy of an AutoCAD plan have been incorporated on the diskette prior to approval of the plan.

After the plan is approved, the diskette shall be modified in a timely manner by the Signal Design Section to show in printed form the names, initials and dates of all persons who were part of the design approval and submittal.

**As-Built Plans**

As-Built plans are an important part of the record of field conditions as of a certain date. They shall be timely prepared for all implemented plans.
The DOT signal yard supervisor or his designee is required to verify that the work shown on the signal plan has been completed by DOT crews, whereas the DOT field signal electrician inspector is required to verify that the work shown on non-ATSAC signal plan has been completed by contractors. The ATSAC Construction Section Head or his designee is required to verify that the work shown on ATSAC signal plan has been completed. Verification of completion shall include verification of all traffic control devices shown on the plan. Construction-related changes and other differences shall be shown in red. Each of these persons is responsible for timely notification to the Signal Data Records Unit of the verification of work and the date of completion. The Signal Data Records Section then becomes responsible for timely notification to the Signal Design Section. The Signal Design Section shall record on the DOT plan “As Built” or “Condition As Of,” along with the date and shall revise the file plan to show any construction-related change orders. The diskette of the plan shall then be revised in a timely manner to show the same information.

Signal Plan Distribution

Signal plans shall be distributed as follows:

- For projects to be completed by DOT field forces, one copy to the appropriate DOT District office, one copy to the Signal Timing Section, and six copies to the Field Coordination Section by the Signal Design Section.
- For B-Permit and CIP projects, one copy to the appropriate DOT District office, one copy to the Signal Timing Section and two copies to the appropriate DOT Yard by the Signal Design Section.
- For ATSAC projects, one copy to the appropriate DOT District office, one copy to the Signal Timing Section and two copies to the appropriate DOT Yard by the ATSAC Design Section.

As-Built plans shall be distributed by the Signal Design Section or ATSAC Design Section with one copy to the appropriate DOT District office, two copies to the appropriate DOT Yard and one copy to the ATSAC Center, if in an ATSAC area.

Signal Plan Files

All current “As-Built” and proposed signal interconnect plans and traffic signal plans (mylars and diskettes) shall be stored in the Signal Design Section as the City’s official record. Sections of the Department, other than the Signal Design Section, that may prepare traffic signal plans shall timely provide the Signal Design Section with a mylar copy and diskette of the plan as soon as the related plan set is completed. When the plan set is constructed, the initiating unit of the Department shall timely provide an “As Built” plan and diskette to the Signal Design Section. Provision of said plans includes their filing in a manner acceptable to the Signal Design Section.

There shall be one comprehensive Signal Plan File in the Signal Design Section for all plans for traffic control signals, beacons, overhead signs, electric signs, variable message signs and traffic monitoring cameras. In addition, there shall be a separate comprehensive file in the Signal Design Section for signal interconnect plans. Other DOT sections may retain copies and diskettes of these files.
pended "As Built" plans shall be sent to the Master File.

Filed signal plans shall not be removed from the file except for brief reference or copying. If prolonged reference to a plan is needed, then a photocopy or print copy shall be made.

Plan Titles

- Numeric-Alpha Order

All plans shall be filed and listed by all units of DOT in numeric-alpha order, with the lowest numbered streets and intersections (if the number appears before the street title) listed before the alphabetic order of named streets and intersections. Numbered streets shall use Arabic numerals and shall not be fully-spelled.

Accordingly, "1st Street" not "First Street" is used. In addition, "4th Avenue" is filed under the number "4," since the number appears before the street title, whereas "Avenue 26" is filed under "A" since the number does not appear first.

- Five-Digit Code

Below the numeric-alpha title shall be a distinct five-digit code number which shall be consistent throughout DOT with those used on timing charts and other records.

- Official Names

If there is any doubt regarding the official name of a public roadway after referring to the Thomas Guide, the agency which operates the roadway should be consulted. Within the City the designated agency is the Bureau of Engineering, while for freeways it is Caltrans. For identification purposes, freeway names, not route shield numbers, shall be used.

The names shall not be abbreviated but street titles which appear after the name may be abbreviated. Where a name has several words, the plan is to be filed under the first word.

Examples which illustrate the above are shown below:

1. "North Main Street" is filed under "N" and exists northeasterly of Alameda Street, whereas Main Street is filed under "M" and exists south-easterly thereof. A cardinal direction within an address number, such as 200 N. Main Street, is not part of the street name.

2. "Hollywood Freeway" exists northwesterly of the Harbor Freeway/Pasadena Freeway junction and "Santa Ana Freeway" exists southeasterly thereof.

3. The official name is "Glenn M. Anderson Freeway" (filed under "G"), not "Century Freeway."

4. The official name is "Ronald Reagan Freeway," not Simi Freeway nor "118 Freeway."
5. “John S. Gibson Boulevard” is filed under “J” not “G.”

6. The official name is “Martin Luther King, Jr. Boulevard,” (filed under “M”), not “ML King Boulevard” nor “King Boulevard.”

- Intersection Names

The names of roadways to be shown in the plan title shall include:

1. All intersecting legs of named public roadways (including freeway names) and officially named private streets operated by the same signal controller; and

2. All driveway approaches, unless the plan title already includes the names of at least two public roadways. Driveway names, when necessary, shall be named on the plan and then officially requested in writing so as to ensure that they are included in the 911 Emergency system and in the Thomas Guide. They should be requested through the Land Development Section of the Development Services Division of the Bureau of Engineering for eventual approval by the City Council. For a new signalized driveway, the B-Permittee should be given the first opportunity to name it. Otherwise, driveway names should be selected based on the commonly known name of the land development served.

Examples which illustrate the above are described below:

1. “Fairfax Avenue, Olympic Boulevard and San Vicente Boulevard” is shown on one plan, and not two plans since this intersection complex is operated by one signal controller.

2. “Courtyard Place and Wilshire Boulevard” incorporates the name of a private street.

3. “Malcolm Avenue and Pico Boulevard” does not include the name of the approach driveway serving the Westside Pavilion regional shopping center because the intersection name already includes the name of two public roadways.

4. “Beverly Center Driveway and La Cienega Boulevard” is the name that was recommended by DOT and approved by the City Council, since there is no other intersecting public street and the Beverly Center regional shopping center is the commonly known name shown in the Thomas Guide.

5. “Alvarado Street and Hollywood Freeway Northbound Ramps” includes the freeway name (versus route shield number) and uses the plural form of the word, “ramp” since there is both an approach off-ramp and a departure on-ramp.
• Midblock Names

For naming purposes midblock locations are considered to be those locations not within a signalized intersection nor at a signalized driveway. They include signalized crosswalks not at signalized driveways and beacons. They may include overhead signs, variable message signs and electric signs not at a signalized intersection.

The first name shall include the route on which they are located. The route name shall be followed by the word, "between," or in some cases, "at". However, if the device is located in an end-of-block segment, cardinal direction references such as "north of," "south of," "east of," or west of" shall be used. The reference street names following the word “between” shall be listed in numeric-alpha order.

Examples which illustrate the above are shown below:

1. “Main Street between 1st Street and Temple Street” uses the route name, the word “between” and the reference street names listed in numeric-alpha order.

2. “Pacific Avenue south of Shepard Street” incorporates the cardinal direction reference since the street terminates

• Jogged Streets

Where a street has a jog at an intersecting cross street and each leg of the jogged street is signalized and operated by a separate controller, it is necessary to have a distinct name for each intersection. This may necessitate reference to the adjacent cross street external to the jogged segment which generally parallels the jogged street. When this is necessary, the name of the intersection should be appended by the word “near,” followed by the adjacent parallel street external to the jogged segment.

Examples which illustrate the above are described below:

1. “Foothill Boulevard and Osborne Street near Clybourn Avenue” and “Foothill Boulevard and Osborne Street near Terra Bella Street” are thusly named to distinguish them.

2. “Franklin Avenue and Highland Avenue” and “Franklin Avenue, Franklin Place and Highland Avenue” do not require appending with the word “near” since they already have distinct names.

• Duplicated Names

Duplicated street names that are not the result of a jog also need to be given distinct names. Usually, name duplication occurs at or near the boundary of adjacent cities or in outlying communities that annexed to the City of Los Angeles. In order to provide a distinct name the associated adjacent city or community should be cited in parentheses after the duplicated street name.

Examples which illustrate the above are described below:
1. "Imperial Highway and Main Street (Los Angeles)" located in the south-central part of the City versus "Imperial Highway and Main Street (El Segundo)" near the Airport.

2. "9th Street and Western Avenue (Koreatown)" versus "9th Street and Western Avenue (San Pedro)"

3. "San Diego Freeway Northbound Off-Ramp and Sepulveda Boulevard (Bel Air)" versus "San Diego Freeway Northbound Off-Ramp and Sepulveda Boulevard (Mission Hills)"

**Interjurisdictional Agreements**

There shall be a maintenance and/or operational agreement for each traffic signalized intersection that lies partially within another jurisdiction, lies completely within another jurisdiction but is maintained and/or operated by DOT or lies completely within the City of Los Angeles but is maintained and/or operated by another agency. The maintenance and/or operational agreement shall define the cost sharing among the jurisdictions. The agreed cost-sharing percentages shall be shown on the signal plan for that intersection. If the cost sharing for a particular project is to be different it is to be so specified on the plan.

**Design Elements**

All designs shall be consistent with the State of California Traffic Manual, the national Manual on Uniform Traffic Control Devices (MUTCD) and those designs prepared after the adoption of this section of the Manual of Policies and Procedures shall also be consistent with LADOT Standard Plans. The LADOT Special Provisions and Standard Drawings for the Installation and Modification of Traffic Signals shows some of the special hardware used.

- **Signal Standard Locations**

  The precise location of traffic signal standards relative to curb faces and crosswalks are shown in S-51.0. However, below-ground utilities and structures may require adjustments to these locations.

- **Warning Beacons**

  Typical layouts and operations for Fire Station Warning Beacons and Smart Pedestrian Warning Beacons are shown in S-60.0 and S-55.0, respectively.

- **Mastarm Signals**

  Mastarm signals are required where an approach has two or more striped lanes or a significant right offset. The criteria are shown in S-102.0. Farside mastarm signal heads generally are to be placed as close as practical to the extension of the middle of the number two, number one or left turn lane, depending on the type of left-turn phasing. Where a mastarm signal is otherwise required facing a terminating street, such as a "T" or offset intersection, a high mount (Type 1A) standard may be used instead, as shown in S-101.0, if the street upon which it is placed is fully developed. Nearside supplemental mastarm signal head to be installed when the mastarm head is outside of a 20 degree half cone-of-vision. The locations are shown in S-65.0.
Pedestrian Control

Pedestrian heads shall be provided wherever pedestrians are legally allowed to cross. Otherwise, pedestrian prohibition signs are to be installed.

On divided streets where there is sufficient pedestrian clearance time to allow pedestrians to cross in one phase, median pedestrian heads shall not be provided. However, on streets at least 84 feet wide with a median island at least 6 feet wide, a median pedestrian push button may be provided (if the crossing is pedestrian-actuated) in order to assist slower pedestrians who might become stranded in the median.

On wide streets where it is not feasible to allow pedestrians to cross in one phase, pedestrians may be required to wait in a median area if it is at least 10 feet in width. In such cases, pedestrian heads in the median island are required. In addition, the crosswalks across each roadway should be offset or aligned to create an angle point at the median island, so as to provide a visual cue of the need to wait in the median.

Pedestrian push buttons are to be located within 5 feet of the outside crosswalk line, as shown in S-101.0.

- Typical Traffic Signal Layouts

Typical traffic signal layouts for locations involving three legs, four legs, one-way streets, left-turn phasing, driveways and midblock crosswalks are shown in S-101.0. The typical layouts assume that the criteria for mastarm signals are met.

- 12 Inch Signal Heads

LADOT criteria for 12 inch signal heads exceed State and national standards. Twelve inch heads generally are required:

1. on mastarms or farside highmount signal standards.
2. where the speed limit is 40 miles per hour or greater;
3. where the head is 120 feet or greater from the stop line; or
4. where the head is outside of the 20 degree half cone.

The criteria are summarized in S-103.0.

- Detectors

Limit line inductive loop detectors are to be located as shown in S-70.0 for single lane and multiple lane approaches.
Inductive loop detectors can be used in a variety of special applications. S-75.0 shows these applications. Other detection technologies may be used, as warranted, in place of inductive loop detection.

System detection identifies volume and occupancy and is used to determine system timing parameters. It may also be used for traffic counting stations and for advance detection.

Advance detection is used on actuated approaches, where speed limits or 85th percentile speeds are 40 miles per hour and above. It is used to call and extend the green so that platoons generally will not have to stop and is located so that a vehicle just upstream of the detector when the yellow is displayed can comfortably decelerate to a stop.

Left turn queue detection is used to call and sometimes extend a protected left-turn phase, when a queue develops. It can be used for transit assistance.

Bus queue jumper detection is used to call and extend a leading bus phase.

Bicycle detection is used where the adjacent vehicle lanes are actuated in order to recognize when slower speed bicyclists are present. The detection allows special timing for bicyclists (call, longer minimum green and longer clearance interval) to better enable them to clear the intersection.

Rest-in red detection is used to encourage motorists to decelerate to a more appropriate speed, where there is a documented accident pattern involving excessive speed near the intersection and an adequate trial of appropriate warning devices has not been successful.

- **Visibility-Limited Traffic Signal Heads**

Visibility of traffic signal heads is to be limited using programmed visibility heads, beveled visors or long visors, as shown in S-85.0.

Longitudinal visibility generally should be limited where adjacent signals are within 300 feet or where slot clearance is to be provided at an offset intersection. The longest ground cut-off feasible should be used, so as to maximize visibility once motorists discharge from the upstream signal. Usually a curb line prolongation is used for the ground cut-off. The yellow lens is not masked to ensure that drivers of buses and tall trucks may see the change interval in time to safely decelerate to a stop.

Lateral visibility generally should be limited so that no more than 50% of the lens width can be seen by motorists anywhere along the stop line of a conflicting approach. Right, left and long (a combination of right and left) visors are to be used in preference to programmed visibility heads, except where they cannot meet the 50% threshold criteria.

- **Signalized Jogged Intersections**

The design of signalized jogged intersections is a most complex task. Motorists can face the following challenges from one or more of the four approaches to a signalized jogged intersection:
1. Pedestrians might not be seen early-on
2. Opposing vehicles might not be seen early on
3. Opposing left turns interlock
4. A reverse turn maneuver versus a single turn cannot readily be distinguished
5. Motorists must determine if there is one versus two intersections and how to respond to each.

These challenges can be mitigated by providing a full complement of controls and applying them in a uniform manner. S-100.0 shows the options available for a variety of conditions. A primary consideration is whether or not to provide interior limit lines, so as to create two intersections. If the internal storage is 40 feet or more, then interior limit lines are to be provided. Another primary consideration is whether or not to provide opposed phasing for the jogged approaches, due to the challenges resulting from the physical separation. If opposing motorists are separated by more than 20 degrees, then some type of exclusive phasing is to be provided. The placement of signal heads is determined from the above considerations and the specific geometrics of the intersection.

- **Left-Turn Phasing**

LADOT guidelines for left-turn phasing have specific threshold values for protected, protected/permited, “Dallas” and opposed phasing. The guidelines are summarized in Table 1. The Signal Design Section or the ATSAC Design Section is responsible for checking with the Signal Timing Section to assure that a guideline has been satisfied before proceeding with the design.

- **Right-Turn Phasing**

Exclusive right-turn phasing generally should be provided where there is an exclusive right-turn lane in combination with complementary left-turn phasing or where high pedestrian volume in combination with right-turn vehicular demand results in excessive delay. Exclusive right-turn phasing should not be provided without an exclusive right-turn lane. Where complementary left and right-turn phasing exists, U-Turns shall be prohibited for the approach which receives the left turn phase. Where the crosswalk that is crossed by the right turn has high pedestrian volumes, the right turn phase should be a lag phase.

- **Interconnect**

Traffic signals within 2000 feet of each other should be interconnected. Those that are 2000 to 3000 feet apart should be evaluated as to the need for interconnect, based on link volume. Signals that are greater than 3000 feet apart need not be interconnected. All signals in an ATSAC system shall be interconnected.

- **Controllers**

All signalized intersections maintained by DOT shall use DOT-compatible Type 170 or Model 2070 controllers.
- Electric and Variable Message Signs

Appropriate application of electric and variable message signs are encouraged as ways of providing credible, real-time information to motorists or to responding to real-time traffic conditions.

- Freeway Guide Signs

Freeway guide signs generally fall into two categories—“lane assignment” and “action.”

Due to the various types of on-ramp configurations, freeways can be entered from right or left lanes on a cross street. Accordingly, Section 4-04.7 of the Traffic Manual requires that multi-lane streets having access to freeways be posted with “lane assignment” signs. “Action” freeway guide signs are an essential follow-up to “lane assignment” signs.

Generally, overhead signing is the most effective means of communicating freeway access to motorists. Roadside guide signing on the right or in a raised median can be used where overhead signing is not immediately feasible. However, roadside guide signing has limited area for text and may require more signs for communicating lane assignment. S-476.1 shows the maximum sign area that may be installed for various postings.

The various formats for freeway guide signing are shown in S-418.5 and S-418.6.

- Overhead Signs

Overhead signs provide a high degree of visibility to forewarn and direct motorists on multi-lane approaches of access or lane assignment conditions that generally cannot be anticipated by unfamiliar motorists. Conditions include: divergent arterial roadways; skewed arterial approaches; unshadowed left-turn lanes; arterial grade separations, including freeways; bus and/or carpool lanes; street name or sign route changes; and end of one-way operation. These situations are illustrated in S-418.6. Overhead signs should be placed no more than 30 feet downstream from a modern electrolier. If this is not feasible, then external illumination should be incorporated into the design of the overhead sign.

- Large Street Name Signs

At signalized intersections supplemental large street name signs are to be posted as per S-486.0 and mounted per S-457.1. At signalized intersections with one-way streets the large supplemental street name signs are to be further supplemented with large R-10 (One-Way) signs as shown in S-473.0.
### Table 1. Summary of LADOT Left-Turn Phasing Guidelines

<table>
<thead>
<tr>
<th>Sing</th>
<th>Overhead Position</th>
<th>Factor</th>
<th>Threshold Values and Criteria</th>
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| **Protected (usually lead; lag OK if no opposing permitted left turns)** | A three-section arrow head over middle of left-turn lane(s), plus a three-section head over middle of number two lane (second lane from center). | Accidents | • Four left-turn accidents in a recent 12 month period during various time periods or 3 or more for 3 consecutive years.  
• Four right angle or four left turn accidents in a recent 12-month period at one of the intersections involving vehicles departing from the interior limit line of a left offset intersection, so as to allow slot clearance. |
|                                           |                   | Geometry | • Dual left-turn lanes across opposing traffic are feasible and desirable.  
• Sight distance less than 5.5 sec. to number one opposing lane, plus 0.5 sec. to each additional opposing through lane.  
• Left-turn lane is inadequately shadowed on opposite leg (less than 9 ft. where turn is initiated.)  
• Opposing left-turn paths on arterial street interlock.  
• Combination of wide intersection, higher speeds and failed cycles. |
| **Livable Neighborhoods**                 |                   | Capacity | Projected volumes: HCM, Chapter 9, Operational Analysis, documents inadequate capacity using optimized timing. |
| ** Protected/Permitted**                  | A five-section cluster head over middle of number one lane (next to median or centerline). | Delay | Eighty percent or more of cycles fail for left turns, and opposing traffic would have an average delay of 40 sec. or less for any two hours. The delay threshold may be waived if there are no feasible alternate left-turn opportunities in a limited arterial street network. |
| **Permitted/Protected**                   | A four-section stacked head over middle of number one lane. | Lane Blockage | Queues recurrently spill over into number one lane and pocket cannot be extended. |
| **“Dallas”**                              | (See Protected/ Permitted factors) | Peak-Period Accidents | Three left-turn accidents in a recent 12-month period during peak traffic periods. |
| **Opposed**                              | A four-section, stacked head over middle of number one lane. | Railroad Pre-emption | Left-turn vehicles queue across tracks and have difficulty clearing them before gate descends. |
| **Permitted**                             | A three-section head over middle of number two lane. | Transit Reliability | Three cycles per hour fail for left-turning buses and opposing traffic would have an average delay of 40 sec. or less for any two hours. |
|                                           |                   | Livable Neighborhoods | To be selectively applied to increase left-turn capacity onto the arterial street network and away from a residential area, where there is a documented problem of significant through traffic using a residentially developed local or collector street. |

**Legend:**
- **Accidents**: Four left-turn accidents in a recent 12-month period during various time periods or 3 or more for 3 consecutive years.
- **Geometry**: Dual left-turn lanes across opposing traffic are feasible and desirable. Sight distance less than 5.5 sec. to number one opposing lane, plus 0.5 sec. to each additional opposing through lane. Left-turn lane is inadequately shadowed on opposite leg (less than 9 ft. where turn is initiated.) Opposing left-turn paths on arterial street interlock. Combination of wide intersection, higher speeds and failed cycles.
- **Capacity**: Projected volumes: HCM, Chapter 9, Operational Analysis, documents inadequate capacity using optimized timing.
- **Delay**: Eighty percent or more of cycles fail for left turns, and opposing traffic would have an average delay of 40 sec. or less for any two hours. The delay threshold may be waived if there are no feasible alternate left-turn opportunities in a limited arterial street network.
- **Lane Blockage**: Queues recurrently spill over into number one lane and pocket cannot be extended.
- **Peak-Period Accidents**: Three left-turn accidents in a recent 12-month period during peak traffic periods.
- **Railroad Pre-emption**: Left-turn vehicles queue across tracks and have difficulty clearing them before gate descends.
- **Transit Reliability**: Three cycles per hour fail for left-turning buses and opposing traffic would have an average delay of 40 sec. or less for any two hours.
- **Livable Neighborhoods**: To be selectively applied to increase left-turn capacity onto the arterial street network and away from a residential area, where there is a documented problem of significant through traffic using a residentially developed local or collector street.

**Progression**
Same as for Protected/Permitted criteria, where a permitted left turn is allowed in the opposing direction.

**Intersection operation can be improved by having separate phasing for opposing directions, often to allow a left-through optional lane.**

**Opposing legs of a single intersection have a significant offset.**
## Appendix of Standard Drawings

<table>
<thead>
<tr>
<th>Drawing No.</th>
<th>Title</th>
<th>Sheets</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-51.0</td>
<td>Typical Location of Traffic Signal Standards</td>
<td>1</td>
<td>11-03-98</td>
</tr>
<tr>
<td>S-55.0</td>
<td>Typical Layout for Smart Pedestrian Warning</td>
<td>1</td>
<td>11-03-98</td>
</tr>
<tr>
<td>S-60.0</td>
<td>Fire Station Warning Beacons</td>
<td>1</td>
<td>01-15-99</td>
</tr>
<tr>
<td>S-65.0</td>
<td>Mastarm Signal Head Placement</td>
<td>2</td>
<td>02-01-99</td>
</tr>
<tr>
<td>S-70.0</td>
<td>Limit Line Inductive Loop Detector Placement</td>
<td>2</td>
<td>11-13-98</td>
</tr>
<tr>
<td>S-75.0</td>
<td>Special Detector Applications</td>
<td>5</td>
<td>11-23-98</td>
</tr>
<tr>
<td>S-100.0</td>
<td>Operation and Design of Signalized Jogged Intersections</td>
<td>12</td>
<td>01-15-99</td>
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<tr>
<td>S-101.0</td>
<td>Typical Traffic Signal Layouts</td>
<td>7</td>
<td>11-13-98</td>
</tr>
<tr>
<td>S-102.0</td>
<td>Mastarm Signal Head Installation Criteria</td>
<td>1</td>
<td>11-13-98</td>
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<tr>
<td>S-103.0</td>
<td>Criteria for 12&quot; Signal Heads</td>
<td>2</td>
<td>11-13-98</td>
</tr>
<tr>
<td>S-418.6</td>
<td>Overhead Guide Signing</td>
<td>16</td>
<td>01-15-99</td>
</tr>
<tr>
<td>S-497.0</td>
<td>Gap Acceptance and Visibility Requirements for Left Turn Lanes</td>
<td>2</td>
<td>06-22-98</td>
</tr>
</tbody>
</table>

MPP521
Plan Preparation

Striping plans are required for any installation that involves: left-turn channelization; or lane lines, barrier lines or centerlines involving convergences, divergences, tapers, curves not parallel to curb lines or offsets. Striping plans identify other traffic control devices.

Striping plans generally shall be prepared by the Geometric Design staff for projects involving City streets. Exceptions are as follows:

- B-Permit plans prepared by consultants;
- Projects for which a City approved agreement specifies another entity;
- Projects under the permanent jurisdiction of another governmental agency, such as Caltrans for State highways; and
- Projects for which the Bureau Head or higher authority has approved preparation by another entity.

Plan Approval

All plans prepared by the Department or a B-Permit consultant shall be signed as follows:

- By the Section Head of the Geometric Design Section unless that person is absent;
- By the Division Head of the Design Division unless that person is absent; and
- By the Bureau Head responsible for the Design Division, unless that person has delegated approval authority to the Division Head.

Plans prepared by another entity or governmental agency that affect streets under the jurisdiction of the City of Los Angeles shall require the signature of the Bureau Head responsible for the Design Division, or the Division Head if approval authority has been so delegated.

The practice of traffic engineering requires that related design plans be signed and stamped by Civil Engineers registered in the State of California. Accordingly, the final approval authority for the Department shall be so registered. In addition, any B-Permit consultant or other person submitting plans shall be so registered and shall sign and stamp said plans.

B-Permit consultants submitting plans shall meet two other requirements. First, they must have a Business License in the City of Los Angeles. Second, they must indicate on the plan that the plan has been reviewed by a person who is either registered as a Traffic Engineer in the State of California or who has a Professional Traffic Operations Engineer Certificate issued by the Institute of Transportation Engineers.
Striping Plan Implementation

Approved striping plans are to be implemented as shown in the table below:

<table>
<thead>
<tr>
<th>Initiation of Project</th>
<th>Implementation By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department-Initiated</td>
<td>DOT Field Forces</td>
</tr>
<tr>
<td>Street Resurfacing</td>
<td>DOT Field Forces</td>
</tr>
<tr>
<td>B-Permits (Developers)</td>
<td>B-Permit Contractor</td>
</tr>
<tr>
<td>City Contracts &amp; CIP</td>
<td>City Contractor</td>
</tr>
<tr>
<td>Non-City Public Agency</td>
<td>Their Contractor or by DOT Field Forces per an approved agreement</td>
</tr>
</tbody>
</table>

For work by DOT field forces, elements such as sandblasting, pavement message installation, etc. may be contracted out at DOT's discretion. For work by contractors on City Streets DOT, through the District office or the Citywide Investigation Unit, must inspect and approve the striping.

In all cases, the final thermoplastic striping may not be implemented until the DOT District office has approved the markout.

Plan Format

All plans of the Geometric Design Section shall be prepared in the latest version of AutoCAD, as menu-enhanced for use by LADOT, except for those plans exempted by the Bureau Head for emergency purposes. Right-of-way, roadway and lane widths shall be shown at separate cross-sections wherever the dimensions change. All right-of-way and roadway curve radii shall be dimensioned. All striping tapers, tangents, and curve radii (if not parallel to curb) shall be dimensioned. Roadway features, striping and other traffic control devices shall be layered to reflect "existing," "to-be-removed" and "proposed" conditions for each stage of construction, using specified line thickness and spacing. Plans shall be on mylar, 24 inches high by 36 inches wide and a minimum of 3.0 mils (0.003 inch) thick, with a specified border, title block and signature block. The scale shall be one inch equals 40 feet or 1 to 500 for metric drawings.

Up to three minor oversights may be manually corrected on the mylar copy of an AutoCAD plan sheet if the change also has been made on the diskette.

Plan Review

Striping plans are to adhere to the national Manual on Uniform Traffic Control Devices, the California Traffic Manual, the California Vehicle Code, LADOT Standard Plans and text herein. In using these sources optional or "may" conditions are to be determined using engineering judgement. Recommended or "should" conditions are to be incorporated, unless there is a compelling reason to deviate. Mandatory or "shall" conditions are to be followed without exception. Recommended and mandatory conditions in the Standard Plans and text that exceed national and State standards do not apply to plans approved prior to the adoption date of this section of the Manual of Policies and Procedures.
In preparing or reviewing striping and channelization plans the Geometric Design Section shall be responsible for ensuring that plans adhere to the above, while incorporating critical information and concerns communicated by the DOT District office or other sections of the Department, such as the feasibility of proposed parking restrictions. In considering all input the plan shall represent the Geometric Design Section's best recommendation. Design and operational issues should be coordinated at the Associate III, Section Head or Division Head levels, if necessary, for resolution. The operational preference of the DOT District office should prevail for discretionary operational matters. Their concurrence shall be indicated by showing their initials along with the concurrence date in the title box. If the in-progress plan shows significant or operational changes after it is initialed by the DOT District office, or others who previously reviewed the plan, then it requires rerouting for concurrence with a new date shown on the plan.

Plans more three years old prior to installation should be newly reviewed for: any change in field conditions; appropriateness of proposed striping operation previously approved; and application of current design standards. Where changes are necessary a superseding plan shall be prepared.

If it is found to be necessary to install striping not in conformance with the plan, then an AutoCAD modification should be requested immediately by the DOT District office for preparation by the Geometric Design Section. The Geometric Design Section shall give preparation of the modification its highest priority if it agrees with the change. The modification shall be "rushed" for signature. However, no striping shall be final striped (i.e., beyond the markout stage) unless it is in conformance with an approved (signed) plan.

Plan Coordination

The Geometric Design Section shall be responsible for ensuring that the striping plan is coordinated and compatible with the traffic signal plan and proposed curb, sidewalk and curb ramp features.

In this regard, the plan shall be routed to other involved sections of the Department, as necessary, such as the Signal Design Section.

Special Projects

The Geometric Design Section is responsible for understanding how the improvements shown on an individual plan or set of plans are integral to the goals and requirements of larger projects such as major land development projects or major detours. This knowledge ultimately will lead to improved design decisions. If the information is not directly submitted, the Geometric Design Section is responsible for seeking it from project managers or other sources, as necessary.

Complex Designs

Complex, unusual, novel or trial designs or methods of operation for major projects should be reviewed by senior management staff before proceeding beyond the preliminary stage. If the project design is initiated outside of the Design Division, then the Design Division Head shall ensure that an internal review and concurrence by a departmental street improvement committee has taken place. This procedure will help to ensure that new designs are properly scoped, well developed and not problematic.
Plan Processing

All striping plans and related documentation submitted for DOT review by consultants or other agencies, shall be submitted to the Plan Processing Control Desk of the Design Division which will route the plans to the Geometric Design Section.

Plans involving striping and signing submitted by Caltrans or another agency that are part of a larger joint project, shall be submitted first to the Interagency Coordination Section for evaluation. If acceptable, the Interagency Coordination Section shall subsequently submit them to the Plan Processing Desk or brief the design staff and/or Department management, as appropriate.

The Geometric Design Section shall seek documentation supporting any operational changes proposed in the plan from consultants submitting plans. Proposed operational changes require justification using realistically projected traffic volumes associated with the immediate phase of land (re) development and yet should anticipate the operational needs for ultimate build-out of the final phase of related land development.

Plans that are being submitted for approval by consultants shall include two mylar originals and a diskette. One of the mylar originals is to be returned to the consultant after plan approval. The Geometric Design Section shall check to see that the contents of the diskette submitted by the consultant are consistent with those on the mylar plan, and that any minor oversights that have been manually corrected on the mylar copy of an AutoCAD plan have been incorporated on the diskette prior to approval of the plan.

After the plan is approved, the diskette shall be timely modified by the Geometric Design Section to show in printed form the names, initials and dates of all persons who were part of the design approval and submittal.

As-Built Plans

As-Built plans are an important part of the record of field conditions as of a certain date. Striping plans shall record the respective dates for “Mark-out Began,” “Mark-out Completed” and “Striping Completed.” The diskettes of said plans shall be revised to show the same information.

Geometric Design Plan Files

All signed and “As-Built” Geometric Design plans (mylars and diskettes) shall be stored in the Geometric Design Section as the City's official record. All such plans shall have a distinctive number. A plan index shall be maintained and timely updated which graphically identifies the segment of street to which the number applies. The index shall show all streets with striping plans in alphabetic and numeric order from the beginning striping plan to the ending plan along the route.

Filed plans shall not be removed from the file except for brief reference or copying. If prolonged reference to a plan is needed then a photocopy or print copy shall be made.
Geometric Design Plan Distribution

Two copies of all signed plans are to be distributed to the appropriate DOT District office. In addition, for projects involving street resurfacing one copy is to be given to the Street Resurfacing Coordinator and/or the Field Coordination Section. Additional copies may be distributed, as necessary for implementation.

Striping Fundamentals

The primary function of striping and channelization is to delineate as clearly as possible the intended operation and desired travel paths.

Materials used for channelization include:

- Raised curb or berm for medians and islands;
- Raised concrete triangular traffic bars;
- Raised ceramic and reflective pavement markers;
- Delineator posts;
- Painted striping;
- Permanent and detour grade pavement marking tape; and
- Alkyd-based thermoplastic striping;

Raised triangular separator islands are desirable in order to confine an intersection that otherwise would be excessively large. Raised median islands can be used to prohibit left turns, separate opposing flows and provide landscaping opportunities. However, at signalized intersections they can create negatively offset left turns with restricted visibility. In some cases they should be partially removed at signalized intersections, as discussed in S-497.0. The approach nose of raised separator island should be marked with reflective white paint. The nose of raised median island may be marked with reflective yellow paint and/or a Type Q marker if there is no R7 sign. The type Q marker will spring back when hit, thus reducing the maintenance burden. It is shown in S-447.0.

Raised triangular traffic bars should be used only when an adequate trial of striped channelization and use of Type Q markers has not been effective. Raised triangular traffic bars can collect debris and cannot be easily street swept. They should be replaced with a raised island with a subsequent project.

Raised ceramic pavement markers may be selectively used where striping requires excessive maintenance. Raised reflective pavement markers may be selectively used where modern street lighting does not exist. However, they shall not be used to delineate edge lines.

Flexible delineator posts can be used to delineate the edge of roadway that lacks conventional curbs and modern street lighting. See S-445.0.

Painted striping is the most common form of pavement delineation in most jurisdictions. However, it requires frequent maintenance. It should be used only for detours or as an interim measure pending alkyd-based thermoplastic striping.
Permanent pavement marking tape may be used to replace short sections of striping that have been removed due to minor street excavations. Detour grade pavement marking tape may be used to cover existing striping and to delineate detour striping for periods of six months or less.

Alkyd-based thermoplastic striping is the primary form of pavement delineation in the City of Los Angeles and has a five to ten year life. A primer is required to ensure adhesion on Portland cement concrete surfaces.

See Table 1, "Application of Striping and Marking Components," which summarizes the use of each type of traffic stripe.

Striping on Narrow or Lower Volume Streets

Striping generally is not necessary on low volume local streets. On collector streets a skip centerline should be provided, as width permits. (See Lane Widths).

A double yellow-centerline should be provided instead of a skip centerline, as follows:

Where horizontal or vertical alignment limits sight distance below that which is appropriate for the design speed.
- Within 100 to 200 feet of a Stop sign, traffic signal or marked crosswalk.
- Within 100 to 200 feet of a taper and along the length of the taper.

A double yellow centerline or partial passing centerline shall be provided instead of a skip centerline where two or more lanes are striped in one direction, with one lane in the other direction.

Where a partial passing centerline is used, the skip yellow stripe shall be for the direction with one lane.

On streets with two or more lanes in each direction a double yellow centerline, raised median island or left turn channelization shall be provided.

Left-Turn Channelization

Left-turn channelization is a most effective tool for improving traffic operation and reducing accidents, such as rear-end, side-swipe, head-on and left-turn types. It is delineated by the two-way left-turn lane, the (unidirectional) left-turn pocket and the striped median. Generally, it is desirable for all arterial streets to operate with at least two lanes in each direction and left-turn channelization (five-lane operation). Where continuous channelization is not feasible due to width restrictions, efforts should be made to install left-turn pockets at signaled intersections, or alternatively, to restrict them. Generally, a five-lane operation has been shown to operate more smoothly than a six-lane operation without channelization. A three-lane operation has been shown to operate more smoothly than a two-lane off peak/four lane peak operation where there is fronting development.

The designer of striping and channelization needs to consider the benefits above when a street is being reviewed for striping improvements. In addition, the designer needs to carefully consider the trade-offs between the appropriate and achievable lengths of left-turn pockets at intersections versus those for two-way left-turn lanes (2WLTL's) to serve mid-block driveways.
All left-turn lanes at intersections should be “shadowed,” so that the departure side of a mandatory left-turn lane is a left-turn lane in the opposite direction, a striped median or a raised median.

Where 2WLTL's are being considered in a hillside area or on a street with steep grades or sharp crest or sag vertical curvature, the sight distance should be field checked to ensure that a motorist in the 2WLTL can see opposing through or left turn traffic. If there is any doubt, civil engineering profiles and vertical sight distance formulas should be used for verification. If sight distance is inadequate, as shown in S-497.0, then a striped median shall be used instead of a 2WLTL.

Generally, the following minimum storage lengths of fully shadowed left-turn channelization should be utilized:

- 2WLTL: 30 feet
- Collector street at non-signalized intersection: 40 feet
- Collector street at signalized intersection: 60 feet
- Arterial street at non-signalized intersection: 40 feet
- Arterial street at signalized collector street: 60 feet
- Arterial street at signalized arterial street: 100 feet

Where these storage lengths are not feasible, traffic may often queue into the number one through lane. In these instances, left turn restrictions rather than left-turn lanes should be considered.

Multiple left-turn lanes require special design considerations at standard intersections (i.e. two-way streets, four legs and right angle alignment). They present challenges to left-turn motorists in seeing opposing through traffic and pedestrians in the receptive leg of the intersection. Accordingly, dual left-turn lanes at standard intersections shall have protected left-turn phasing. A left-through lane adjacent to a left turn lane presents the same challenges. In addition, this operation can result in lane blockage as left-turn motorists wait for gaps in opposing traffic. Accordingly, the entire approach should be phased separately from that for opposing traffic. In addition, this operation should be phased separately from that for pedestrians.

Applications of left-turn channelization are shown in S-401.0, S-401.1 and S-414.4. Visibility requirements for motorists in left-turn lanes are shown in S-497.0.

Right-Turn Channelization

All right-turn lanes should be "shadowed" on the far-side of intersections. Shadowing for a right turn lane includes an undelineated curb lane, reduced roadway width, a raised island, or a striped island on the departure side. A receptive through lane on the far side of an intersection directly opposite a right-turn only lane can result in disrespect or mis-use of the turn lane.

Raised islands or other raised barriers for divergences or right turn lanes should be preceded by painted gores which should be preceded by barrier lines. In trap lane situations, the barrier line is preceded by lane drop striping which is preceded by standard lane lines. This hierarchy of striping helps to alert motorists of changing conditions.
It is desired to advise pedestrians of a preferred crossing; or
It is desired to channelize pedestrians to a single crossing.

Marked Crosswalks shall be aligned so that they meet two criteria:

- There is a buffer zone between the edge of the marked crosswalk and the adjacent lane of parallel traffic.
- The area between the middle of the curb return and the point of intersection of the crosswalk lines is not so great so as to inadvertently invite pedestrians to wait in the street.

See S-490.0 for specific details on aligning crosswalks.

Marked crosswalks across uncontrolled approaches should be installed with discretion, as some pedestrians may be over-confident that motorists will yield to them when in a marked crosswalk. Because accidents involving pedestrians commonly are severe, a full complement of traffic controls is necessary to advise motorists to be alert for pedestrians. S-481.0 is used for this situation and shows advance and intersectional signing and pavement messages and the approach red curb necessary for motorists to see pedestrians on the curb from a safe stopping distance.

Also see S-493.0 regarding crosswalk locations.

Curves

Curves in the roadway can present special challenges to motorists, which in turn may require special traffic control devices. Curves may require curve warning (W1, W2, W3, W4 or W5) signs. Where the design speed of the curve is greater than the speed limit and street lighting is provided then curve warning signing is not necessary. Otherwise, it should be provided. Where the speed of the curve is less than the speed limit then the curve warning signs should be supplemented with advisory speed (W6) signs. Curves with a central angle of 90 degrees or more should be posted with W4 signs.

The table below can be used to determine the approximate design speeds and appropriate warning signing for curves:

<table>
<thead>
<tr>
<th>Approximate Design Speed</th>
<th>Centerline Radius</th>
<th>Curve Warning Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 mi/hr</td>
<td>50 feet</td>
<td>W2 or W3</td>
</tr>
<tr>
<td>20</td>
<td>100</td>
<td>&quot;</td>
</tr>
<tr>
<td>25</td>
<td>200</td>
<td>&quot;</td>
</tr>
<tr>
<td>30</td>
<td>350</td>
<td>&quot;</td>
</tr>
<tr>
<td>35</td>
<td>500</td>
<td>W1 or W5</td>
</tr>
<tr>
<td>40</td>
<td>700</td>
<td>&quot;</td>
</tr>
<tr>
<td>45</td>
<td>900</td>
<td>&quot;</td>
</tr>
<tr>
<td>50</td>
<td>1,200</td>
<td>&quot;</td>
</tr>
<tr>
<td>55</td>
<td>1,500</td>
<td>&quot;</td>
</tr>
</tbody>
</table>
In addition to the above signing, other curve-related signs may be required. For curves where the difference between the design speed and speed limit is 10 miles per hour or greater, W57 or W81 signing should be installed. W57 signs should be used for relatively short lengths or curve and should be installed singly facing head-on traffic. W81 signs should be used to emphasize longer curves and should be spaced so that a minimum of three are in view throughout the curve. See S-501.0 for application of W81 signs.

Curves at intersections may require intersection striping as per S-405.0 and protected left-turn phasing as per S-497.0.

Transitions

Angle-point tapers are the most common method for implementing a transition. However, the curve-tangent-curve (C-T-C) method provides a smoother transition and, in some cases, provides a shorter length of transition than does tapering. On arterial streets the minimum length of C-T-C tangent should be two seconds of travel time at the design speed and shall not be less than 50 feet. Where a non-arterial street has a jogged alignment at a traffic signalized intersection reverse curve cat-tracking should be provided as per S-100.0. A tangent may be deleted in this situation.

Design speeds and their associated minimum taper rates are shown below. Generally, a higher five-unit increment such as 25 to 1, 30 to 1, etc. should be used, unless there would be a significant adverse impact to curb parking spaces.

<table>
<thead>
<tr>
<th>Speed Limit</th>
<th>Minimum Taper Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>10.5 to 1</td>
</tr>
<tr>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>35</td>
<td>20.5</td>
</tr>
<tr>
<td>40</td>
<td>26.7</td>
</tr>
<tr>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>55</td>
<td>55</td>
</tr>
</tbody>
</table>

Bikeways

Where feasible, bikeways are installed where a sufficient number of users can be expected to use them on a regular basis. Users tend to fall into four categories: recreational users, school children, college students and commuters. Most of the City's bikeways are located near recreational parks and playgrounds, areas of scenic beauty, schools and colleges.

Bikeways fall into three following categories:

Class 1 bikeways are off-street bike paths which usually are found in recreational areas where right-of-way is available. These tend to include parks, beach areas, and flood control channels.
Class 2 bikeways are on-street bike lanes. They are appropriate along arterial streets where it is believed that potential user demand exists, where the street is sufficiently wide to allow the addition of bike lanes and where a policy decision has been made that bike lanes are a higher priority than any future addition of vehicle lanes.

Class 3 bikeways are signed routes with no separate lanes. They are appropriate along low volume residential and collector streets where there is inadequate width for separate bike lanes. They sometimes may be appropriate along short segments of higher volume arterial streets where they provide continuity to longer reaches of bike lanes and bike paths.

**Lane Additions**

Short lengths of added through lanes generally are not advisable because they must terminate abruptly resulting in weaving sections which can compromise the safety and capacity of the adjacent lane. Thus, they should not be developed for lengths less than one-half mile, including the approach to and departure from a traffic signal. In such cases, right-turn lanes may provide a better operation.

Generally, on two-way streets added through lanes should be designed to start on the right side of the street and there should be only one lane added per block. On one-way streets added through lanes may be designed to start on the right or left side of the street, but there should be only one lane added per side per block.

Where right turn only lanes less than 18 feet wide are added, they should be preceded by 80 feet of red curb so as to allow unobstructed entry into the lane. Where there would be significant adverse impact to curb parking spaces then no less than 40 feet of red curb shall be used.

**Lane Reductions**

Lanes are reduced by lane dropping or by mandatory turns or divergences. Both methods require a sufficient length of unobstructed downstream reception width to allow the motorist to understand the situation, seek a gap in the adjacent lane and transition from the discontinued lane to the adjacent lane, as per S-485.0 and S-491.0. Note that S-485.0 shows a series of posted warning signs and pavement arrows, while S-491.0 also shows a series of posted signs and "elephant track" striping in order to meet this objective. Mandatory turn lanes that are necessary for lane reductions should terminate at signalized arterial intersections and not at local or collector streets.

**Pavement Messages and Symbols**

The size and shape of pavement and messages and symbols shall be consistent with those shown in the California Traffic Manual.

At the first location with Stop sign control along a route preceded by two or more traffic signals, "Stop" pavement messages should be installed at the limit lines and advance "Stop Ahead" pavement messages and signing should be installed on the approaches to supplement R1 and W17 signing. These same traffic control devices should be used on approaches with angle parking.
Wait Here" pavement messages should be installed in conjunction with the limit lines where:

- the stopping point is not at the marked crosswalk;
- pedestrian crossings are prohibited and the intersection has an unusual alignment, such as a skew, or
- pedestrian crossings are prohibited and the approach speeds are 40 miles-per-hour or greater, so as to improve target value.

Pavement arrows are installed at the beginning of turn and optional turn lanes. They also are installed mid-length in long turn lanes. See S-456.0 for specific details.

“Keep Clear” pavement messages supplement regulatory signs, such as R65, R66 and R90 signs. Otherwise, they are advisory and unenforceable. Some applications are shown in S-493.0.

Angle Parking

Angle parking is parking that is not parallel to the curb and is considered where the number of curb parking spaces is inadequate. Motorists using angle parking spaces must exercise additional caution when backing out, as compared with parallel curb spaces, due to limited sight distance. For this reason they are acceptable on residential and collector streets because speeds are relatively low and motorists tend to expect local access interruptions. However, on higher speed arterial streets sight distance may be inadequate and a backing vehicle tends to be an unexpected condition. Accordingly, angle parking is permissible on arterial streets only where there is sufficient receptive room to accommodate the backing vehicle without crossing into a lane.

On-street angle parking dimensions use off-street parking lot dimensions, as established in the Municipal Code. See S-440.0 for the dimensions associated with angle parking. The dimensions assume a 2 foot overhang beyond the curb. In addition, they provide a buffer area between the back of vehicle and the lane, so as to accommodate rear vehicle loading.

Angle parking requires additional red curb to meet visibility requirements on the approaches to crosswalks or stop signs. A check should be made of the adequacy of red curb, using distance “A” in S-481.0.

Narrowed Roadways

Roadways that suddenly narrow can present a surprise situation for unfamiliar motorists. A combination of special striping and sign is used to advise of this condition, as shown in S-444.0.

Exclusive Bus Lanes

Exclusive bus lanes are relatively rare and tend to be confined to the Central Business District. Special striping, pavement markings and signing helps alert unfamiliar motorists not to use them. See S-487.0.
Speed Humps

Speed humps are used on non-arterial streets which experience speeding problems, to encourage motorists to drive slower or to use alternate, arterial streets for through travel. Distinctive markings and signing are used to advise motorists of this special roadway feature. They are shown in S-483.0.

Signalized Jogged Intersections

The design of signalized jogged intersections is one of the most complex tasks in traffic engineering. Motorists can face the following challenges from one or more of the four approaches to a signalized jogged intersection:

- Pedestrians might not be readily seen when motorists begin their turning maneuvers.
- Opposing vehicles might not be readily seen when motorists enter the intersection.
- Opposing left turns interlock.
- A reverse turn maneuver versus a single turn cannot readily be distinguished.
- Motorists must determine if there is one versus two intersections and how to respond to each.

These challenges can be mitigated by providing a full complement of controls and applying them in a uniform manner. S-100.0 shows the options available for a variety of conditions. A primary consideration is whether or not to provide interior limit lines, so as to create two intersections. If the internal storage is 40 feet or more then interior limit lines are to be provided. Another primary consideration is whether or not to provide exclusive or semi-exclusive phasing for the jogged approaches, due to the challenges resulting from the physical separation. If opposing motorists are separated by more than 20 degrees then some type of exclusive phasing is to be provided. The placement of signal heads is determined from the above considerations and the specific geometries of the intersection.

Detours and Worksite Traffic Control Plans

Detours around roadway worksites lasting 36 hours or less and no more than one night, that involve traffic being diverted to the left of a double yellow centerline, may use temporary delineation as depicted in S-488.0. Otherwise, detours require worksite traffic control design plans involving striping realignment, removal and/or cover, with approval as discussed herein. Worksite traffic control design plans include striping plans and shall include signal plans, if signalized intersections are involved and signal visibility is impacted.

Freeway Guide Signs

Freeway guide signs generally fall into two categories - "lane assignment" and "action."

Due to the various types of on-ramp configurations freeways can be entered from right or left lanes. Accordingly, Section 4-04.7 of the Traffic Manual requires that multi-lane streets having access to freeways be posted with "lane assignment" signs. "Action" freeway guide signs are an essential follow-up to "lane assignment" signs.
Generally, overhead signing is the most effective means of communicating freeway access to motorists. Roadside guide signing on the right or in a raised median can be used where overhead signing is not immediately feasible. However, roadside guide signing has limited area for text and may require more signs for communicating lane assignment. See S-476.1 which shows the maximum sign area that may be installed for various postings. The various formats for freeway guide signing are shown in S-418.5 and S-418.6.

Overhead Guide Signs

Overhead guide signs provide a high degree of visibility to forewarn and direct motorists on multilane approaches of access or lane assignment conditions that generally cannot be anticipated. Conditions include:

- Divergent arterial roadways
- Skewed arterial approaches
- Unshadowed left-turn lanes
- Arterial grade separations, including freeways
- Bus and/or carpool lanes
- Street name or sign route changes
- End of one-way operation

These situations are illustrated in S-418.6.

Street Name Signs

In the City of Los Angeles, street name signs shall be posted at all intersections on the near right of each approach. The format is shown in S-438.0. The various applications are shown in S-221.3. At signalized intersections supplemental large street name signs are to be posted as per S-486.0. See “One-Way Signs” section below for postings with arterial one-way streets.

One-Way Signs

At arterial signalized intersections with one-way streets, large R-10 (One-Way) signs are to be installed on mastarms as shown in S-473.0. These installations may necessitate that the large street name signs be posted on the vertical pole, due to limited mastarm length.

End of Roadway

W31 (End) signs and Type N-2 panels should be used at the terminus of streets without cul-de-sac designs and with cul-de-sac designs where the frontage of the cul-de-sac is not fully developed. See S-446.0

At the beginning of the block preceding the terminus a W53 (Not a Through Street) sign should be posted. In addition, striping, if any, should be terminated 100 feet or more in advance to provide another clue as to its discontinuity.
Impact Attenuators

Non-yielding fixed objects between exterior curb lines should be avoided wherever feasible, so as to provide a forgiving roadway environment. Where non-yielding fixed objects must be placed in a raised median island they should be placed as far as possible from the edge of traveled way and away from intersections. Non-yielding fixed objects near the traveled way, at an intersection or at divergences should be accompanied by impact attenuators, if feasible, as shown in S-489.0 and S-489.1.

Logo Guide Signs

Some destinations of general public interest depend to some degree on a logo of their facility or function to guide motorists. Any special logo used might be recognized by some but certainly not by all motorists. Accordingly, a logo shall not be used alone. When a logo sign is used it shall be consistent with S-499-0.

Street Adoption Sign

"Street Adoption" signs are used to publicize that a particular civic-minded group or individual has agreed to assist in the maintenance of the street. When used, the sign shall be consistent with S-484.0.

City Limit and Community District/Name Signs

S-502.0 shows the standard format for City Limit ("City of Los Angeles") and Community District/Name signs. In some cases, neighborhood groups may desire distinctive, unique signing. Specifications and guidelines are shown for these signs. The Department will allow custom neighborhood signs to be posted in accordance with S-502.0, but will not inventory nor maintain them.

Table 1

<table>
<thead>
<tr>
<th>Stripping/Marking Component</th>
<th>Application</th>
<th>Reference to Traffic Manual, MUTCD, or other document</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skip Centerline</td>
<td>Allows passing of opposing traffic on 2-lane streets.</td>
<td>T.M. Figure 6-1. Detail 1</td>
</tr>
<tr>
<td>Partial Passing Centerline</td>
<td>Allows passing of opposing traffic on 2-lane streets from one direction only.</td>
<td>Detail 15</td>
</tr>
<tr>
<td>Double Yellow Centerline</td>
<td>Prohibits passing of opposing traffic, but allows crossing.</td>
<td>Detail 21</td>
</tr>
<tr>
<td>Striped Median</td>
<td>Physically separates opposing traffic flows, prohibits passing, and crossing. Internal separation must be at least 2 feet for enforcement.</td>
<td>Detail 28</td>
</tr>
</tbody>
</table>
### Table

**Application of Striping and Marking Components**

<table>
<thead>
<tr>
<th>Striping/Marking Component</th>
<th>Application</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Two-Way Left-Turn Lane (2WLTL)</td>
<td>Provides midblock left-turn storage. May be used at non-signalized intersections to provide storage for both intersectional left turns and nearby driveways from the other direction. It may also be used to provide refuge for motorists entering the highway as they seek a gap in the other direction.</td>
<td>Detail 31</td>
</tr>
<tr>
<td>Left Edge Line</td>
<td>Delineates left edge of roadway or median and is parallel to edge.</td>
<td>Detail 24</td>
</tr>
<tr>
<td>Left Channelization Line</td>
<td>Delineates left edge of travel path where it is not parallel to the edge of roadway.</td>
<td>Detail 21</td>
</tr>
<tr>
<td>Cigar Nose</td>
<td>Delineates a tapered striped median at “T” intersection crossings. It is commonly used where the left-turn radius from the stem roadway of the “T” is less than 70 feet or where it is not necessary to provide left-turn storage into driveways near the top of the “T” via a 2WLTL.</td>
<td>Detail 28 with one Double Yellow Centerline closing in on the other, usually 40' in length</td>
</tr>
<tr>
<td>Reversal</td>
<td>Identifies and provides the travel path into a uni-directional left-turn lane or a Two-Way Left Turn Lane.</td>
<td>Detail 21 aligned in a sharp</td>
</tr>
<tr>
<td>Left Edge Cross Hatch</td>
<td>Provides emphasis in striped medians at least 5 feet in width and in the area between the left edge of roadway and a Left Channelization Line or Left Edge Line at least 5 feet in width. Is aligned at 45 degrees diagonally forward with respect to the direction of travel.</td>
<td>12” yellow; MUTCD Figure 3-13 top</td>
</tr>
<tr>
<td>Lane Line</td>
<td>Separates concurrent through lanes.</td>
<td>T.M. Figure 6-1, Detail 8</td>
</tr>
<tr>
<td>Barrier Line</td>
<td>Separates turn lanes from through lanes or other turn lanes.</td>
<td>Detail 38A</td>
</tr>
</tbody>
</table>
### Table 1: Application of Striping and Marking Components

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Right Edge Line</td>
<td>Delineates right edge of roadway and is parallel to edge.</td>
<td>Detail 27B</td>
</tr>
<tr>
<td>Right Channelization Line</td>
<td>Delineates right edge of travel path where it is not parallel to the edge of roadway.</td>
<td>Detail 38A</td>
</tr>
<tr>
<td>Striped Island</td>
<td>Physically separates converging or diverging traffic flows and prohibits vehicular crossings.</td>
<td>A pair of Detail 38A lines with diverge, converge, or are parallel</td>
</tr>
<tr>
<td>Lane Drop Line or “Elephant Track”</td>
<td>Transition striping for an entrapped-turn lane or an advance turn lane. See S-491.0.</td>
<td>Detail 37B</td>
</tr>
<tr>
<td>Bike Lane Line</td>
<td>Separates the travel paths between bicycles and motor vehicles. The Bike Lane Line is broken between 100 feet and 200 feet upstream of the intersection in order to identify where right-turning motor vehicles may cross the bicycle lane.</td>
<td>Details 39, 39A.</td>
</tr>
<tr>
<td>Right Edge Cross Hatch</td>
<td>Provides emphasis in striped islands at least 5 feet in width and in the area between the right edge of roadway and a Right Channelization Line or Right Edge Line at least 5 feet in width. Is aligned at 45 degrees diagonally forward with respect to the direction of travel.</td>
<td>12&quot; white; Half of the Chevron markings shown in MUTCD Figure 3-13, bottom.</td>
</tr>
<tr>
<td>Chevron</td>
<td>Provides emphasis within a striped island or a gore area at least 5 feet in width where concurrent traffic travels on either side.</td>
<td>MUTCD, Figure 3-13 bottom</td>
</tr>
</tbody>
</table>
### Table 1

Application of Striping and Marking Components

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Hook (Wrap) and Bar</td>
<td>Used at the downstream end of a Barrier Line for a Trap Turn Lane, where the adjacent lane is a through lane. Where the adjacent lane is a concurrent turn lane the Bar is not used. See S-491.0 Note 7 and illustration. Also see S-405.0.</td>
<td>T.M. Figure 6-1, Detail 38A</td>
</tr>
<tr>
<td>Crosswalk (Marked)</td>
<td>Emphasizes the legal crosswalk at signalized intersections, indicates a preferred legal crosswalk at non-signalized intersections, and identifies a legal marked crosswalk where no legal unmarked crosswalk exists. Generally is 15' or 20' wide with a minimum width of 10'.</td>
<td>12&quot; white or 12&quot; yellow (schools)</td>
</tr>
<tr>
<td>Limit Line</td>
<td>Indicates the stopping point at Stop signs, and traffic signals without crosswalks. May also be used with Yield signs.</td>
<td>12&quot; white</td>
</tr>
<tr>
<td>Railroad Stop Line</td>
<td>Indicates the stopping point adjacent to railroad crossings.</td>
<td>T.M. Figure 6-40</td>
</tr>
<tr>
<td>Arrow</td>
<td>Emphasizes a mandatory turn lane or optional turn lane not otherwise permitted. It must be accompanied by complementary regulatory signs in order to be enforceable, except for conventional right-turn or left-turn pocket lanes. See S-456.0.</td>
<td>T.M. Figures 6-37, 6-38</td>
</tr>
<tr>
<td>Intersection Stripe or “Cat Track”</td>
<td>Clarifies travel paths within intersection for multiple turns, or a curved or tapered travel path. Applicable to Double Yellow Centerlines, Barrier Lines, Lane lines, and Bike Lanes. See S-405.0.</td>
<td>12&quot; lengths of T.M. Figure 6-1, Details 8, 21, and 38A</td>
</tr>
<tr>
<td>Legend</td>
<td>Emphasizes and complements warning or regulatory signs.</td>
<td>T.M. Figure 6-36</td>
</tr>
</tbody>
</table>
Appendix of Standard Drawings

<table>
<thead>
<tr>
<th>Drawing No.</th>
<th>Title</th>
<th>Sheets</th>
<th>Date</th>
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</thead>
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<tr>
<td>S-100.0</td>
<td>Operation and Design of Signalized Jogged Intersections</td>
<td>12</td>
<td>01-15-99</td>
</tr>
<tr>
<td>S-221.3</td>
<td>Street Name Signs</td>
<td>1</td>
<td>03-02-89</td>
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<tr>
<td>S-401.0</td>
<td>Typical Major Highway Striping Treatments</td>
<td>1</td>
<td>07-01-97</td>
</tr>
<tr>
<td>S-401.1</td>
<td>Typical Secondary Highway Striping Treatments</td>
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<td>07-01-97</td>
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<td>S-405.0</td>
<td>Intersection Striping</td>
<td>12</td>
<td>11-21-97</td>
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<tr>
<td>S-414.4</td>
<td>Left Turn and Median Channelization Pavement Markings</td>
<td>7</td>
<td>08-06-98</td>
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<tr>
<td>S-418.5</td>
<td>Roadside Freeway Guide Signing</td>
<td>9</td>
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<tr>
<td>S-418.6</td>
<td>Overhead Guide Signing</td>
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<td>01-15-99</td>
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<td>S-438.0</td>
<td>Street Name Sign-Bracket Details</td>
<td>4</td>
<td>06-14-96</td>
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<td>S-440.0</td>
<td>On-Street Angle Parking Stalls</td>
<td>2</td>
<td>07-10-96</td>
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<tr>
<td>S-444.0</td>
<td>Narrowed Roadway Delineation (Without Lane Drop)</td>
<td>1</td>
<td>07-22-97</td>
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<tr>
<td>S-445.0</td>
<td>Delineator</td>
<td>1</td>
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<td>S-446.0</td>
<td>Sign Posting for Street Termini</td>
<td>1</td>
<td>11-13-98</td>
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<tr>
<td>S-447.0</td>
<td>Type Q Object Marker</td>
<td>1</td>
<td>10-21-92</td>
</tr>
<tr>
<td>S-456.0</td>
<td>Typical Placement of Pavement Turn Arrows</td>
<td>1</td>
<td>11-13-98</td>
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<tr>
<td>S-473.0</td>
<td>One-Way Arrow Mastarm Mounted</td>
<td>1</td>
<td>02-22-89</td>
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<tr>
<td>S-476.1</td>
<td>Sign Installation-Heavy Duty</td>
<td>1</td>
<td>06-09-89</td>
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<tr>
<td>S-481.0</td>
<td>Traffic Controls for Marked Crosswalks on Non-Controlled Approaches</td>
<td>1</td>
<td>02-24-99</td>
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<tr>
<td>S-483.0</td>
<td>Speed Hump</td>
<td>2</td>
<td>12-09-94</td>
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<tr>
<td>S-484.0</td>
<td>Street Adoption Sign</td>
<td>1</td>
<td>10-13-93</td>
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<tr>
<td>S-485.0</td>
<td>Lane Reduction</td>
<td>2</td>
<td>08-24-98</td>
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<tr>
<td>S-486.0</td>
<td>Mast Arm Mounted Street Name Signs</td>
<td>2</td>
<td>05-28-96</td>
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<td>S-487.0</td>
<td>Exclusive Bus Lane Pavement Markings</td>
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<tr>
<td>S-488.0</td>
<td>Worksite Traffic Control Plan</td>
<td>23</td>
<td>01-06-95</td>
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<td>S-489.0</td>
<td>Impact Attenuator Selection Guide</td>
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<td>06-17-94</td>
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<tr>
<td>S-489.1</td>
<td>Telescoping Thriveam Impact Attenuator</td>
<td>2</td>
<td>04-11-94</td>
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<td>S-490.0</td>
<td>Crosswalk Alignment</td>
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<td>03-24-95</td>
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<td>S-491.0</td>
<td>Advance Turn Lanes</td>
<td>1</td>
<td>11-13-98</td>
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<tr>
<td>S-493.0</td>
<td>Location of Limit Lines and Crosswalks</td>
<td>7</td>
<td>09-16-97</td>
</tr>
<tr>
<td>S-494.0</td>
<td>Channelized Right Turns</td>
<td>5</td>
<td>07-25-97</td>
</tr>
<tr>
<td>S-497.0</td>
<td>Gap Acceptance and Visibility Requirements for Left Turn Lanes with Permissive Phasing</td>
<td>2</td>
<td>06-22-98</td>
</tr>
<tr>
<td>S-499.0</td>
<td>Guide Sign With Logo</td>
<td>1</td>
<td>09-08-98</td>
</tr>
<tr>
<td>S-501.0</td>
<td>Supplemental Curve Warning Signing</td>
<td>2</td>
<td>11-23-98</td>
</tr>
<tr>
<td>S-502.0</td>
<td>Community and Neighborhood Signs</td>
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<td>03-10-99</td>
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