CHAPTER M1
Pavement Delineation

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M1.01 Introduction

M1.01.01 Chapter Content and Resources

This chapter contains information relevant to all work performed to maintain the permanent and temporary pavement delineation placed on the State Highway System for the purpose of communicating the rules, warnings, guidance, and other highway information. This includes the following M Family areas:

- M1 – Pavement Striping
- M2 – Pavement Markings
- M3 – Raised Pavement Markers
- M5 – Roadside Delineators

Damaged pavement delineation that can seriously affect public safety or capital investment should be the highest priority for repair or temporary corrections until permanent repairs can be scheduled. Lower priority should be assigned to inoperative or damaged devices, which do not seriously affect public safety.

Typical work on pavement delineation and markings may include the following:

(A) Inspection of pavement delineation

(B) Layout for replacement purposes

(C) Refurbishing delineation

(D) Replacement of missing markers

(E) Repainting of red curbs where it is a State obligation

Work in this chapter includes only pavement delineation on the traveled way, shoulders, ramps, and auxiliary lanes. It does not include markings, legends or parking stalls at roadside rest areas, weigh stations, and other public service locations. Work in such areas is covered under Public Facilities.

This chapter provides an overview of policies, expectations, and strategies regarding pavement delineation. For additional information and a complete description of materials, applications, and recommended highway maintenance strategies, please see the following references:

California Manual on Uniform Traffic Control Devices (MUTCD):
https://dot.ca.gov/programs/safety-programs/camutcd/camutcd-files

- Part 3 – Markings
- Part 6 – Temporary Traffic Control
- Part 7 – Traffic Control for School Areas
- Part 8 – Traffic Control for Railroad and LRT Grade Crossings

California Vehicle Code: Codes: Codes Tree - Vehicle Code - VEH (ca.gov)

- Division 1, Section 377
- Division 11, Chapter 2, Article 1, Section 21368
- Division 11, Chapter 2, Article 3, Section 21458

Code of Safe Operating Practices: Manuals and Reference | Maintenance (ca.gov)

Maintenance Program Strategic Plan (2022-2027): Strategic Plan 2022–2027 (ca.gov)

Memorandum - "Implementation of 6-Inch Traffic Lines and Discontinued Use of Nonreflective Pavement Markers." The purpose of this Memorandum is to increase the width of all 4-inch-wide longitudinal traffic lines and discontinue the use of non-reflective pavement delineation Type A and Type AY nonreflective raised pavement markers (RPMs) on maintenance restriping of existing traffic lines: CPD 17-3 Implementation of 6-Inch Traffic Lines and Discontinued Use of Nonreflective Pavement Markers (ca.gov)

Memorandum - "Route Shield Pavement Markings" The purpose of this Memorandum is to establish guidance for the use of route shield pavement markings. Placement of route shield pavement markings supplement the information provided on overhead or roadside signs that depict the upcoming interchange geometry: https://dot.ca.gov/-/media/dot-media/programs/traffic-operations/documents/memos-letters/f0018538-route-shield-pavement-markings-memo-5-10-16-a11y.pdf

Memorandum - "Pavement Marking and Monitoring Policy." The purpose of this Memorandum is to establish a guide for the selection of pavement markings material: https://safetyprograms.onramp.dot.ca.gov/downloads/safetyprogram/files/longitudinal-pavement-marking-memo_06_02_20.pdf

Safety and Health Manual: Employee Safety Manual Online | Health and Safety (ca.gov)

Standard Plans/Revised Standard Plans: https://dot.ca.gov/programs/design

- Pavement Markers and Traffic Lines - A20A through A20E
- Pavement Markings - A24A through A24F
- Markers - A73B
- Delineators, Channelizers and Barricades - A73C

Standard Specifications/Revised Standard Specifications: https://dot.ca.gov/programs/design

- Section 12 – Temporary Traffic Control
- Section 84 – Markings

M1.01.02 Definitions

AC – Asphalt Concrete
C - Celsius
CEFS – Caltrans Electronic Forms System
DTO – District Traffic Operations
F - Fahrenheit
HM – Highway Maintenance
IMMS - Integrated Maintenance Management System
IO – Installation Order
LOS – Level of Service
MUTCD - Manual on Uniform Traffic Control Devices
SHS – State Highway System
VEH – California Vehicle Code (Previous abbreviation of CVC)

Definitions from California MUTCD 1A.13, "Definitions of Headings, Words, and Phrases in this Manual" referenced in this chapter:

Bicycle: A pedal-powered vehicle upon which the human operator sits. As per CVC 231, a bicycle is a device upon which any person may ride, propelled exclusively by human power through a belt, chain, or gears, and having one or more wheels. Persons riding bicycles are subject to the provisions of this code specified in Sections 21200 and 21200.5. Also refer to CVC 39000 and S&H Code Section 890.2.

Bicycle Lane: A portion of a roadway that has been designated for preferential or exclusive use by bicyclists by pavement markings and, if used, signs. See Class II Bikeway.

Class II Bikeway (such as a Bike Lane): Provides a restricted right-of-way designated for the exclusive or semi-exclusive use of bicycles with through travel by motor vehicles or pedestrians prohibited, but with vehicle parking and crossflows by pedestrians and motorists permitted. Refer to California Streets and Highways Code Section 890.4. Refer to Caltrans' Highway Design Manual Index 1003.2 for design criteria.

Channelizing Line Markings: A wide or double solid white line used to form islands where traffic in the same direction of travel is permitted on both sides of the island.

Crosswalk: (a) that part of a roadway at an intersection included within the connections of the lateral lines of the sidewalks on opposite sides of the highway measured from the curbs or in the absence of curbs, from the edges of the traversable roadway, and in the absence of a sidewalk on one side of the roadway, the part of a roadway included within the extension of the lateral lines of the sidewalk at right angles to the center line; (b) any portion of a roadway at an intersection or elsewhere distinctly indicated as a pedestrian crossing by pavement marking lines on the surface, which might be supplemented by contrasting pavement texture, style, or color. As per CVC 275, "Crosswalk" is either: (a) That portion of a roadway included within the prolongation or connection of the boundary lines of sidewalks at intersections where the intersecting roadways meet at approximately right angles, except the prolongation of such lines from an alley across a street. (b) Any portion of a roadway distinctly indicated for pedestrian crossing by lines or other markings on the surface. Notwithstanding the foregoing provisions of this section, there shall not be a crosswalk where local authorities have placed signs indicating no crossing.

Crosswalk Lines: White or yellow (in school areas per CVC 21368) pavement marking lines that identify a crosswalk.

Delineator*:* A retroreflective device mounted on the roadway surface or at the side of the roadway in a series to indicate the alignment of the roadway, especially at night or in adverse weather.

Detectable: Having a continuous edge within 6 inches of the surface so that pedestrians who have visual disabilities can sense its presence and receive usable guidance information.

Edge Line Markings: White or yellow pavement marking lines that delineate the right or left edge(s) of a traveled way.

Engineering Judgment: The evaluation of available pertinent information, and the application of appropriate principles, experience, education, discretion, provisions, and practices as contained in this Manual and other sources, for the purpose of deciding upon the applicability, design, operation, or installation of a traffic control device. Engineering judgment shall be exercised by an engineer, or by an individual working under the supervision of an engineer, through the application of procedures and criteria established by the engineer. Documentation of engineering judgment is not required.

Freeway: A divided highway with full control of access. As per CVC 332, "Freeway" is a highway in respect to which the owners of abutting lands have no right or easement of access to or from their abutting lands or in respect to which such owners have only limited or restricted right or easement of access.

Highway: A general term for denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way. As per CVC 360, "Highway" is a way or place of whatever nature, publicly maintained and open to the use of the public for purposes of vehicular travel. Highway includes street. Also, refer to CVC 590 definition of “Street”.

Intersection: Intersection is defined as follows:
As per CVC 365, an "intersection" is the area embraced within the prolongation of the lateral curb lines, or, if none, then the lateral boundary lines of the roadways, of two highways which join one another at approximately right angles or the area within which vehicles traveling upon different highways joining at any other angle may come in conflict.

a. The area embraced within the prolongation or connection of the lateral curb lines, or if none, the lateral boundary lines of the roadways of two highways that join one another at, or approximately at, right angles, or the area within which vehicles traveling on different highways that join at any other angle might come into conflict.
b. The junction of an alley or driveway with a roadway or highway shall not constitute an intersection, unless the roadway or highway at said junction is controlled by a traffic control device.
c. If a highway includes two roadways that are 30 feet or more apart (see definition of Median), then every crossing of each roadway of such divided highway by an intersecting highway shall be a separate intersection.
d. If both intersecting highways include two roadways that are 30 feet or more apart, then every crossing of any two roadways of such highways shall be a separate intersection.

e. At a location controlled by a traffic control signal, regardless of the distance between the separate intersections as defined in (c) and (d) above:
   1. If a stop line, yield line, or crosswalk has not been designated on the roadway (within the median) between the separate intersections, the two intersections and the roadway (median) between them shall be considered as one intersection;
   2. Where a stop line, yield line, or crosswalk is designated on the roadway on the intersection approach, the area within the crosswalk and/or beyond the designated stop line or yield line shall be part of the intersection; and
   3. Where a crosswalk is designated on a roadway on the departure from the intersection, the intersection shall include the area extending to the far side of such crosswalk.

Island: A defined area between traffic lanes for control of vehicular movements, for toll collection, or for pedestrian refuge. It includes all end protection and approach treatments. Within an intersection area, a median or an outer separation is considered to be an island.

Lane Line Markings: White pavement marking lines that delineate the separation of traffic lanes that have the same direction of travel on a roadway.

Longitudinal Markings: Pavement markings that are generally placed parallel and adjacent to the flow of traffic such as lane lines, center lines, edge lines, channelizing lines, and others.

Median*:* The area between two roadways of a divided highway measured from edge of traveled way to edge of traveled way. The median excludes turn lanes. The median width might be different between intersections, interchanges, and at opposite approaches of the same intersection.

Object Marker: A device used to mark obstructions within or adjacent to the roadway.

Overhead Sign: A sign that is placed such that a portion or the entirety of the sign or its support is directly above the roadway or shoulder such that vehicles travel below it. Typical installations include signs placed on cantilever arms that extend over the roadway or shoulder, on sign support structures that span the entire width of the pavement, on mast arms or span wires that also support traffic control signals, and on highway bridges that cross over the roadway.

Parking Area: A parking lot or parking garage that is separated from a roadway. Parallel or angle parking spaces along a roadway are not considered a parking area.

Paved: A bituminous surface treatment, mixed bituminous concrete, or Portland cement concrete roadway surface that has both a structural (weight bearing) and a sealing purpose for the roadway.

Pedestrian: A person on foot, in a wheelchair, on skates, or on a skateboard. As per CVC 467, (a) A "pedestrian" is a person who is afoot or who is using any of the following: (1) A means of conveyance propelled by human power other than a bicycle. (2) An electric personal assistive mobility device. (b) "Pedestrian" includes a person who is operating a self-propelled wheelchair, motorized tricycle, or motorized quadricycle and, by reason of physical disability, is otherwise unable to move about as a pedestrian, as specified in subdivision(a).

***Pedestrian Facilities**:* A general term denoting improvements and provisions made to accommodate or encourage walking.

***Private Road Open to Public Travel**:* Private toll roads and roads (including any adjacent sidewalks that generally run parallel to the road) within shopping centers, airports, sports arenas, and other similar business and/or recreation facilities that are privately owned, but where the public is allowed to travel without access restrictions. Roads within private gated properties (except for gated toll roads) where access is restricted at all times, parking areas, driving aisles within parking areas, and private grade crossings shall not be included in this definition. The MUTCD national standard and Caltrans standards and specifications for traffic control devices shall not be applicable to privately owned and maintained roads or commercial establishments, unless the particular city or county enacts an ordinance or resolution to this effect. Refer to CVC Sections 21100, 21100.1, 21107, 21107.5, 21107.6, and 21107.7.

Raised Pavement Marker: A device mounted on or in a road surface that has a height generally not exceeding approximately 1 inch above the road surface for a permanent marker, or not exceeding approximately 2 inches above the road surface for a temporary flexible marker, and that is intended to be used as a positioning guide and/or to supplement or substitute for pavement markings.

Retroreflectivity: A property of a surface that allows a large portion of the light coming from a point source to be returned directly back to a point near its origin.

Road: See Roadway.

Road User: A vehicle operator, bicyclist, or pedestrian, including persons with disabilities, within the highway or on a private road open to public travel (see definition of private road open to public travel).

Roadway: That portion of a highway improved, designed, or ordinarily used for vehicular travel and parking lanes, but exclusive of the sidewalk, berm, or shoulder even though such sidewalk, berm, or shoulder is used by persons riding bicycles or other human-powered vehicles. In the event a highway includes two or more separate roadways, the term roadway as used in this Manual shall refer to any such roadway separately, but not to all such roadways collectively. Refer to CVC 527.

School: A public or private educational institution recognized by the state education authority for one or more grades K through 12 or as otherwise defined by the State.

***School Zone**:* A designated roadway segment approaching, adjacent to, and beyond school buildings or grounds, or along which school related activities occur. As per CVC 22352(a)(2)(B) When approaching or passing a school building or the grounds thereof, contiguous to a highway and posted with a standard “SCHOOL” warning sign, while children are going to or leaving the school either during school hours or during the noon recess period. The prima facie limit shall also apply when approaching or passing any school grounds which are not separated from the highway by a fence, gate, or other physical barrier while the grounds are in use by children and the highway is posted with a standard “SCHOOL” warning sign.

Shoulder: The portion of the highway contiguous with the roadway for accommodations of pedestrians, bicyclists, stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Sidewalk: That portion of a street between the curb line, or the lateral line of a roadway, and the adjacent property line or on easements of private property that is paved or improved and intended for use by pedestrians. As per CVC 555, “Sidewalk” is that portion of a highway, other than the roadway, set apart by curbs, barriers, markings or other delineation for pedestrian travel.

Sign: Any traffic control device that is intended to communicate specific information to road users through a word, symbol, and/or arrow legend. Signs do not include highway traffic signals, pavement markings, delineators, or channelization devices.

Stop Line: A solid white pavement marking line extending across approach lanes to indicate the point at which a stop is intended or required to be made. For all purposes, limit line(s) as defined per CVC 377 shall mean stop line(s).

Street: See Highway. As per CVC 590, "Street" is a way or place of whatever nature, publicly maintained and open to the use of the public for purposes of vehicular travel.

Symbol: The approved design of a pictorial representation of a specific traffic control message for signs, pavement markings, traffic control signals, or other traffic control devices, as shown in the MUTCD.

Temporary Traffic Control Zone: An area of a highway where road user conditions are changed because of a work zone or incident by the use of temporary traffic control devices, flaggers, uniformed law enforcement officers, or other authorized personnel.

Traffic: Pedestrians, bicyclists, ridden or herded animals, vehicles, streetcars, and other conveyances either singularly or together while using for purposes of travel any highway or private road open to public travel (see definition of private road open to public travel). As per CVC 620, the term "traffic" includes pedestrians, ridden animals, vehicles, street cars, and other conveyances, either singly or together, while using any highway for purposes of travel.

Traffic Control Device: A sign, signal, marking, or other device used to regulate, warn, or guide traffic, placed on, over, or adjacent to a street, highway, private road open to public travel (see definition of private road open to public travel), pedestrian facility, or shared-use path by authority of a public agency or official having jurisdiction, or, in the case of a private road open to public travel (see definition of private road open to public travel), by authority of the private owner or private official having jurisdiction.

Traffic Control Signal (Traffic Signal): Any highway traffic signal by which traffic is alternately directed to stop and permitted to proceed.

Traveled Way: The portion of the roadway for the movement of vehicles, exclusive of the shoulders, berms, sidewalks, and parking lanes.

Warrant: A warrant describes a threshold condition based upon average or normal conditions that, if found to be satisfied as part of an engineering study, shall result in analysis of other traffic conditions or factors to determine whether a traffic control device or other improvement is justified. Warrants are not a substitute for engineering judgment. The fact that a warrant for a particular traffic control device is met is not conclusive justification for the installation of the device.

Worker: A person on foot whose duties place him or her within the right-of-way of a street, highway, or pathway, such as street, highway, or pathway construction and maintenance forces, survey crews, utility crews, responders to incidents within the street, highway, or pathway right-of-way, and law enforcement personnel when directing traffic, investigating crashes, and handling lane closures, obstructed roadways, and disasters within the right-of-way of a street, highway, or pathway.

M1.01.03 References and Hyperlinks

Some of the references found in this chapter have hyperlinks that connect to Caltrans intranet pages which are not displayable to the public. Until such time that the specific reference becomes available on the internet, the user will have to contact their district maintenance engineer or the appropriate Headquarters division to inquire about the availability of the reference.

M1.01.04 Chapter Contact

This chapter of the Maintenance Manual is maintained by the Division of Maintenance, Office of Maintenance Traffic Guidance and Safety.

M1.02 Overview

M1.02.01 Objective

The general objective of the program is to maintain all highway traffic guidance devices as near to original condition as practical and to ensure the reliability of the system. Maintenance includes repairing and/or replacing damaged traffic control devices and pavement delineators with approved materials.

Performing regularly scheduled maintenance inspections will reduce environmental and other impacts on the equipment, ensure a professional appearance, and improve the effectiveness of the system operations. Ensuring proper operation of devices and systems will provide the most reliable, informative, safe, and efficient transportation system.

M1.02.02 Pavement Delineation

Pavement delineation is used to provide guidance and information for the road user. In some cases, markings are used to supplement other traffic control devices (such as signs, signals, and other markings), and in other instances, markings may be used solely to effectively convey regulations, guidance, or warnings. Markings have limitations and visibility can be limited by snow, debris, and water on or adjacent to the markings. Under most highway conditions, markings provide important information while allowing minimal diversion of attention from the roadway. Approval from District Traffic Operations (DTO) must be obtained before using any

delineation other than standard delineation. District Maintenance should continuously work with DTO to identify pavement delineation that is obsolete and should not be maintained. Documentation is required from DTO before maintenance of pavement delineation is waived. A DTO Installation Order (IO) is required prior to removal of pavement delineation by grinding or other methods indicated by DTO.

Stencils used to place pavement markings shall be in accordance with the latest Standard Plans, plans sheets A-24A through A-24F.

M1.02.03 Responsibility

Maintenance of pavement markings placed off the right-of-way for roads entering the State highway may be an obligation of the Department of Transportation (Caltrans) when placed primarily for the protection of traffic on the State facility. Examples are pavement markings that support the R1-1 STOP, and W3-1 STOP AHEAD signs. It is standard practice for the owner of the entering facility to fund the initial installation. Future maintenance costs, including clearing of trees and brush to improve visibility of signs, is generally borne by Caltrans. If an agreement is in place, maintenance costs may be borne by the owner of the entering facility.

Districts are responsible for the placement and maintenance of limit lines (stop bars) at both existing and new paved approaches to a State highway, and "STOP" pavement markings requested by DTO. Districts will coordinate the work of the pavement marking and sign crews for these installations. For maintenance responsibilities, a review of any applicable Maintenance Agreements with local agencies should be considered. The review of any applicable Maintenance Agreements will help ensure proper handling of maintenance responsibilities by other entities per those agreements, which are to be followed.

Where local governmental agencies have been delegated pavement delineation responsibilities by a Maintenance Agreement, their performance shall conform to the standards set forth in this chapter. The district should periodically inspect delineation to assure that local agencies are maintaining acceptable standards.

M1.02.04 Safety

The Caltrans Safety and Health Manual provides information for Caltrans' managers, supervisors, and employees to conduct Caltrans business in a safe manner, consistent with applicable laws, rules, policies and/or regulations. Maintenance managers and supervisors should refer to Caltrans Safety and Health Manual to provide a safe work environment for themselves and the employees.

Volume 1, Chapter 8 of the Maintenance Manual provides information for Caltrans' managers, supervisors, and employees on protection of workers. Caltrans' managers and supervisors have the responsibility to implement, maintain, and enforce Caltrans' safety rules and policies.

Employees shall be provided with and shall wear personal protective equipment appropriate for the work being done. Before work starts, Safety Data Sheets (SDS) for any substances used shall be reviewed, and all crew members shall be made aware of any potential toxic hazards in the work. Pavement delineation equipment, including appropriate support equipment, shall be maintained, and operated in a manner that promotes reasonably safe practices, and does not pose

a hazard to other employees, the public, or the environment.

Thermoplastic material heated to excessive temperatures can flash and splatter when the material is drawn and exposed to air. Temperature gauges mounted on thermoplastic application equipment shall be checked at frequent intervals. Equipment found to have defective temperature gauges shall not be used until repaired.

While removing or applying pavement delineation, all traffic control and worker protection shall conform to Volume 1, Chapter 7 (Traffic Management) and Chapter 8 (Protection of Workers) of the Maintenance Manual.

M1.02.05 Layout

Layout refers to the process of placing reference marks on the pavement to be used as a guide for locating pavement delineation on the roadway surface.

Reference marks may also occasionally be located on curbs or sidewalks. In snow areas, saw cuts in the pavement can be used to identify the location of left turn lane pockets. Images of pavement delineation can also provide a valuable reference for replacement in kind.

Reference marks are a guide for placement of pavement delineation and are not to be used as temporary lane lines.

M1.02.06 Pavement Delineation on Resurfaced Areas

(A) Requirement for Replacement of Pavement Delineation

All lane line pavement delineation that has been covered must be replaced (permanent or temporary) at the end of each day's operation. The person in charge of the field operation is responsible to take proper action to assure the correct type of pavement delineation is placed within the required time frames.

(1) Permanent pavement delineation covered by Maintenance activities shall be replaced within two (2) weeks. In the interim, "short-term" delineation measures shall be used. Contact DTO or the Headquarters Maintenance Division for the latest instructions.

(2) Temporary lane lines shall be placed before leaving the job site if permanent delineation cannot be restored by the end of the work shift. Temporary markers, if used, shall conform to the specifications outlined in the Standard Specifications, Section 12-6 "Temporary Pavement Delineation." These markers are to be placed with no more than 24 feet on-center on curves and tangent.

On liquid asphalt concrete patches, a temporary day/night marker, secured by butyl adhesive to a 1-foot piece of temporary foil-backed tape, has proven capable of staying in place while the patch cures.

(B) Specific Instructions for Placement of Signs

(1) On two lane conventional highways where a no passing-zone lane line has been covered, a sign package consisting of a W20-1 ROAD WORK AHEAD and a R4-1 DO NOT PASS sign shall be posted within 1000 feet of the no passing zone. The R4-1 DO NOT PASS sign should be posted at 2,000 feet intervals throughout the extended no-passing zone. The R4-2 PASS WITH CARE sign should also be placed at the end of the zone.

(2) On seal coats more than two (2) miles in length, the instruction given above in (1) could be modified by posting a W20-1 ROAD WORK AHEAD sign at each end of the job, supplemented with a W7-3a NEXT XX MILES black on orange plate below the sign.

(3) Obliterated edge lines are not to be replaced with temporary dashes or retroreflective markers. When edge line delineation is required because of narrowing pavement or curvilinear alignment, portable delineators (guide markers) may be used to guide traffic.

(C) Delays in Placement of Permanent Pavement Delineation

It is understood that equipment breakdown, weather, or other problems may unavoidably delay placement of permanent pavement delineation. It is important the reason for the delay be documented and filed with the project files.

(D) Exceptions to the 2-Week Time Limit

Exceptions to the 2-week time limit to restore permanent delineation are as follows:

(1) Cure time of pavement before placing raised markers.

(2) Winter conditions where pavement delineation cannot be maintained due to rain snow, plowing, etc.

(3) Short patches that are less than 500 feet long on tangent alignment where the pavement is visible when entering the patch from either direction. This exception is intended for only single patches not placed in close proximity to another.

Under no circumstances shall a job site be left without at least temporary delineation and/or signs as noted above.

M1.02.07 Pavement Delineation Removal

The acceptable methods of removing pavement delineation are horizontal rotary grinding, sandblasting, and hydroblasting. When using these methods to remove pavement delineation, the entire pavement surface within the area of the pavement delineation shall be removed. Failure to remove the surface of the entire pavement delineation area can result in the former message being conveyed by the resulting scar on the pavement surface. Refer to the Standard Specifications, Section 84-9, “Existing Markings.”

Paint or asphalt emulsion shall not be used to cover pavement delineation except as a temporary measure until permanent repairs can be made. A general guideline for temporary delineation is six (6) months or less. Pavement that has been covered with paint or asphalt emulsion for more than six (6) months should be scheduled for permanent removal when workload allows. The crew supervisor, in consultation with the Superintendent, shall determine if permanent removal is more appropriate than a temporary cover of the pavement delineation when the IO is issued by DTO.

Raised markers are sometimes removed on small jobs using hand tools such as, pry bars, hammer and screwdriver, or chisel. Large removal projects can best be accomplished by utilizing a special attachment on a motor grader.

M1.02.08 Environmental Concerns

Districts will be responsible for monitoring and acting as independent agents in dealing with local air quality control districts. The California Environmental Protection Agency (CalEPA) may override local district rulings.

Residue of paint from color changes or cleaning tanks is to be handled as a hazardous waste.

Paint guns shall not be purged on shoulders. Each district should follow established procedures adopted in their area for picking up and disposing of these materials.

Current law provides that an individual employee may be held personally liable for penalties assessed for willful or negligent violations of these rules. Caltrans will take disciplinary action against employees who violate hazardous waste disposal laws, up to and including termination of employment.

M1.03 Types of Pavement Delineation

M1.03.01 Longitudinal Pavement Markings

(A) Longitudinal pavement markings serve the following specific traffic guidance functions:

(1) Single broken white line is used to delineate the edge of a traffic lane where traffic is permitted in the same direction on both sides of the line.

(2) Single broken yellow line is used to delineate the left edge of a traffic lane where overtaking with care is permissible for traffic in either direction of travel.

(3) Single solid white line is used to delineate the edge of a traffic lane where travel in the same direction is permitted on both sides of the line, but crossing the line is discouraged. It is also used to mark the right edge line.

(4) A wide solid white line is used for emphasis where crossing it requires extraordinary care. It is also used to delineate turnouts, left or right turn lanes, and bicycle lanes.

(5) Single solid yellow line delineates the left edge line of each roadway of divided streets or highways, one-way roadways, and ramps in the direction of travel.

(6) Double yellow line consisting of a single broken yellow line and a single solid yellow line delineates a separation between traffic lanes in opposite directions where overtaking with care is permissible for traffic adjacent to the broken line and is prohibited for traffic adjacent to the solid line.

This pattern is also used to delineate a two-way left turn lane in which the solid line is placed on the outside. Traffic adjacent to the solid line may cross this marking with care, only as part of a left turn or U-turn maneuver.

(7) Double line consisting of two (2) solid yellow lines delineates the separation between traffic lanes in opposite directions, where overtaking is prohibited in both directions. It is used as a channelizing line in both directions. It is frequently used as a channelizing line in advance of an obstruction that must be passed on the right. Black paint should be used between the yellow stripes to improve definition and maintain the interior gap during repainting.

(8) Dotted line may be used to delineate the extension of a line through an intersection or an interchange area. The dotted line shall be the same color of the line it extends.

DTO should be contacted for guidance related to longitudinal pavement markings.

M1.03.02 Pavement Markers

Pavement markers are available in various configurations and may be surface mounted (raised) or recessed. Markers can be retroreflective, temporary, or permanent, and can be installed using either epoxy or bitumen adhesives. All pavement markers used must be pre-approved by Headquarters Division of Traffic Operations and tested for compliance with specifications by the Office of Materials Engineering and Testing Services. The California standard is shown in the Standard Plans, plan sheets A20A through A20E. Refer to the link to the Standard Plans in Section M1.01.01 of this chapter.

The allowable ambient temperature range for pavement marker installation varies with the type of adhesive used. When using bitumen adhesive, it is important that adhesive temperature during application be between 375°F (190.6°C) and 425°F (218.3°C).

The use of epoxy adhesive requires that traffic control be maintained for protection of the marker until the final set of epoxy is placed. This may require as much as one (1) hour of cure time.

The 1 to 1 mixing proportion of epoxy components must be carefully controlled to achieve the best bond between the pavement surface and the bottom of the marker. Minor deviations can utterly increase marker loss.

Markers of approved colors may be placed by other agencies to identify locations of special facilities, such as, water sources for fire protection. Permits are required for such installations.

M1.03.03 Pedestrian Crossings

Attention is directed to the California MUTCD, Part 3 "Markings," provided in Section M1.01.01 of this chapter. Pedestrian crosswalk markings may be placed at intersections, defining and delineating paths of pedestrian crossing. Crosswalks and related pavement markings will be painted white or yellow depending on location. Crosswalk markings serve primarily to guide pedestrians into the proper paths.

Pedestrian crosswalk markings should not be used indiscriminately. Unwarranted crosswalks can be detrimental to pedestrian safety by providing a false sense of security.

Replacement by highway Maintenance personnel of crosswalks at intersections of local streets with State highways shall be confined to State highway surfaces. Where possible, this work should be delegated to local authorities under a cooperative Maintenance Agreement.

When markings are to be covered by resurfacing, the DTO should be requested to review the project for removal of markings that are no longer necessary or are redundant.

M1.03.03.01 School Area Pedestrian Crossings

Attention is directed to the California MUTCD, Part 7 "Traffic Control for School Areas," provided in Section M1.01.01 of this chapter. Pedestrian crosswalks and related pavement markings will be painted yellow, depending on the location of the school building or grounds with respect to the highway. In this regard, the California Vehicle Code Division 11, Chapter 2, Article 1, Section 21368, provides the following:

> Whenever a marked pedestrian crosswalk has been established in a roadway directly adjacent to a school building or the grounds thereof, it shall be painted or marked in yellow, as shall be all the marked pedestrian crosswalks at an intersection directly adjacent to a school building or school grounds.
>
> Other established marked pedestrian crosswalks may be painted or marked in yellow, if either (a) the nearest point of the crosswalk is not more than 600 feet from a school building or the grounds thereof or (b) the nearest point of the crosswalk is not more than 2,800 feet
>
> from a school building, or grounds thereof, there are no intervening crosswalks, other than those next to the school grounds, and it appears that the circumstances require special painting, or marking of the crosswalk, for the safety of persons attending the school.
>
> The following words shall be painted or marked in yellow on each side of the street in the lane or lanes leading to all yellow marked crosswalks: "SLOW–SCHOOL XING." Such words shall not be painted or marked in any lane leading to a crosswalk at an intersection controlled by stop signs, traffic signals or yield right-of-way signs. A crosswalk shall not be painted or marked yellow at any location other than as required or permitted by this section.

All school pavement delineation shall conform to the California MUTCD Part 7 "Traffic Control for School Areas." Sign installation should be coordinated with delineation placement.

M1.03.04 Parking Regulation Curb Markings

The California Vehicle Code Division 11, Chapter 2, Article 3, Section 21458 authorizes the use of paint on curbs to show parking regulations. The following colors shall be used as indicated.

Red	No stopping, standing, or parking.
Yellow	Loading.
White	Stopping for loading at specified times.
Green	Short time limit parking.
Blue	Indicates parking limited exclusively to the vehicles of persons with disabilities.

Painting and maintenance of curb markings to show parking regulations are the responsibility of the local agency. An exception occurs when curb markings have been installed at the request of the State to meet traffic operational and/or safety needs. This type of work should be delegated to local agencies by means of Maintenance Agreements.

M1.03.05 Limit Lines (Stop Bars)

Per California Vehicle Code, Division 1, Section 377, limit lines are solid white lines, normally 12 inches to 24 inches wide, extending across all approach lanes to indicate the point behind which vehicles are required to stop.

If a marked crosswalk is in place, it would generally function as a limit line. For added emphasis, a limit line may be placed 4 feet in advance and parallel to the crosswalk line nearest approaching traffic.

In the absence of a marked crosswalk, the limit line should be placed at the desired stopping point. This point is typically no more than 30 feet or less than 4 feet from the nearest edge of the intersecting roadway.

If a limit line is used in conjunction with a stop sign, it should ordinarily be placed in line with the stop sign. However, if the sign cannot be located exactly where vehicles are expected to stop, the limit line should be placed at the stopping point.

A limit line shall be placed on paved approaches to State highways, and a “STOP” pavement marking may be placed only if specifically requested by the DTO.

M1.03.06 Parking Stall Markings

The placement and maintenance of parking stalls is the responsibility of the local agency. An exception to the above practice may be made when a State highway resurfacing project covers existing parking lines. In this case, it is the responsibility of Caltrans to replace the parking markings. Parking stall markings shall be white. Refer to the California MUTCD, Part 3 “Markings,” for details of parking stall layout.

M1.03.07 Pavement Arrows

Primary use of pavement arrows are at freeway entrance and exit ramps, turn lanes, and lane reduction locations. Type of arrow and proper location can be found in the California MUTCD, Part 3 "Markings."

M1.03.08 Railroad and Light Rail Crossings

For railroad and light rail crossing information, attention is directed to the California MUTCD, Part 3 "Markings" and Part 8 "Traffic Control for Railroad and LRT Grade Crossings."

Pavement markings are to be placed and maintained at all railroad and light rail grade crossings on State highways, including spur tracks.

Railroad grade crossing pavement markings shall also be placed in each approach lane in advance of every light rail grade crossing where automatic gates or flashing lights are present.

M1.03.09 Miscellaneous Markings

Instructions for proper placement and stencil design for the following markings are found in the California MUTCD:

(A) Speed Enforcement by Aircraft

(B) High Occupancy Vehicle Lanes

(C) Bike Lane Markings

(D) Disabled Persons Parking Symbol

(E) Cattle Guard Crossings (Work on cattle guard crossings is to be reported to "C" Family, Slopes/Drainage/Vegetation).

M1.03.10 Roadside Markers

Roadside markers comprise the various permanent devices, excluding signs, used off the traveled way to guide the motorist and warn of restricted width and/or identify or mark locations along the highway. Instructions for use of roadside delineators, object markers, and channelizers are included in the California MUTCD, Part 3 "Markings."

Flexible delineators will generally be used for maintenance replacements unless the following conditions are met:

(A) Where it is necessary to attach snow poles to posts.

(B) In rocky areas, or hard ground, where steel posts have some advantage for installation.

(1) Consideration may be given to the possibility of using a two-part, metal base and flexible post system in these areas.

(C) In protected areas where posts are not exposed to traffic (such as behind guardrails and in front of structures).

(D) When there is a need to support post mile markers.

Decisions regarding locations on existing roads which warrant the use of flexible delineator posts shall be the responsibility of District Maintenance in consultation with DTO. Circumstances of weather, snow removal, difficulty of installation or other special needs will dictate when metal markers are required.

Any district-wide program to upgrade undamaged installations to provide uniformity of appearance is considered "improvement work" and cannot be done using Maintenance funds.

Replacement and salvage of guide markers in good condition is not generally cost effective. An exception may be considered where, after knocked down markers have been replaced, the remaining metal guide markers in good condition on a particular ramp or curve represent 25 percent or less of the total number of delineator posts. In this case, replacement of the remaining metal markers for the sake of uniform delineation treatment may be considered.

Markers should be installed only when determined necessary. However, except for culvert markers and clean out markers used by Maintenance, all markers on the system should be maintained unless directed otherwise by the DTO.

Delineators

Attention is directed to Standard Plan A73C and California MUTCD Figure 3F-1, Figure 3F-101(CA), Figure 3F-102(CA), and Figure 3F-105(CA). The purpose of delineators is to indicate the roadway alignment and accent critical locations. Delineators should not be used for other purposes. The practice of using them to mark drainage structures, pull boxes, underground utilities, etc. should be discontinued.

All delineators shall be retroreflectorized. Retroreflective sheeting shall have a minimum dimension of 3 inches in width and 12 inches in height.

Uniformity of type, color, and positioning of reflectors to delineate the roadway is essential. All proposed deviations from the patterns shown in the California MUTCD should be approved by DTO.

The overall line of delineators should parallel the roadway centerline as closely as possible. When possible, delineators should be placed 2 feet outside the edge of the usable shoulder, but not more than 12 feet from the pavement edge. In curbed sections, the markers will be placed 2 feet outside the face of the curb.

Clearance Markers

Attention is directed to Standard Plan A73B. Clearance markers are used to indicate obstructions or restrictions in width to the right of traffic, including bridge and culvert rails. They should be placed for all major obstructions in the plane of the roadway and within 4 feet of the shoulder

edge. On divided highways, clearance markers are also used to the left of traffic for the same purpose. All clearance markers are retroreflectorized for night visibility.

Clearance marker posts are placed on a line with the edge of the obstruction nearest to the pavement. When placed in conjunction with guardrail on bridge approaches, the clearance markers are located immediately behind the guardrail and at sufficient height to make all reflectors visible to approaching traffic).

Culvert Markers

Attention is directed to the California MUTCD Section 3F.101 (CA), "Culvert Markers." Culvert markers are placed as a convenience to Maintenance crews in marking locations of culvert openings. Such marking may be necessary to protect culvert ends from damage from adjacent operations, and to serve as an aid in locating culverts during storm conditions.

Most culverts can be located without the use of markers. In such cases, and if protection is not needed, markers need not be used. When culverts are difficult to locate, markers may be placed on each side of the roadbed, above the culvert. They may be placed either outside or in line with a series of markers.

Culvert markers shall not be retroreflectorized except where the marker is completely off the traveled way and locating the culvert could be a problem during hours of darkness. Attention should be given to ensure the culvert marker is not placed where it could be mistaken for a roadway delineator.

Culvert markers are not part of the post mile system for identifying locations, and post mile markings (route - county - post mile) are not to be stenciled on replacement culvert markers. If needed for Maintenance identification of a particular culvert, crews should stencil only the numerical value of the post mile (not route and county) on new or replacement markers.

Removal of excess culvert markers may be performed at any time as part of routine Maintenance operations. Revision of existing markers to eliminate retroreflectorization and post mile markings, should be performed whenever the marker requires replacement for other purposes.

Emergency Crossover Markers

Attention is directed to California MUTCD, Section 3F.102 (CA), "Emergency Passageway Marker." Markings for abandoned or obliterated crossovers should be removed.

Use of fencing and/or gates at crossover locations to prevent unauthorized use is strongly discouraged, except when warranted by circumstances. Acceptable locations for the establishment of gated crossovers may be used for incident management detours or snow removal operations.

Post Mile Markers

Attention is directed to Standard Plan A73B for Highway Post Marker. The post mile marker is an integral part of the post mile system, and is used by traffic officers, Maintenance personnel, and others to locate specific incidents or features on the roadway with respect to the post mile

system. Post mile markers should not be used for additional marker functions, and other type markers should not be used as post mile markers. The post mile marker shall indicate the route, county, and post mile of the installation. Only post mile markers shall contain the route and county designation.

The lettering size shall be 2½ inch letters for county, route, and post mile fraction (hundredths). The post mile numerals shall be 4-inches in height.

Post mile markers shall not be retroreflectorized. When installed behind guardrail, the marker should be placed so that the entire legend is readable from the road.

Stenciling of the post mile on concrete median barriers is permissible in addition to, but not in place of, the regular post mile markers located along the outer shoulder. This is an additional aid for Maintenance and accident investigation forces.

DTO shall have the responsibility of verifying the accuracy of the placement of post mile markers. All post mile markers should be located to an accuracy of 50 feet (0.01 mile) on the ground. The value shown on the marker shall be to the nearest 0.01 of a mile and shall reflect the mile point of the centerline opposite the marker location. If any are found to be more than plus/minus 0.01 mile from the intended location, they must be relocated.

Periodic field review and inspection should be conducted by field Maintenance to locate damaged or illegible markers. Reports of incorrect post mile markers may originate from various sources.

The DTO and the Roadway Records unit of Headquarters Division of Traffic Operations must agree as to which field markers are to be corrected and which accident records are to be relocated before any action is initiated. Care must be taken in replacing damaged markers to assure the new markers are installed in the same places as the old markers.

Miscellaneous Markers

Roadside markers are sometimes used to mark the location of pull boxes, survey monuments, water line crossings, etc. Where such items are readily visible, or can be found easily, marker posts should not be installed. These markers shall not be retroreflectorized. When placed adjacent to the shoulder, the markers should face approaching traffic.

M1.03.11 Materials

All pavement delineation materials used to guide or control vehicular and pedestrian traffic on the State Highway System shall be approved by the Division of Engineering Services, Office of Materials Engineering and Testing Services. Test sections of new materials may be placed with concurrence of Headquarters Division of Traffic Operations.

M1.03.11.01 Traffic Paint

For the paint type and color for traffic stripes and pavement markings, refer to Section 84-2.02C of the Standard Specifications.

Traffic paint is available in bulk containers called “totes” (approximately 345 gallons), 55-gallon barrels, and 5-gallon buckets.

Waterborne paint should not be stored where it may be exposed to repetitive freeze/thaw cycling.

Waterborne paint shall be applied at a thickness of 15 millimeters.

High build paint shall be applied at a thickness of 25-30 millimeters.

When water-borne traffic paint is used, two (2) coats of paint are not required, except on chip seals.

For chip seals, one (1) coat of paint shall be applied in each direction of travel. Both coats shall be beaded. Care should be exercised that recommended application rates for water-borne paint are not exceeded. Applying water-borne paint too heavily will cause the paint to chip. Refer to Section 84, subsection 84-2.03C(3) of the Standard Specifications for pavement Marking and Paint application rate.

Deviations from recommended application rates may become necessary to accommodate local conditions, such as, tracking, temperature, etc. Decisions to adjust application rates should be based on the supervisor’s knowledge of local conditions, experience, and best judgment.

To achieve maximum service life from the painted traffic stripe, striping operations should normally be conducted during a period of favorable weather conditions. Water-borne paint should not be applied when the ambient temperature is below 50°F (10°C) or when relative humidity exceeds 75 percent. Refer to Section 84-2.03C(1) of the Standard Specifications for guidance on application of Stripes and Marking.

M1.03.11.02 Hot Melt Thermoplastic

Thermoplastic materials are the preferred pavement delineation and marking materials for all areas that are not regularly plowed for snow or mud, and the pavement is in good condition.

Thermoplastic is supplied in two generic types, depending on the type of base resin used. The two types, hydrocarbon and alkyd, are not compatible in the application equipment and must never be mixed. Although alkyd and hydrocarbon materials will fuse to one another on the road, they are incompatible in a melting kettle. Failure to completely clean out kettles during material changeover may cause severe equipment troubles.

Both types of thermoplastics are available in granular form for spray, ribbon, or extruded application. Thermoplastic is a dry blended mixture of resins, pigments, fillers, and glass beads packaged in a meltable plastic bag.

Thermoplastic for traffic stripe is available in white or yellow.

Thickness of thermoplastic may be reduced to achieve a better cost effectiveness when used on pavement surfaces having a short life expectancy. The recommended minimum application rate of extruded thermoplastic is –80 - 90 mils.

M1.03.11.03 Cold Pre-Formed Plastic Tape

Plastic tape comes as a complete stripe or pavement marking legend ready to be applied to the road. It may be surface applied, recessed, or rolled into the pavement on new asphalt paving projects.

This material may be considered for locations where use of tape may be cost effective compared to other alternatives. Cold weather application of tape is generally not recommended, and pavement temperatures should be at least 50°F (10°C). Manufacturer's instructions for allowable temperature ranges should be followed.

M1.03.11.04 Recessed Delineation Materials

Grinding slots in the pavement and placing recessed markers and/or thermoplastic material in the slots, has greatly extended the life of pavement delineation in some areas. Materials installed in the recessed areas include retroreflective pavement markers and thermoplastic, tape, or Methyl Methacrylate (MMA). Typical areas selected for this type of installation include highways with high weave/heavy traffic and snow removal conditions.

M1.03.11.05 Surface Preparation

(A) Painting

A mechanical sweeper may be used prior to paint application to remove debris from road surface. This operation may or may not be necessary, depending on the amount of dirt/debris on the roadway surface. On new Portland Concrete Cement (PCC), mechanical wire brush or abrasive blasting must be used to remove curing seal and

other foreign material. Use of an air line (duster) mounted in front of the paint guns on the striper has proven successful in removal of dust.

Attention must be given not to use too much air and overwork the compressor. It is an unacceptable waste of Maintenance resources to place paint or other delineation materials, on areas where dirt, debris, or weeds prevent adherence of such materials to the roadway surface.

(B) Placing Pavement Markers

Both PCC and asphalt concrete (AC) road surfaces should be clean and dry before application of adhesive. This is especially important on new PCC pavements. The contact area for markers placed over existing paint must be either abrasive blasted, or the paint must be well worn, to achieve a satisfactory bond. Pavement delineation materials shall not be applied in wet weather.

M1.04 Condition Measurement and Inventory

M1.04.01 General

Pavement delineation (including longitudinal line, transverse line, crosswalk, arrow, etc.) conditions are measured as per Volume 2, Chapter 9 "IMMS Asset Inventory" of the Maintenance Manual.

Caltrans currently has a service contract that inspects all longitudinal delineation with the exception of ramps, connectors, and crosswalks on the State Highway System (SHS). A formal night inspection of all pavement delineation on ramps, connectors, and crosswalks shall be completed once per year between April 1st and May 31st. Each inspection record shall use the Highway Facilities Night Inspection form (MTC-0108) available on the Caltrans Electronic Forms System (CEFS). Alternatively, contact the Headquarters Division of Maintenance for a copy of the form.

The completed MTC-0108 forms shall be stored at the District Office and readily available to be sent electronically to the Headquarters Division of Maintenance upon request.

At the district level, the records should be kept on file for a minimum of three (3) years.

If the service contract is not in place, a formal night inspection of all pavement delineation including crosswalks and markers shall be completed.

Routine or informal delineation inspections are performed on an "as-needed" basis, or under the general guideline of twice a year. Informal delineation inspections are not reported to the Headquarters Division of Maintenance.

M1.04.02 Asset Condition

Asset condition is a rating system applied to different distresses and needs to help best assess current status in meeting promised goals, funding needs, and priorities set forth in the State Highway System Management Plan. Its primary use is for allocating Major Maintenance (HM) funds for engineering and construction projects. Asset condition can also be used for establishing needs and allocating resources in the absence of or to support LOS.

Asset conditions are typically categorized into three basic categories (good, fair, and poor) as shown in the table below. In some cases, these categories could be further subdivided into additional categories, or different categories may be used for management and funding purposes. For Maintenance forces, these conditions provide general guidance as to the level and extent of maintenance needs.

Condition	Description	Typical Maintenance Activity
Good	Pavement marking shows no apparent damage.	No repairs needed.
Fair	Typical wear and/or discoloration to the pavement marking, the marking still visible with slight damage.	Minor repairs needed to return to good working condition.
Poor	Pavement markings are not providing adequate presence.	Significant distress requiring rehabilitation, reconstruction, or replacement to return to good working condition.

M1.05 Identifying Distresses and Maintenance Needs

M1.05.01 General

The following summaries of common distresses provide an overview of typical examples of pavement delineation related distresses and expected maintenance. The Maintenance Supervisor should periodically review this information with staff to make all are aware of what distresses to search for.

M1.05.02 Pavement Delineation Distresses

(A) Description

(1) Pavement Stripes and Markings

Pavement stripes and markings should be renewed when, in the judgment of the Supervisor or DTO, they have lost their effectiveness. The assigned Supervisor shall have the primary responsibility for identifying needed pavement marking renewals. All employees, however, should be instructed to report observed locations where pavement marking may need to be refreshed or renewed.

(2) Missing or Ineffective Pavement Delineation

Missing or ineffective pavement delineation that significantly affects configuration of the line should be considered for replacement. Whenever possible, replacement should be scheduled in conjunction with other Maintenance operations to minimize disruptions to traffic.

(3) Inspection

A formal night inspection of all pavement delineation including pedestrian crosswalks (pending Management approval) condition shall be completed once per year between April 1st and May 31st. Results of the pavement delineation condition inspection shall be recorded and utilized to develop the work plan. Date of inspection and scheduled restoration shall be included in the records. Factors that need to be considered include workloads and weather.

The purpose of the formal night delineation inspection is to help Caltrans prioritize and schedule future workload and replacement needs.

The Supervisor of the striping crew or the Special Crews Superintendent shall have the primary responsibility for detecting and reporting delineation in need of refreshing. However, all Caltrans Maintenance employees should be instructed to report damaged, non-performing, or obliterated delineation and markers whenever noted.

DTO may also aid in determining the adequacy of pavement delineation and markers.

Good Fair Poor



Good Fair Poor

(B) Causes

(1) Retroreflectivity degrades over time making pavement markings less visible at night.
(2) Environment conditions such as ultraviolet sunlight, moisture, and pollutants cause deterioration in retroreflective performance.
(3) Reduction in retroreflectivity can occur due to traffic, roadway debris, and snowplowing activities.
(4) Improper initial installation practices of pavement markings.

(C) Measured By

A formal night inspection of all pavement delineation and crosswalks markings shall be completed once per year between April 1st and May 31st. Each inspection record shall use the Highway Facilities Night Inspection form (MTC-0108) available on the Caltrans Electronic Forms system (CEFS) or contact Headquarters Division of Maintenance for a copy of the form. The completed MTC-0108 forms shall be delivered electronically to the Headquarters Division of Maintenance by June 30th annually.

At the district level, the completed MTC-0108 forms should be kept on file for a minimum of three (3) years.

Routine or informal delineation inspections are performed on an "as-needed" basis, or under the general guideline of twice a year. Informal delineation inspections are not reported to the Headquarters Division of Maintenance.

The Night Inspection report for delineation and markers needing restoration/replacement must be completed accurately to assure that appropriate corrective action will be taken. Budgeting, staffing, and work scheduling are typical uses of reported data.

The following are Best Practice Guidelines for performing delineation inspections at night:

(1) Inspection vehicle headlamps must be properly adjusted. Headlamps should be in the low-beam position for night inspections.

(2) Inspections should not be completed during inclement weather, or when water, debris, or dirt obscures the markings. These conditions may affect the outcome of the inspection and may contribute to a negative rating of the performance. These conditions are difficult for properly performing delineation and marker inspections. An inaccurate delineation review may cause Caltrans to use resources unnecessarily.

(3) Conduct inspections safely. Try to blend with the flow of traffic. If it is absolutely necessary to slow or stop on the shoulder close to the traveled way, use a flashing light, amber rotating light, or light bar. A hard hat and reflective vest shall be worn if the inspector leaves the inspection vehicle. Please refer to the current Code of Safe Operating Practices (CSOP), provided in Section M1.01.01 of this chapter, for required and suggested personal safety equipment for night work.

(4) The inspection team shall consist of a minimum of two (2) employees. One member of the team should be from the district's striping crew. Other potential team members are personnel from the raised pavement markers crews or local maintenance crews. DTO employees should also be invited to participate in these annual reviews.

(5) It is necessary that at least one team member have good color vision for evaluating delineation colors.

(6) Delineation should be observed at the "distance of driver need." This distance varies depending on factors such as posted speed and roadway alignment. However, for the average highway, observers should focus attention on delineation and markers at about 250 feet ahead of the vehicle. For city streets, where posted speeds are generally lower, delineation observations may be made closer to the vehicle.

(7) The inspection vehicle should ordinarily be driven in the outside lane of multilane highways. This is generally the safest path of travel for the night inspection team.

(8) The adequacy of retroreflectivity is not based on specific levels of brightness. Rather, it is based on the best judgment of the night inspection team to determine whether reflectivity is Good, Fair or Poor. Typical questions to consider when making decisions regarding delineation adequacy are:

a. Is the geometry of the Roadway making it difficult to see the pavement markers or delineation?

b. Is the appropriate type of material used at location?

(9) All pedestrian crosswalk markings on State Highway System shall be inspected.

(D) Goals

Maintain the minimum retained retroreflectivity level of 100 mcd/m2/ls for all traffic striping and pavement marking material for use on the State Highway System.

(E) Actions

When needed, the existing pavement delineation pattern shall be replaced with the identical delineation pattern. There shall be no deviation from the standards illustrated or written in the California MUTCD, and no traffic stripe or raised markers shall be placed except at locations indicated in the California MUTCD without direction from District Traffic Operations. Installation Orders, provided by District Traffic Operations, for placement of new or modified delineation shall show the location and type on a print, authorized by Deputy District Director, Traffic Operations. Questions regarding Installation Orders should be directed to District Traffic Operations. It is acceptable to substitute materials different from the original material being replaced, such as thermoplastic instead of water-borne paint, or thermoplastic in place of raised pavement markers. The substitute material shall follow the standards as outlined in this chapter.

M1.06 Condition Goals and Expectations

M1.06.01 Goals

The proper maintenance of traffic control devices is important in maximizing safety and efficiency for the users of the State Highway System. Caltrans Division of Maintenance has established a system performance goal to maintain a statewide level of service score of 90, or greater, for traffic control devices. As outlined in the Maintenance Program Strategic Plan (2022-2027), provided in Section M1.01.01 of this chapter, the Division of Maintenance priorities focus on safety, people, stewardship, and equity.

M1.07 Non-Motorized Travelers on State Highways

M1.07.01 Pedestrians and Bicyclists

It is recommended that crosswalk markings be properly maintained.

Advance notification and adequate access shall be provided when maintenance work affects the movement of pedestrians and bicyclists. If the temporary traffic control zone affects an accessible and detectable pedestrian facility, the accessibility and detectability shall be maintained along the alternate pedestrian route.

APPENDIX M1

Pavement Delineation

Fact Sheets

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<table>
<tr><th colspan="2">Pavement Markings</th></tr>
<tr><th>Example</th><th>Features</th></tr>
<tr><td rowspan="2"> 
Pavement Marking Faded</td><td>1. Replace existing pavement markings with retroreflective thermoplastic or water-borne paint.

2. Pavement marking, and delineation must meet the minimum retroreflectivity retention threshold per policy.</td></tr>
<tr><td>General Maintenance Notes
• Replace existing pavement delineation pattern with the identical delineation pattern. There shall be no deviation from the standards illustrated or written in the California MUTCD, and no traffic stripe or raised markers shall be placed except at locations indicated in the California MUTCD without direction from District Traffic Operations.

• Review current policy on minimum retroreflectivity requirement.

• Refer to the California MUTCD and Standard Plans for pavement markings and delineation.</td></tr>
</table>

Pavement Markings - continued			
Condition	**Example**	**Description**	**Maintenance Actions**
Good		• Pavement marking shows no apparent damage.	• No maintenance needed. • Conduct routine daylight hour and night visible inspection for daytime and nighttime conditions.
Fair		• Typical wear and/or discoloration to the pavement marking, the marking still visible with slight damage.	• Notify striping crew. • Minor repairs needed to return to good working condition. • Existing pavement delineation pattern shall be replaced with the identical delineation pattern.
Poor		• Pavement marking does not provide adequate presence.	• Report into IMMS • Initiate service request • Placement of new or modified delineation must come from District Traffic Operations showing the location and type on a print.