

CALIFORNIA DEPARTMENT OF TRANSPORTATION



Procedure for Evaluation and Authorization of Signing and Delineation Materials



Revised May 18, 2026

Foreword

California's transportation network is undergoing a profound evolution, driven by rapid advancements in material science, shifting industry standards, and an unwavering commitment to multimodal traffic safety. As we modernize our roadways to better protect motorists, cyclists, and pedestrians alike, the signing and delineation materials we deploy must meet the highest benchmarks of durability, visibility, and performance. This guide is being updated to establish a thorough, transparent, and standardized pathway for integrating traffic control technologies into the State Highway System. Historically, evaluating new materials has presented unique challenges, balancing the urgent need for field innovation with the strict imperative of regulatory consistency and public safety. This updated edition addresses those challenges head-on by formalizing technical evaluation protocols, defining clear compliance pathways, and streamlining coordination between manufacturers and the California Department of Transportation (hereinafter referred to as the Department or Caltrans).

The primary mechanism for this oversight is the Authorized Material List (AML) of "Prequalified and Tested Signing and Delineation Materials," maintained by the Division of Road Safety. The scope of this AML covers traffic control devices and materials regulated by the California Manual on Uniform Traffic Control Devices (CA MUTCD), including signing materials, retroreflective sheeting, pavement markers, traffic striping, pavement marking tape, delineators, channelizers, and object markers. Ensuring the engineering integrity of the AML requires a robust, cross-functional collaboration across multiple technical disciplines. The Cross-Functional Materials Review Team, composed of members from various Caltrans divisions and offices, including the Division of Maintenance, the Office of Employee Health and Safety, reviews new submittals to evaluate departmental need and provides critical recommendations to the Division of Road Safety.

To maximize administrative and technical efficiency, this update procedure transitions the Department toward a national standardization model that explicitly prioritizes verified durability, laboratory testing, and long-term field performance data from the AASHTO Product Evaluation & Audit Solutions program. Caltrans is integrating the AASHTO DataMine repository. Manufacturers seeking listing and reauthorization on the Caltrans AML are expected to actively leverage this national repository to satisfy baseline evaluation parameters.

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Scope and Submittal Types

This manual establishes the protocol for the technical evaluation of signing and delineation materials. Depending on the nature of the product and its current status, submittals fall into one of the following paths:

I. Products within established AML (Approved Material List) categories

This path is for items that comply with requirements specified in the Caltrans Standard Specifications and Standard Plans.

This path is further divided into two sub-paths:

I.I New Product Submittal for products not currently listed, but seeking initial authorization based on the criteria outlined in the sections below.

I.II Re-evaluation/Reauthorization for products currently on the AML that require periodic re-validation to ensure compliance with the latest Standards and Specifications, which may have been revised since the product's most recent approval.

II. New Technology and Non-AML Categories.

This path is for innovative traffic control devices, pavement treatments, or other roadway safety features that do not fall under any of the current AML categories. These materials may incorporate innovative technologies, alternative compositions, or new installation methods.

General Provisions and Resources

Latest Edition Policy:

All references to named documents and standards in this guide, such as the California Manual on Uniform Traffic Control Devices (CA MUTCD), Caltrans Standard Specifications, etc., refer to the latest version available at the time of use. The Reference to a specific version or year has been intentionally omitted to ensure the user refers to the most recent and up-to-date publication, including all current amendments and updates.

Supplemental Resources:

Caltrans Construction Contract Standards

<https://dot.ca.gov/programs/design/ccs-standard-plans-and-standard-specifications>

Authorized Materials List (AML)

<https://dot.ca.gov/programs/engineering-services/authorized-materials-lists>

California Manual on Uniform Traffic Control Devices (CA MUTCD)

<https://dot.ca.gov/programs/safety-programs/camutcd>

AASHTO – Product Evaluation & Audit Solutions – DataMine

<https://transportation.org/product-evaluation-and-audit-solutions/>

Caltrans – Division of Road Safety

<http://safetyprograms.onramp.dot.ca.gov>

Contractor's Corner (Awarded Contracts) Database

https://ppmoe.dot.ca.gov/cc?id=cc_awarded&contract=10&bid_month=01&bid_year=2026&sort_by=award_date&sort_order=desc

The Division of Road Safety's contact for general information regarding this AML:

HQ.OSSD.Support@dot.ca.gov

Office of Safety Systems and Devices, Traffic Safety Engineering Branch

General Submittal and Review Process

All applicants must follow the standard submittal, testing, and review procedures outlined in this manual. These general requirements apply to all product categories, in addition to the category-specific criteria listed in later sections. The Department reserves the right to request supplemental data to verify compliance.

It is important to note that manufacturers must comply with both the general requirements provided in this section as well as the category-specific requirements outlined in the AML Evaluation Criteria and Reference section. The AML Evaluation Criteria and Reference section serves as the primary link to the Caltrans Standard Specifications, Standard Plans, and other applicable manuals that define the engineering benchmarks for the AML. Prior to submittal, manufacturers are responsible for evaluating their products against these specific standards to ensure all technical characteristics align with the regulatory requirements and material specifications.

Note: Material submittals under any evaluation path must include a Quality Control (QC) Data Package from the manufacturer or vendor to validate the material's quality, accuracy, precision, and consistency. If independent, third-party laboratory test reports are submitted, they must accompany the manufacturer's QC summary. Testing shall be performed by an independent laboratory accredited to ISO/IEC 17025, with the specified ASTM test methods explicitly included in its official Scope of Accreditation.

Once all documentation has been submitted and the initial assessment is completed, the technical review engineer may contact the manufacturer to request samples for physical inspection and/or additional supporting documentation.

1. New AML product submittal package must include:

- **Authorized Material List Submittal Form TL-9502** (Completed and signed).
- **Technical Data Sheet** (Completed per Appendix B checklist).
- **Safety Data Sheet** (Required for all hazardous chemicals per Cal/OSHA; not required for "Articles").
- **Manufacturer's installation/application instructions.**
- **AASHTO DataMine product evaluation report** (formerly National Transportation Product Evaluation Program [NTPEP]) covering a minimum of one-year period, unless alternative criteria are specified in the AML Evaluation Criteria and References section.
- **Accredited laboratory test results** verifying compliance with specific ASTM standards and demonstrating that the product meets all established

performance acceptance criteria, if specified in the AML Evaluation Criteria and References section.

- **Build America, Buy America (BABA) certification**, provided via a formal signed letter on the manufacturer's letterhead, as applicable.

Note: Review the Criteria and References section before submittal to confirm that your product meets all necessary standards and to verify compliance with the required Caltrans Laboratory testing protocols.

2. Reauthorization product submittal package must include:

- **Authorized Material List Submittal Form TL-9502** (Completed and signed).
- **Technical Data Sheet** (Completed per Appendix B checklist).
- **Safety Data Sheet** (Required for all hazardous chemicals per Cal/OSHA; not required for "Articles").
- **AASHTO DataMine product evaluation report** (formerly NTPEP) covering a minimum of 3 (three) years, unless alternative criteria are specified in the AML Evaluation Criteria and References section.
- **Formal statement on the company letterhead** stating whether any changes have been made or have not been made to the material composition or manufacturing process since the original approval. If changes have occurred, the manufacturer must provide a letter indicating the changes, any changes to the Safety Data Sheet, and confirmation that the product still performs similarly as before.

Note: Before submittal, the manufacturer must review the Criteria and References section to ensure compliance with current standards; any updates to federal or state regulations, such as BABA or Caltrans Standard Specifications, may require supplemental documentation.

3. The New Technology and Non-AML Categories package should include the following items at a minimum:

- **New Product Evaluation Submittal Form TL-9501** (Completed and signed).
- **Technical Data Sheet** (Completed per Appendix B checklist).
- **Safety Data Sheet** (Required for all hazardous chemicals per Cal/OSHA; not required for "Articles").
- **Accredited laboratory test results** that demonstrate the product's performance, durability, and compliance with relevant industry consensus standards.
- **Build America, Buy America (BABA) certification**, provided via a formally signed letter on the manufacturer's letterhead, as applicable.

Note: Additional documents may be requested as needed.

Before submittal, the manufacturers or vendors must thoroughly evaluate the Caltrans Standard Specifications, Standard Plans, and applicable manuals (e.g., CA MUTCD) to verify baseline compliance. If a product does not fall under a currently established AML category, the submittal must explicitly demonstrate alignment with a recognized application standard or regulatory framework within these documents. Submittals for products lacking an established specification, standard, or authorized use case will be deemed non-responsive and rejected without evaluation.

4. Safety Data Sheet (SDS) requirements.

An **SDS is required** for all “hazardous chemicals” as defined by OSHA, including liquid-applied materials (paints, resins, adhesives), thermoplastic compounds, or any material that could release hazardous chemicals during normal use or foreseeable emergencies.

To maintain compliance with California Code of Regulations Title 8, §5195 (Hazard Communication Standard), and other applicable laws and regulations, the Department requires a comprehensive SDS that adheres to all Cal/OSHA requirements. See the **SDS checklist** in **Appendix A**.

Special attention must be drawn to the following frequently overlooked compliance items to ensure that the submitted SDS meets all California regulatory and safety criteria listed below:

- California Proposition 65
- Cal/OSHA Exposure Limits
- Emergency Contact Information
- Hazards must match the product labels and the GHS pictogram provided
- All data fields must be populated; any field where information is unknown should be explicitly marked as “not available.”

An **SDS is not required** for products that meet the OSHA definition of an “Article.” An article is a manufactured item which is formed to a specific shape or design during manufacture, has end-use function(s) dependent in whole or in part upon its shape or design, and under normal conditions of use, does not release more than very small quantities (e.g., minute or trace amounts) of a hazardous chemical and does not pose a physical hazard or health risk to employees.

5. Processing and Evaluation

All submittal packages must be sent electronically to new.products@dot.ca.gov. Digital submission is required to initiate tracking and ensure the Department accurately monitors the established review period.

The Department strives to complete evaluations in a timely manner; however, review periods vary significantly based on the complexity of the material and the type of submittal.

- **For products currently listed in the AML** that are undergoing periodic re-evaluation, the Department will complete the administrative review, technical review, and performance data verification within 30 days, resulting in approval, rejection, or a formal request for additional information issued to the manufacturer.
- **For new products seeking entry into the existing AML category**, the Department will complete the administrative review, technical review, and evaluation within 90 days, resulting in approval, rejection, or a formal request for additional information issued to the manufacturer.
- **For new technology and non-AML Category** products that conform to CA MUTCD standards but lack an established Caltrans Standard Specifications or AML classification, the Department will complete an initial technical scoping review within 90 days of receipt, resulting in a rejection, a request for additional information, or a mandate for a pilot project. Due to the operational scope of real-world field testing, the total timeline for this process can take a year or more, depending on the complexity and the depth of data required to ensure public safety.

Note: Submittal packages that remain incomplete (missing or incomplete forms, data sheets, test reports, etc.) will not be considered and will be discarded.

Following the evaluation, the Department will formally notify the manufacturer of the findings. Approved materials will be added to the AML upon resolution of any technical discrepancies.

Product Lifecycle and Conditional Material Authorization Requirements

1. Background

AML serves as the expedited pathway for project delivery on the State Highway System (SHS). In accordance with the Caltrans Standard Specifications, “authorized” materials are those that the Department has pre-evaluated and determined to be compliant with quality and safety standards. This preapproval is critical because it shifts the technical validation process from the active construction site to a controlled laboratory environment. By verifying a product's chemical and physical properties before it ever reaches the job site, the Department ensures consistent performance and maintains the rigorous oversight required for state and federally funded infrastructure.

Under the Caltrans Standard Specifications, certain products must be on the AML before they can be used or deployed. But the list is dynamic in that, firstly, its records require periodic revision, and secondly, manufacturers are responsible for submitting their products for evaluation to be listed on the AML. A listing may expire if not re-evaluated in a timely manner.

Furthermore, as technology advances, alternative materials may deviate from the Standard Specification while offering superior performance. There is a need for collaboration between resident engineers (REs), district safety engineers, and product developers to better identify projects that would suit the various products under review and to engage REs in piloting those products on their projects.

2. Suspended AML Products

If an AML product does not undergo the required periodic reevaluation by its specified deadline, the product listing will be suspended. Manufacturers are responsible for maintaining timely compliance; if a manufacturer fails to submit the product for review or submits the package that fails to satisfy the requirements within three (3) months of the initial suspension date, the product listing will be permanently deleted from the AML.

If a contractor or manufacturer subsequently submits Notice of Materials to Be Used for a product that is currently suspended or was previously removed from the list, the submittal cannot be processed as a routine update. Instead, the applicant must provide all required technical documentation and testing data as required for a new AML product submittal.

3. Pilot Projects

A pilot project applies to products, materials, or treatment that comply with the CA MUTC but are not currently covered by the Caltrans Standard Specification or listed on the AML. Pilot projects are categorized into two distinct evaluation pathways based on whether the primary objective is evaluating a new operational strategy/geometric configuration or assessing physical material durability:

Type I: System-Level/Operational Pilot Projects (Decision Document is Required)

- Applies to complex, multi-component systems, geometric configurations, or operational strategies that fundamentally alter traffic patterns.
- Primary focus on operational functionality, systemic safety, and driver behavior.
- Required a formal **Decision Document** prepared under the direction of and stamped by a registered Civil Engineer (PE). The document establishes the trial evaluation window (typically 2 to 5 years), operational

geometry, and success metrics, and must be officially signed by the District Director and two Deputy District Directors prior to implementation.

Example: Constructing a modular plastic roundabout.

Type II: Component-Level/Material Pilot Projects (NSSP may require)

- Applies to individual materials, proprietary products, or alternative material formulations seeking placement on the AML or requiring a Standard Specification amendment where the underlying operational application is already an approved countermeasure.
- Primary focus is on physical performance under traffic and environmental wear (e.g., durability, adhesion, impact resistance, retroreflectivity).
- Authorization may require a Non-Standard Special Provision (NSSP)

Examples: A hot-applied thermoplastic bonding agent used for permanent installation of raised pavement markers (RPMs), polymeric traffic control stripes applied in a transverse pattern for speed reduction, or new bikeway separation post design.

If a product is granted conditional approval, "A pilot project is required," manufacturers are encouraged to identify suitable test locations by coordinating with district safety engineers, REs, and prime contractors. Tools such as the Contractor's Corner database may help identify potential projects. This evaluation typically occurs under a zero-dollar agreement, with the manufacturer providing materials and technical support at no cost to the Department.

AML Evaluation Criteria and References

1. Pavement Markers

RETROREFLECTIVE WITH ABRASION-RESISTANT SURFACE (ARS)

RETROREFLECTIVE WITH ARS FOR RECESSED APPLICATIONS

References

- Caltrans Standard Specifications, Section 81-3
- Caltrans Standard Plans, A20A through A20G, and A24G
- CA MUTCD, Chapter 3B
- ASTM D4280 Standard Specification for Extended Life Nonplowable Raised Retroreflective Pavement Markers

Performance Acceptance Criteria

AASHTO Test Deck Data:

- Compressive Strength: Minimum 6,000 lb.
- A minimum 90% Functional Retention Rate is required (or a maximum 10% failure rate combined from ratings 0 and 1 per AASHTO Test Deck Data) independently on both Hot Mix Asphalt (HMA) and Portland Cement Concrete (PCC) test decks.
- Abrasion Resistance: Minimum 50% retention of the initial coefficient of luminous intensity at 0° incidence angle after abrasion testing.
- Temperature Cycling: No cracking or delamination after exposure
- Initial Retroreflectivity (Minimum mcd/lx at 0.2° observation angle):
 - 0° Incidence Angle: White $\geq 1,064$; Yellow ≥ 470 ; Red ≥ 197
 - $\pm 20^\circ$ Incidence Angle: White ≥ 867 ; Yellow ≥ 259 ; Red ≥ 105 .
- Retained Retroreflectivity (Minimum mcd/lx at 0° Incidence Angle after 1 year in service): White ≥ 106 ; Yellow ≥ 47 ; Red ≥ 20 .

2. Temporary Pavement Markers

TEMPORARY MARKERS FOR LONG-TERM DAY/NIGHT USE (6 MONTHS OR LESS)

TEMPORARY MARKERS FOR SHORT-TERM DAY/NIGHT USE (14 DAYS OR LESS)

References

- Caltrans Standard Specifications, Sections 12-6 and 81-3
- Caltrans Standard Plans, A20A through A20E
- CA MUTCD, Chapter 6J
- ASTM D4280 Standard Specification for Extended Life Nonplowable Raised Retroreflective Pavement Markers

3. Striping and Pavement Marking

PERMANENT TRAFFIC STRIPING AND PAVEMENT MARKING WARRANTY TAPE

References

- Caltrans Standard Specifications, Section 84
- Caltrans Standard Plans A20A through A20E
- CA MUTCD, Part 3
- ASTM D6628 Standard Specification for Color of Retroreflective Pavement Marking Materials
- ASTM D4505 Standard Specification for Preformed Retroreflective Pavement Marking Tape for Extended Service Life
- ASTM E1710 Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer
- ASTM E3320 Standard Test Method for Measurement of Retroreflective Pavement Marking Materials Using a Mobile Retroreflectometer Unit

Performance Acceptance Criteria

AASHTO Test Deck Data:

- The product must remain on the roadway, maintain color, and provide retroreflectivity comparable to the control.
- The white and yellow tape, when measured in accordance with ASTM D4505 using a retroreflectometer in accordance with ASTM E1710 or ASTM E3320, shall maintain a minimum retroreflectivity of $700 \text{ mcd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$ for white and $500 \text{ mcd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$ for yellow.
- The tape shall also meet the daytime color requirement as specified in ASTM D6628.

TEMPORARY (REMOVABLE) STRIPING AND PAVEMENT MARKING TAPE (6 MONTHS OR LESS)

References

- Caltrans Standard Specifications, Section 12
- CA MUTCD, Part 6
- ASTM D6628 Standard Specification for Color of Retroreflective Pavement Marking Materials
- ASTM D4592 Standard Specification for Preformed Retroreflective Pavement Marking Tape for Limited Service Life
- ASTM E1710 Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer
- ASTM E3320 Standard Test Method for Measurement of Retroreflective

Pavement Marking Materials Using a Mobile Retroreflectometer Unit

Performance Acceptance Criteria

AASHTO Test Deck Data:

- The product must remain on the roadway and maintain its color and provide retroreflectivity comparable to the control.
- A minimum 90% Functional Retention Rate is required (or a maximum 10% failure rate combined from rating 0 and 1 per AASHTO Test Deck Data) averaged across HMA and PCC test decks.
- The white and yellow tape, when measured in accordance with ASTM 4592 using a retroreflectometer in accordance with ASTM E1710 or ASTM E3320, shall maintain a minimum retroreflectivity of $100 \text{ mcd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$ after 6 months of field exposure.
- The tape must be manually removable intact or in large pieces at the conclusion of the test period without requiring heat, solvents, or grinding, and without causing structural damage or permanent scarring to HMA and PCC pavement.
- The tape shall meet the daytime color requirements as specified in ASTM D6628.

PREFORMED THERMOPLASTIC (HEATED IN PLACE)

References

- Caltrans Standard Specifications, Section 84
- Caltrans Standard Plans, A20A through A20E
- CA MUTCD, Part 3
- ASTM D6628 Standard Specification for Color of Retroreflective Pavement Marking Materials
- ASTM E1710 Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer
- ASTM E3320 Standard Test Method for Measurement of Retroreflective Pavement Marking Materials Using a Mobile Retroreflectometer Unit

Performance Acceptance Criteria

AASHTO Test Deck Data:

- The product must remain on the roadway and maintain its color and provide retroreflectivity comparable to the control.
- A minimum 90% Functional Retention Rate is required.
- White and yellow preformed thermoplastic, when measured using a retroreflectometer in accordance with ASTM E1710 or ASTM E3320, shall

maintain a minimum retained retroreflectivity of $100 \text{ mcd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$ over the evaluation period of 12 to 36 months.

- Preformed thermoplastic shall meet the daytime color requirements as specified in ASTM D6628.

4. Delineators

ONE-PIECE DRIVABLE CLASS 1 FLEXIBLE POSTS

A single, continuous flexible post driven directly into unpaved soil or roadside shoulders using a manual or mechanical post driver, requiring no separate ground anchor or sleeve.

References

- Caltrans Standard Specifications, Sections 12 and 81
- Caltrans Standard Plans, A73C
- CA MUTCD, Chapter 3G
- ASTM D4956 Standard Specification for Retroreflective Sheeting for Traffic Control
- ASTM G154 Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials

Performance Acceptance Criteria

- Post shall remain upright within 10 degrees and serviceable after 10 bumper impacts and 10 wheel-over (roll-over) by vehicle impact at 55 mph. Total retroreflective sheeting delamination, tearing, or material loss shall not exceed 5% of the total applied sheeting area following the full impact test matrix.
- Retroreflective sheeting shall meet the performance requirements of ASTM D4956 Type III or higher (flexible/reboundable grade).
- Accelerated Weathering: ASTM G154 (QUV exposure for 1,000 hours minimum) with zero evidence of edge lifting, blistering, cracking, or color shift.
- Substrate Adhesion: ASTM D4956 adhesion testing on the candidate post substrate following thermal cycling (-20°F to 140°F).

TWO-PIECE (ANCHOR & POST) CLASS 1 FLEXIBLE POSTS

A delineation assembly consisting of a driven ground anchor (such as an 18-inch steel U-channel or soil socket) and a separate flexible post attached to the anchor with mechanical fasteners, allowing post replacement without disturbing the embedded anchor.

References

- Caltrans Standard Specifications, Sections 12 and 81
- Caltrans Standard Plans, A73C
- CA MUTCD, Chapter 3G
- ASTM D4956 Standard Specification for Retroreflective Sheeting for Traffic Control
- ASTM G154 Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials

Performance Acceptance Criteria

- Post shall remain upright within 10 degrees and serviceable after 10 bumper impacts and 10 wheel-over (roll-over) by vehicle impact at 55 mph. Total retroreflective sheeting delamination, tearing, or material loss shall not exceed 5% of the total applied sheeting area following the full impact test matrix.
- Retroreflective sheeting shall meet the performance requirements of ASTM D4956 Type III or higher (flexible/reboundable grade).
- Accelerated Weathering: ASTM G154 (QUV exposure for 1,000 hours minimum) with zero evidence of edge lifting, blistering, cracking, or color shift.
- Substrate Adhesion: ASTM D4956 adhesion testing on the candidate post substrate following thermal cycling (-20°F to 140°).

5. Channelizers

SURFACE MOUNT TYPE, 36-INCH

References

- Caltrans Standard Plans, A73C
- CA MUTCD, Chapter 3I
- ASTM D4956 Standard Specification for Retroreflective Sheeting for Traffic Control
- ASTM G154 Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials

Performance Acceptance Criteria

- Post shall remain upright within 10 degrees of vertical and fully serviceable after 10 bumper impacts and 10 wheel-over (roll-over) by vehicle impact at 55 mph. Total retroreflective sheeting delamination, tearing, or material loss shall not exceed 5% of the total applied sheeting area following the full impact test matrix.
- Retroreflective sheeting shall meet the performance requirements of ASTM D4956 Type III or higher (flexible/reboundable grade).

- Accelerated Weathering: ASTM G154 (QUV exposure for 1,000 hours minimum) with zero evidence of edge lifting, blistering, cracking, or color shift.
- Substrate Adhesion: ASTM D4956 adhesion testing on the candidate post substrate following thermal cycling (-20°F to 140°).

HIGH-SPEED CHANNELIZER - SURFACE MOUNT TYPE, FLEXIBLE TYPE, 36-INCH

References

- Caltrans Standard Plans A73C
- CA MUTCD, Chapter 3I
- ASTM D4956 Standard Specification for Retroreflective Sheeting for Traffic Control
- ASTM G154 Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials

Performance Acceptance Criteria

- Post and base assembly shall remain upright withing 15 degrees of vertical and fully serviceable after 200 vehicle impacts (100 bumper impacts and 100 wheel-over impacts) at 70 mph, split equally between hot ($\geq 81^{\circ}\text{F}$) and cold ($\leq 34^{\circ}\text{F}$) testing conditions. Total retroreflective sheeting delamination, tearing, or material loss shall not exceed 30% of the total applied sheeting area following the full impact test matrix.
- Product approval shall require the complete system, including, base, and anchorage methods (soil anchor, mechanical anchor, or surface adhesive), to be evaluated and determined as integral part of the product. Detached post shall leave anchor flush with or below the surrounding surface to eliminate snagging or tire hazard.
- The post-to-base connection shall utilize a quick-release interface allowing replacement using standard hand tools without distributing the underlying anchorage.
- Retroreflective sheeting shall meet the performance requirements of ASTM D4956 Type IV or higher (flexible/reboundable grade), may be installed within molded recessed channels or protected by integral raised impact ribs.
- Accelerated Weathering: ASTM G154 (QUV exposure for 1,000 hours minimum) with zero evidence of edge lifting, blistering, cracking, or color shift.
- Substrate Adhesion: ASTM D4956 adhesion testing on the candidate post substrate following thermal cycling (-20°F to 140°).

LANE SEPARATION SYSTEM

A surface-mounted assembly typically consisting of low-profile modular curb and flexible posts with retroreflective bands/sheeting installed along pavement to physically divide adjacent travel lines, bikeways, or dedicated transit corridors

References

- CA MUTCD, Chapter 3I
- AASHTO Manual for Assessing Safety Hardware (MASH)
- ASTM D4956 Standard Specification for Retroreflective Sheeting for Traffic Control
- ASTM G154 Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials
- ASTM D4329 Standard Practice for Fluorescent Ultraviolet (UV) Lamp Apparatus Exposure of Plastic

Performance Acceptance Criteria

- The complete system (curb modules, connection hardware, anchors, and vertical channelizing posts) shall be crash-tested and certified under AASHTO MASH Category 3 criteria for longitudinal channelizing/curb devices. Must possess an active FHWA Safety Eligibility Letter for MASH Test Level 3.
- Raised curb bases shall feature a low profile, sloping mountable contour (maximum height to 4 inches) allowing emergency vehicles to roll over without causing vehicle vaulting, undercarriage snagging, or tire deflation. Curb modules shall not shatter, fragment into hazardous debris, or dislodge from adjoining units upon high-velocity impact.
- Modular curb units shall incorporate undersurface drainage channels or scuppers providing a minimum cross-sectional clearance to allow uninterrupted stormwater runoff and prevent water pounding across bike or travel lanes.
- Channelizing posts shall remain upright within 10 degrees and serviceable after 10 bumper impacts and 10 wheel-over (roll-over) by vehicle impact at 55 mph. Total retroreflective sheeting delamination, tearing, or material loss shall not exceed 5% of the total applied sheeting area following the full impact test matrix.
- The flexible boot or mounting coupling connecting the vertical post to the curb base shall maintain retention under direct wheel impacts without popping out or tearing the base slot, while allowing single-person field replacement in under 5 minutes without replacing the underlying base or anchors.

- Channelizing posts shall feature retroreflective sheeting/bonds and meet the performance requirements of ASTM D4956 Type III or higher (flexible/reboundable grade).
- Curb bases, channelizing posts, and retroreflective elements shall undergo accelerated UV weathering per ASTM G154 (QUV exposure for 1,000 hours minimum) or ASTM D4329, resulting in zero edge lifting, blistering, or delamination of the retroreflective sheeting, zero surface cracking or polymer embrittlement of the bases and posts, and no visual color shift across all components.
- Retroreflective sheeting applied to flexible post substrates shall maintain complete bond integrity following thermal cycling across an operational temperature range of -20°F to 140°F per ASTM D4956. The applied sheeting shall exhibit zero edge lifting, blistering, delamination, or adhesive separation for the post substrate.

BIKEWAY SEPARATOR POSTS

References

- CA MUTCD, Sections 3F and 3G
- ASTM D4956 Standard Specification for Retroreflective Sheeting for Traffic Control
- ASTM G154 Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials

Performance Acceptance Criteria

- Post shall remain upright within 10 degrees of vertical and fully serviceable after 10 bumper impacts and 10 wheel-over (roll-over) by vehicle impact at 55 mph. Total retroreflective sheeting delamination, tearing, or material loss shall not exceed 5% of the total applied sheeting area following the full impact test matrix.
- Retroreflective sheeting shall meet the performance requirements of ASTM D4956 Type III or higher (flexible/reboundable grade).
- Accelerated Weathering: ASTM G154 (QUV exposure for 1,000 hours minimum) with zero evidence of edge lifting, blistering, cracking, or color shift.
- Substrate Adhesion: ASTM D4956 adhesion testing on the candidate post substrate following thermal cycling (-20°F to 140°).

6. Object Markers

TYPE 2, OM1, OM3

TYPE Q (CA), 24-INCH

References

- Caltrans Standard Specifications, Sections 75, 81, and 82
- Caltrans Standard Plans, A73A and A73B
- CA MUTCD, Chapters 2C, 6H, and 9C
- ASTM A36/A36M Standard Specification for Carbon Structural Steel
- ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized)
- ASTM D4956 Standard Specification for Retroreflective Sheeting for Traffic Control
- ASMM D6628 Standard Specification for Color of Nighttime and Daytime Color Bounds
- ASTM G154 Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials

Performance Acceptance Criteria

Type 2, OM1, and OM2 (Rigid Object Markers):

- Substrate material shall be aluminum (typically Alloy 3003-H14, minimum 0.050-inch or 0.063-inch thickness) or zinc-coated galvanized steel complying with ASTM A653. The substrate must be flat, smooth, and free of burrs, corrosion, or edge defects.
- Mounting hardware (post) shall be galvanized steel per ASTM A36 and Section 75 or wood post per Section 82, and fasteners must maintain a secure mechanical connection without inducing stress cracking or galvanic corrosion on the target plate.
- Retroreflective sheeting shall meet the performance requirements of ASTM D4956 Type III or higher microprismatic sheeting.
- Yellow or white retroreflective sheeting shall be compliant with ASTM D6628 for daytime color and nighttime performance.
- Accelerated Weathering: ASTM G154 (QUV exposure for 1,000 hours minimum) with zero evidence of edge lifting, blistering, cracking, or color shift.
- Substrate Adhesion: ASTM D4956 adhesion testing on the candidate target plate substrate following thermal cycling (-20°F to 140°) with no loss of bond or sheeting delamination.

Type Q (CA) (Flexible Object Markers):

- Post shall remain upright within 5 degrees of vertical and fully

serviceable after 10 bumper impacts and 10 wheel-over (roll-over) at 55 mph. Total retroreflective sheeting delamination, tearing, or material loss shall not exceed 5% of the total applied sheeting area following the full impact test matrix. Base mechanism (mechanical anchor plate, epoxy adhesive, etc.) must maintain retention to concrete or asphalt pavement without shear failure or pavement pull-out during direct impact.

- Retroreflective sheeting shall meet the performance requirements of ASTM D4956 Type III or higher (flexible/reboundable grade).
- Yellow retroreflective sheeting shall be compliant with ASTM D6628 for daytime color and nighttime performance.
- Accelerated Weathering: ASTM G154 (QUV exposure for 1,000 hours minimum) with zero evidence of edge lifting, blistering, cracking, or color shift.
- Substrate Adhesion: ASTM D4956 adhesion testing on the candidate post substrate following thermal cycling (-20°F to 140°).

7. Concrete Barrier Markers

References

- Caltrans Standard Plans, A76A, A76D, A76G, ~~A78A~~
- CA MUTCD, ~~Chapter 2C (Section 2C.72)~~, Chapter 3G
- ASTM D4956 Standard Specification for Retroreflective Sheeting for Traffic Control
- ASTM G154 Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials

Performance Acceptance Criteria

- The marker shall feature a vertical target face measuring up to 4 inches high and up to 4.5 inches wide, a base mounting flange at least 1.5 inches wide formed at a normal $90^{\circ} \pm 2^{\circ}$ angle, and a minimum retroreflective sheeting area of 12 sq. in.
- Substrate material: Weather-resistant, impactable engineering plastic, engineered to withstand roadside environmental exposure and cyclical wind buffeting from passing heavy vehicles without flexural fatigue or structural failure at the bend during long-term exposure.
- Retroreflective sheeting shall meet the performance requirements of ASTM D4956 Type III or higher.
- Accelerated Weathering: ASTM G154 (QUV exposure for 1,000 hours minimum) with zero evidence of edge lifting, blistering, cracking, or color shift.

- Substrate Adhesion: ASTM D4956 adhesion testing on the candidate marker substrate following thermal cycling (-20°F to 140°) with no loss of bond or sheeting delamination.

8. Delineators for Concrete Barrier and Guard Rail

References

- Caltrans Standard Plans, A77N4
- CA MUTCD, Chapter 3G
- ASTM D4956 Standard Specification for Retroreflective Sheeting for Traffic Control
- ASTM G154 Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials

Performance Acceptance Criteria

- Retroreflective sheeting shall meet the performance requirements of ASTM D4956 Type III or higher (flexible/reboundable grade).
- Accelerated Weathering: ASTM G154 (QUV exposure for 1,000 hours minimum) with zero evidence of edge lifting, blistering, cracking, or color shift.
- Substrate Adhesion: ASTM D4956 adhesion testing on the candidate marker substrate following thermal cycling (-20°F to 140°) with no loss of bond or sheeting delamination.

9. Retroreflective Sheeting, Bands, and Strips – Channelizers, Barrier Markers, Delineators, Cones, and Drums

References

- ASTM D4956 Standard Specification for Retroreflective Sheeting for Traffic Control

Performance Acceptance Criteria

- Retroreflective sheeting shall meet the performance requirements of ASTM D4956 Type III or higher and shall not be Type I or II.
- Substrate Application and Adhesion: Sheeting shall be tested directly on the candidate device substrate material, resin formulation, and surface finish using the manufacturer's recommended application procedures. Sheeting shall pass adhesion testing per ASTM D4956 following thermal cycling (-20°F to 140°F) with zero delamination, blistering, or peel failure from the substrate.
- Accelerated Weathering: ASTM G154 (QUV exposure for 1,000 hours minimum) with zero evidence of edge lifting, cracking, or color shift

beyond ASTM D4956 chromaticity boundaries.

10. Retroreflective Sheeting – Signs

TYPE VIII, SUPER HIGH INTENSITY (TYPICALLY UNMETALLIZED CUBE CORNER MICROPRISMATIC ELEMENT MATERIAL)

TYPE IX, VERY HIGH INTENSITY (TYPICALLY UNMETALLIZED CUBE CORNER MICROPRISMATIC ELEMENT MATERIAL)

TYPE XI, VERY HIGH INTENSITY (TYPICALLY UNMETALLIZED CUBE CORNER MICROPRISMATIC ELEMENT MATERIAL)

References

- Caltrans Standard Specifications, Section 82
- CA MUTCD, Part 2
- ASTM D4956 Standard Specification for Retroreflective Sheeting for Traffic Control

Performance Acceptance Criteria

- ASTM D4956 compliance: Retroreflective sheeting products shall satisfy all physical, photometric, chromaticity, and adhesive performance requirements set forth in ASTM D4956 for specified Sheeting Type (Type VIII, Type IX, or Type XI), Class (Class 1 pressure-sensitive adhesive), and color.
- Exclusive Verification via AASHTO DataMine: Verification of compliance with ASTM D4956 shall be solely through published evaluation data and test reports available in the AASHTO Product Evaluation & Audit Solutions DataMine repository. Independent laboratory test reports, manufacturer self-certification, or Certificate of Compliance submitted in lieu of official AASHTO DataMine report listings will not be accepted for material authorization.

11. Alternative Sign Substrates

FIBERGLASS REINFORCED PLASTIC (FRP) AND EXPANDED FOAM (PVC)

ALUMINUM COMPOSITE, TEMPORARY CONSTRUCTION SIGNS AND PERMANENT SIGNS UP TO 4 FEET, 7 INCHES

References

- Caltrans Standard Specification, Section 82
- ASTM D4956 Standard Specification for Reflective Sheeting for Traffic Control
- AASHTO M 286 Standard Specification for Retroreflective Sheeting for Traffic Control

- AASHTO Manual for Assessing Safety Hardware (MASH)

Performance Acceptance Criteria

- Alternative substrate materials shall demonstrate physical and mechanical performance equivalent to standard soil aluminum alloy sheet (5052-H38 or 6061-T6) of corresponding standard thickness (0.080 in., 0.100 in., or 0.125 in.). The panel shall withstand wind load without permanent deformation, warping, excessive flexural deflection, or core delamination.
- Substrate surface must satisfy ASTM D4956 adhesion requirements for applied retroreflective sheeting. Surface preparation and chemical compatibility shall prevent edge lifting, blistering, wrinkling, or loss of bond caused by differential expansion across a temperature range of -20°F to 140°F.
- Substrates shall be impact resistant and shatter-proof. Panels tested at low temperatures (32°F and -20°F) shall not crack, splinter, produce sharp hazardous debris, or lose structural integrity upon direct vehicle impact.
- Accelerated Weathering: Substrate material (including core layers and facing sheets) shall undergo accelerated weathering test per ASTM G154 (QUV exposure for 1,000 hours minimum) with zero evidence of chalking, crazing, cracking, embrittlement, core separation, or dimensional distortion following environmental exposure.
- Alternative sign substrates used for temporary or permanent applications must meet MASH crash-testing criteria on authorized sign support assemblies.

12. Portable Transverse Rumble Strips

References

- Caltrans Standard Specification, Section 12
- Caltrans Standard Plan, T13
- CA MUTCD, Chapter 6M
- AASHTO Product Evaluation & Audit Solution Work Plan for Temporary Traffic Control Devices (TTCD)

Performance Acceptance Criteria

- Individual strip sections shall measure 12 to 13 inches wide and 0.625 to 0.75 inches thick, spanning full lane width in modular or continuous segments.
- Material composition shall be heavy-duty, UV-stabilized rubber or polymer elastomer that conforms to roadway surface contours without

permanent deformation.

- Must maintain lane position on asphalt and concrete pavements under heavy vehicle traffic without creeping, curling, rolling, or throwing. Must not require glue, epoxy, or mechanical anchors.
- Operating temperature range from -20°F to 140°F without becoming brittle in cold weather or tacky/soft in extreme heat.
- Top surface shall feature a texture, non-skid profile providing adequate wet and dry traction for all vehicle types and motorcycles.

Appendix A

SAFETY DATA SHEET COMPLIANCE CHECKLIST

Based on California Code of Regulations Title 8 §5194 – Hazard Communication Standard (Cal/OSHA)

This checklist includes required SDS content, practical compliance items, and Cal/OSHA audit notes that inspectors commonly verify during workplace inspections.

1. Identification

- ☐ Product identifier (must match label)
- ☐ Common names or synonyms
- ☐ Recommended uses
- ☐ Restrictions on use
- ☐ Manufacturer/importer/distributor name
- ☐ Address
- ☐ Company phone number
- ☐ Emergency phone number

Note: Inspectors check that the product name matches the container label and that emergency contact information is available.

Regulatory Citation: 8 CCR §5194(g)(2)(A)

2. Hazard(s) Identification

- ☐ Hazard classification (physical and health hazards)
- ☐ Signal word (Danger or Warning)
- ☐ Hazard statements
- ☐ GHS pictograms
- ☐ Precautionary statements (prevention, response, storage, disposal)
- ☐ Hazards not otherwise classified (HNOC)
- ☐ Unknown acute toxicity percentage (if applicable)

Note: Hazards must match the classification used on labels and in the Caltrans

Hazard Communication program.

Regulatory Citation: 8 CCR §5194(g)(2)(B)

3. Composition / Information on Ingredients

- ☐ Chemical name
- ☐ Common name or synonyms
- ☐ CAS number
- ☐ Hazardous impurities or stabilizers
- ☐ For mixtures: hazardous ingredients
- ☐ Concentration or concentration ranges
- ☐ Trade secret claims (if applicable)

Note: Confirm that all hazardous components are listed and concentrations are provided.

Regulatory Citation: 8 CCR §5194(g)(2)(C)

4. First-Aid Measures

- ☐ Instructions for inhalation exposure
- ☐ Instructions for skin contact
- ☐ Instructions for eye contact
- ☐ Instructions for ingestion
- ☐ Most important symptoms/effects (acute and delayed)
- ☐ Indication of immediate medical attention or special treatment

Note: Information must be clear enough for non-medical personnel to respond to exposures.

Regulatory Citation: 8 CCR §5194(g)(2)(D)

5. Fire-Fighting Measures

- ☐ Suitable extinguishing media
- ☐ Unsuitable extinguishing media
- ☐ Specific hazards from the chemical
- ☐ Special protective equipment for firefighters
- ☐ Special firefighting procedures

Note: Fire response guidance must align with the product's flammability classification.

Regulatory Citation: 8 CCR §5194(g)(2)(E)

6. Accidental Release Measures

- ☐ Emergency procedures
- ☐ Personal protective equipment recommendations
- ☐ Methods for containment
- ☐ Cleanup procedures
- ☐ Environmental precautions

Note: Caltrans must be able to comply with containment and cleanup procedures.

Regulatory Citation: 8 CCR §5194(g)(2)(F)

7. Handling and Storage

- ☐ Precautions for safe handling
- ☐ Hygiene recommendations
- ☐ Safe storage conditions
- ☐ Incompatible materials
- ☐ Temperature or storage restrictions

Note: Storage guidance must match compatibility rules and fire code practices.

Regulatory Citation: 8 CCR §5194(g)(2)(G)

8. Exposure Controls / Personal Protection

- ☐ OSHA Permissible Exposure Limits (PEL)
- ☐ Cal/OSHA exposure limits if applicable
- ☐ ACGIH TLV values
- ☐ Engineering controls
- ☐ Eye and face protection
- ☐ Gloves
- ☐ Protective clothing
- ☐ Respiratory protection

Note: Must align with the Caltrans PPE program and available ventilation controls.

Regulatory Citation: 8 CCR §5194(g)(2)(H)

9. Physical and Chemical Properties

- ☐ Appearance
- ☐ Odor
- ☐ Odor threshold
- ☐ pH
- ☐ Melting/freezing point
- ☐ Boiling point
- ☐ Flash point
- ☐ Evaporation rate
- ☐ Flammability
- ☐ Explosive limits
- ☐ Vapor pressure
- ☐ Vapor density
- ☐ Relative density
- ☐ Solubility
- ☐ Auto-ignition temperature
- ☐ Decomposition temperature
- ☐ Viscosity

Note: Missing data must be indicated as 'not available' if unknown.

Regulatory Citation: 8 CCR §5194(g)(2)(I)

10. Stability and Reactivity

- ☐ Reactivity information
- ☐ Chemical stability
- ☐ Possible hazardous reactions
- ☐ Conditions to avoid
- ☐ Incompatible materials

- ☐ Hazardous decomposition products

Note: Must have clear incompatibility warnings (e.g., acids vs. bases, oxidizers vs. organics).

Regulatory Citation: 8 CCR §5194(g)(2)(J)

11. Toxicological Information

- ☐ Routes of exposure
- ☐ Symptoms related to exposure
- ☐ Acute toxicity estimates
- ☐ LD50 or LC50 values
- ☐ Delayed or chronic effects
- ☐ Carcinogenicity information

Note: Carcinogen listings should match recognized authorities such as IARC, NTP, or OSHA. If carcinogenic, then the Prop 65 information in section 15 should align.

Regulatory Citation: 8 CCR §5194(g)(2)(K)

12. Ecological Information

- ☐ Ecotoxicity
- ☐ Persistence and degradability
- ☐ Bioaccumulative potential
- ☐ Mobility in soil
- ☐ Other environmental effects

Note: Required in the SDS format and the GHS.

Regulatory Citation: 8 CCR §5194(g)(2)(L)

13. Disposal Considerations

- ☐ Waste disposal methods
- ☐ Waste treatment recommendations
- ☐ Disposal of contaminated packaging

Note: Must be consistent with hazardous waste regulations.

Regulatory Citation: 8 CCR §5194(g)(2)(M)

14. Transport Information

- ☐ UN number
- ☐ Proper shipping name
- ☐ Hazard class
- ☐ Packing group
- ☐ Environmental hazards
- ☐ Transport precautions

Note: Should align with DOT hazardous materials classification if applicable.

Regulatory Citation: 8 CCR §5194(g)(2)(N)

15. Regulatory Information

- ☐ Applicable safety, health, and environmental regulations
- ☐ Federal regulations
- ☐ State regulations
- ☐ Chemical inventory status

Note: Manufacturers entering the California market often overlook the mandatory CA Prop 65 disclosures.

Regulatory Citation: 8 CCR §5194(g)(2)(O)

16. Other Information

- ☐ Date of SDS preparation
- ☐ Date of last revision
- ☐ Revision summary
- ☐ Additional safety information

Note: Cal/OSHA requires SDS updates within 3 months when new hazard information becomes available.

Regulatory Citation: 8 CCR §5194(g)(5)

Appendix B

TECHNICAL DATA SHEET REQUIREMENTS AND CHECKLIST

This appendix outlines the mandatory components, technical data, and engineering metrics that manufacturers must include in their Technical Data Sheets (TDS) when submitting signing and delineation materials for review. TDS is a legal and technical declaration of performance that provides the technical, schematic, and performance data essential for verifying engineering benchmarks prior to laboratory and field evaluation.

Section	Key Components & Content
☐ Header & Identification	Manufacturer logo, exact product name, unique material formulation/model code, a high-level 2-sentence objective product description, and scaled engineering schematic/dimensional drawings (for hardware items)
☐ Technical Specification	A structured table of raw physical and chemical properties. Every value must include its standard unit and the specific test method used (e.g., ASTM, AASHTO, ISO)
☐ Performance Metrics	One-sided limits (min or max), specific operational ranges, or tolerance ranges ($\pm$) under specified environmental conditions
☐ Expected Service Life & Durability	This section must define a baseline year range under standard conditions, explicit operational/environmental boundaries (e.g., UV exposure limits, retroreflectivity retention, traffic count/loading cycles), and a measurable end-of-life performance threshold.
☐ Support & Legal Notices	Manufacturer technical support details, legal disclaimers, and warranty information
☐ Regulatory Certification & Cross-References	An explicit manufacturer declaration of the specific Caltrans Standard Specifications, Standard Plans, and CA MUTCD that the material is engineered to satisfy.

Q&A

Q1: Are there any standardized tests available for Guardrail and Concrete Barrier-mounted delineators?

A: No single, full-assembly standard exists specifically for barrier-mounted delineators. Unlike traditional flexible roadside delineators, the primary long-term performance concerns for guardrail and concrete barrier-mounted markers are not vehicular deflection or impact recovery, but rather catastrophic sheeting delamination, UV-induced optical degradation, and wind-loading fatigue.

For this type of product, standardized testing is applicable to the individual components:

- **ASTM D4956:** Provides the weathering and flexibility criteria to test whether the sheeting and its adhesive backing can resist degradation and prevent field failure.
- **AASHTO DataMine (Delineator Post Program):** Provides specialized testing protocols to test the structural components under cycling mechanical wind-fatigue. |