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## ***Tab E – Traffic Design Standards***

**E.1. Traffic Design, General.** The purpose of the standards and specifications contained herein is to establish uniform policies and procedures for traffic engineering functions of the County of Mendocino Department of Transportation. It is NOT intended to establish a legal standard for these functions. These standards are considered minimum and do not preclude the use of a higher standard such as the Manual of Uniform Traffic Control Devices (MUTCD) or Caltrans Design manuals as approved by the DOT Director. Signing, striping, and marking shall GENERALLY conform to MENDOT STD. NO. A20F, A20G, T21, except that these standards are typical and subject to the most current version of the California Sign Chart and Improvement Plan Standard Notes.

### **E.2. Traffic Signs.**

*E.2.A) Traffic Signs, General.* All regulatory and warning signs shall be constructed to the standard size and specifications of the State of California, Department of Transportation (Caltrans). Signs larger than the standard sign may be required. Unless otherwise specified by the DOT Director, the thickness of all signs shall be .080 inches, except for mast-arm mounted signs which shall be 0.125 inches.

#### *E.2.B) Traffic Signs, Urban*

- 1) Typical installation shall conform to the requirements of MENDOT STD. NO. RS10.
- 2) "No Parking" signs shall be installed at a thirty-degree angle toward the traveled way.
- 3) Signs in the median area shall be placed midway between curbs. These signs shall be mounted no closer than six inches to, and no farther than six feet from, the edge of the traveled way which the sign faces.

#### *E.2.C) Traffic Signs, Rural*

- 1) Typical installation shall conform to the requirements of MENDOT STD. NO. RS11.
- 2) "No Parking" signs shall be installed at a thirty-degree angle toward the traveled way.

#### *E.2.D) Street Name Signs*

- 1) Standard street name signs at non-signalized intersections shall conform to the requirements of MENDOT STD. NO. RS20. The mounting location at non-signalized intersections shall conform to MENDOT STD. NO. RS21.
- 2) Street name signs installed at signalized intersections shall conform to the following requirements

- a) Street name signs shall be mounted to the traffic signal standard by the use of a heavy duty arm bracket for electrolier mounting.
- b) Two sets of street name signs shall be mounted at each signalized intersection.

E.2.E) *Sign Poles.*

- 1) All poles shall be two-inch I.D. galvanized steel, schedule 40 ASTM 120 and shall be threaded at both ends.
- 2) In concrete or other paved surfaces, a two-inch diameter hole shall be rock drilled to a minimum depth of eighteen inches. Upon installation, the pole shall be set using sand and cement.
- 3) In rural areas, an eight-inch diameter hole shall be dug to a minimum depth of eighteen inches. Upon installation, the pole shall be set using concrete mix.
- 4) For the bolting of signs directly to the pole, 5/16-inch x three-inch long Grade 3 bolts with a flat washer shall be used.

**E.3. Pavement Markings.**

E.3.A) *Raised Pavement Markings.*

- 1) Raised pavement markers shall conform to the shape, types and dimensions of State of California Standard Plan A-20A.
- 2) Except as indicated below, raised pavement markers shall conform to the requirements and applicable provisions of Section 85 of the State of California Standard Specifications. The following specifications shall be added to the applicable provisions:

A hot melt bitumen adhesive may be used to cement the markers to the pavement, instead of the Rapid Set Type or Standard Set Type adhesive. The bitumen adhesive material, if used, shall conform to the following:

<u>Specification</u>	<u>ASTM Test Method</u>	<u>Requirement</u>
Flash point, CCC, F	D 92	550 Min.
Softening Point, F	D 36	200 Min.
Brookfield Viscosity, 400□ F cP, Max	D 2196	7500
Penetration, 100g 5 sec. 77° F	D 5	10-20 dmm

<u>Specification</u>	<u>ASTM Test Method</u>	<u>Requirement</u>
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Filler Content, percent by weight (insoluble in 1,1,1 Trichlorethane)	D 23711	50-75
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Filler material shall be calcium carbonate and shall conform to the following fineness:

Sieve Size	Percent Passing
No. 100	100
No. 200	95
No. 325	75

Bitumen adhesive shall be indirectly heated in an applicator with continuous agitation. The adhesive shall be applied at a temperature between 400 degrees F and 425 degrees F. Markers shall be placed immediately after application of the adhesive.

Placement of markers using bitumen adhesive shall conform to the requirements for placing markers in Section 85-1.06 of the State of California Standard Specifications, except as follows:

- a. Markers shall not be placed when the pavement or air temperature is fifty degrees F or less.
  - b. Blast cleaning of clean, new asphalt concrete surfaces will not be required.
- 3) For application of the raised pavement marker to the pavement surface, the adhesive shall surround the perimeter of the marker after the marker has been pressed into place.
  - 4) Lane widths as shown on design documents shall be measured from centerline to centerline of adjacent striping patterns, or, from face of curb to the centerline of the striping pattern.

**E.3.B) Durable Pavement Markings, Tape**

- 1) At the discretion of the DOT Director, pavement markings may be required to be composed of durable pavement tape of one of two types:
  - a) General purpose high durability retroreflective pliant polymer film, or
  - b) Durable retroreflective pavement marking film.

- 2) General purpose high durability retroreflective pliant polymer film shall be used for preformed longitudinal, transverse and word/symbol markings subject to high traffic volumes and severe wear conditions such as repeated shear action from crossover or encroachment on edge and channelization lines, and stop, start, or turn movements.
- 3) Durable retroreflective pavement marking film shall be used for preformed markings subjected to moderate, well-channelized, free rolling traffic volumes, less severe wear, and where there is a need for higher reflectivity.
- 4) The preformed markings shall consist of white or yellow films with pigments selected and blended to conform to standard highway colors through the expected life of the film. Glass beads shall be incorporated to provide immediate and continuing retroreflection.
- 5) The size, quality and refractive index of the glass beads shall be such that the performance requirements for the markings shall be met and the bead adhesion shall be such that beads are not easily removed.
- 6) Preformed words and symbols, and traffic striping, shall conform to the applicable shapes, sizes, and colors as outlined in the California Department of Transportation Traffic Manual or as approved by the DOT Director.
- 7) The preformed markings shall be capable of being adhered to asphalt concrete or portland cement by a pre-coated pressure sensitive adhesive. A primer may be used to precondition the pavement surface. The preformed marking film shall mold itself to pavement contours by the action of traffic. The pavement marking films also shall be capable of application on new, dense and open graded asphalt concrete wearing courses during the paving operation. After application, the markings shall be immediately ready for traffic. All solvents and/or primers (where necessary), equipment necessary for application, and recommendations for application that will assure the materials shall be suitable for use shall be identified to the County.
- 8) The general purpose high durability retroreflective pliant polymer film, when applied according to the recommendations of the manufacturer, shall provide a neat, durable marking that will not flow or distort due to temperature if the pavement surface remains stable. The film shall be weather resistant and, through normal traffic wear, shall show no fading, lifting or shrinkage which will significantly impair the intended usage of the marking throughout its useful life and shall show no significant tearing, roll back or other signs of poor adhesion.
- 9) The durable retroreflective pavement marking film, when applied according to the recommendations of the manufacturer, shall provide a neat, durable making that will not flow or distort due to temperature if the pavement surface remains stable. The film shall be weather resistant and, through normal traffic wear, shall show no fading, lifting or shrinkage which will significantly impair the intended usage of the marking throughout its useful life and shall show no significant tearing, roll back or other signs of poor adhesion.

E.3.C) *Thermoplastic Pavement Markings.*

- 1) All striping, pavement markings, including stoplines, and all channelizing lines shall be thermoplastic unless otherwise shown or noted on the plans approved by the DOT Director.
- 2) The furnishing and applying of thermoplastic pavement marking material shall conform to the requirements of the modified California State Specification No. 8-10-41G-21.
- 3) Glass beads applied to the surface of the molten thermoplastic material shall conform to the requirements of the modified California State Specification No. 8010-51J-22 (Type II).

E.3.D) *Pavement Marking Paint.*

- 1) Pavement Marking Paint, where shown or noted on the plans approved by the DOT Director, shall be commercial quality, solvent or water borne paint and be applied in two coats to achieve the designed coverage.
- 2) The kind of paint to be used (solvent borne or water borne) shall be determined by the County.
- 3) Glass beads used for reflectorized pavement markings will conform to the modified California State Specification No. 8010-51j-22 (Type II).
- 4) Thinner shall not be mixed with paint. Paint shall dry "track free" in not less than thirty (30) minutes and not more than ninety (90) minutes.
- 5) All painted pavement markings shall be clean and sharp as to dimensions. Ragged ends of segments, fogginess along the sides, or objectionable dribbling along the unpainted portions of the pavement marking shall not be permitted.
- 6) The painted pavement marking shall have an opaque, well-painted appearance with no black or discolorations showing through.
- 7) Words, symbols and traffic striping shall conform to the applicable shape, sizes and colors as outlined in the California Department of Transportation Traffic Manual.

E.3.E) *Eradication of Pavement Markings.* Pavement marking paint and thermoplastic shall be removed by sand blasting. Painting over as a means of pavement marking eradication shall not be permitted.

E.3.F) *Temporary Pavement Markings.*

- 1) When pavement markings have been obliterated or damaged in construction work zones, temporary pavement markings shall be installed in accordance with these standards.
- 2) At the end of each day's work, temporary pavement markings shall be in place on each paving lift that is open to normal traffic flow.
- 3) Temporary pavement marking materials shall be approved by the DOT Director prior to installation.
- 4) Temporary pavement marking configurations shall be in accordance with the California Department of Transportation Traffic Manual.

- 5) The temporary pavement markings shall be maintained and replaced by the Contractor until they are covered with the next paving course or are replaced with durable pavement markings applied on the final wearing course.
- 6) Temporary pavement markings shall be applied to clean, dry surfaces in accordance with the manufacturer's recommendations.

#### **E.4. Construction Area Traffic Control.**

E.4.A) *Construction Area Traffic Control, General.* All contractors, permittees or agencies doing work in public roads or public right-of-way shall:

- 1) Obtain all necessary permits.
- 2) Install and maintain required traffic control devices.
- 3) Provide flaggers when required.
- 4) Provide adequate safeguards for workers and the public.
- 5) Assure that survey crews and other employees working in or adjacent to a traveled roadway wear flagging garments as required for flaggers.
- 6) Patrol the construction site as required to insure that all devices are in place and operating at all times.
- 7) Remove traffic control devices when they are no longer needed.

E.4.B) *Traffic Control Plan.* A traffic control plan shall be required for all road closures, detours, land closures or other work within the public right-of-way. Relief from the requirement for a traffic control plan shall require the specific approval of the DOT Director as part of improvement plan or encroachment permit review. Traffic control plans shall include delineator placement, type and location of all signs (construction signs, detour signs, street nameplates, etc.), barricade placement, flaggers, temporary pavement markings, and any other pertinent information. The latest edition of the California Department of Transportation's Manual of Traffic Controls for Construction and Maintenance Work Zones and MENDOT STDs NO. T21 and T22 shall be used as references for determining appropriate signing.

#### **E.5. Traffic Signals.**

E.5.A) *Traffic Signals, General.*

- 1) Traffic signal and safety lighting equipment shall comply with the requirements of the applicable provisions of Section 86 of the California State Specifications and Standard Plans and these traffic standards.
- 2) Foundations for traffic signal standards shall be constructed per the applicable California State Standard Plans.

E.5.B) *Traffic Signal Poles, Pedestals and Posts*

- 1) Traffic signal poles, arms, and related appurtenances shall be installed per the requirements of the California State Standard Plans.
- 2) The chase outlet shown on the California State Standard Plans in the mast arm mounting plate, and in the mast arm mounting plate on the pole, shall be one-inch minimum diameter and shall be smoothed after galvanizing to facilitate installation of conductors without damaging the insulation.
- 3) Each pole shall be provided with one three-inch x five-inch minimum handhole for wiring, located within one foot of the base and on the same side of the pole as the mast arm.

E.5.C) *Traffic Signal Controllers.*

- 1) Traffic Signal Controllers shall be Model 170 units and shall conform to the requirements of the latest edition of the "Traffic Signal Control Equipment Specifications," issued by the California Department of Transportation, and to all addenda thereto.
- 2) The power supply shall be a ferro-resonant type of transformer. Linear and switching power supplies shall not be acceptable.
- 3) The controller shall have a minimum of eight kilobytes of battery-backed RAM memory on the CPU board.
- 4) The CPU power control circuitry shall be located on the CPU board.
- 5) The ACIA baud rates shall be jumper selectable from 300 to 19K baud.
- 6) The controller shall be capable of supporting one additional ACIA auxiliary communication adapter port at addresses 6002/6003.
- 7) The standby battery assembly shall be located on the swing-out front panel assembly, and shall be easily accessible for maintenance and testing purposes.

E.5.D) *Traffic Signal Controller Cabinets.*

- 1) The controller cabinet shall be Type 332 or Type 303 as specified by the DOT Director.
- 2) When the controller is not used, conduit shall run directly to the pull box.
- 3) The controller cabinet shall be mounted no closer than four feet from the service cabinet.

E.5.E) *Traffic Signal Service Cabinets.* Traffic signal service cabinets shall meet the following requirements:

- 1) Inside dimensions:

	<u>Minimum</u>	<u>Maximum</u>
Height	41 inches	45 inches
Width	11-3/4	19 inches
Depth	8-1/4	10-1/2

- 2) Twelve-gauge steel treated with primer and two coats of baked-on enamel or electrostatically applied thermosetting polyester
- 3) A provision for reading the service meter through a window without opening any doors shall be provided. The window shall be clear glass, Lexan or plastic.
- 4) The cabinet shall be watertight with a weatherproof door and window.
- 5) Foundation shall be twenty-four inches deep below ground level and constructed per section 86-2.03 of the California State Specifications.
- 6) Timer, flasher, and spare shall be used only when shown on the plans approved by the DOT Director.
- 7) The cabinet shall be no closer than six feet from the distribution pole.
- 8) The cabinet shall be mounted no closer than four feet from the traffic signal controller cabinet.

E.5.F) *Traffic Signal Electrical Service.* Electrical service to traffic signals shall be underground.

E.5.G) *Traffic Signal Wiring.*

- 1) Traffic Signal Wiring shall conform to the requirements of MENDOT STD. No. ES41.
- 2) No splices of traffic signal lights, pedestrian signal lights, or pedestrian push button wires shall be allowed in any pull box. Ground wires may be spliced in pull boxes.
- 3) Straight splices in signal neutral and multiple lighting conductors shall be insulated in conformance with Method "A" as shown on the California State Standard Plans.
- 4) Conductors shall be permanently identified as to function. Identification shall be placed on each conductor or each group of conductors comprising a signal phase in each pull box and near the end of conductor termination.
- 5) Identification shall be by tags or bands fastened to the conductors using nylon wire ties in such a manner that they will not move along the conductors. Conductors comprising a single signal phase may be grouped together and tagged with a single band provided the band is designed to tie conductors together as well as tag them.
- 6) Marking on tags shall be by mechanical methods (scribing, etc.) and shall be permanent.

E.5.H) *Loop Detectors.*

- 1) Traffic signal loop detector wiring shall conform to the requirements of MENDOT STD. NO. ES40.
- 2) Each lane shall have one shielded cable pair lead-in continuous to controller.
- 3) No splicing of shielded cable pair lead-in shall be permitted.
- 4) Loop wire shall be #12 AWG stranded conductor with USEXLP insulation.
- 5) Detector lead-in cable shall be Type B per California State Specifications.

- 6) Detector lead-in cables shall be permanently and clearly marked at cabinet and pull boxes.
- 7) All advance loop detectors shall have their own detector lead-in cable per approach lane.
- 8) Where required on the improvement plans approved by the DOT Director, sensor units shall be provided for inductive loop traffic counting equipment.
- 9) Type "A" detector handholes shall be installed per California State Standard Plan No. ES-5E.

E.5.I) *Loop Wire Sealant*. The encapsulant shall be one-part elastomeric compound requiring no mixing, measuring or application of heat prior to or during its installation. The elastomeric sealant shall be a polyurethane material of a composition that will, within its stated shelf life, cure only in the presence of moisture. Sealant shall be suitable for use in both asphalt concrete and Portland cement concrete. The cured sealant shall have the following performance characteristics:

<b>Property Results</b>	<b>Measuring Standards and Conditions</b>
Hardness (indentation) 65-85	ASTM D 2240 Rex. Type A, Model 1700 77°F. (25°C) 50% relative humidity
Tensile strength-- 500 psi minimum Elongation-- 400% minimum	ASTM D 412 Die C, pulled at 20 IPM ASTM D 412 Die C, pulled at 20 IPM
Flex at -40°F.-- No cracks	25 mil Free Film Bend (180°) over ½-inch mandrel
Weathering Resistance-- (slight chalking)	ASTM D 822 Weatherometer 350 hours. Cured 7 days at 77°F. (25°C.) 50% relative humidity
Salt Spray Resistance-- 500 psi, minimum tensile; 400%, minimum elongation	ASTM D 117 28 days at 100 degrees F. (38 degrees C.) 5% NaCl, Die C, pulled at 20 IPM
Dielectric Constant-- less than 25% change over a temperature range of -30°C. to 50°C.	ASTM D 150

E.5.J) *Traffic Signal Faces*. Traffic signal faces shall conform to Caltrans Standard Plan ES4A and Caltrans Standard Specification Section 86-4, Traffic Signal Faces and Fitting. Red ball and red arrow shall be light emitting diode (LED) per Caltrans Standard Specifications Section 86-4.02.

E.5.K) *Pedestrian Signal Faces*.

- 1) Messages shall be lunar white WALKING PERSON and Portland Orange UPRAISED HAND (symbol type) per California State Standard Plan No. ES-4B and the Institute of Traffic Engineers, Standards: "Adjustable Face Pedestrian Signal Head Standard".
- 2) One of the following types of screen shall be provided. The type of screen shall be chosen at the discretion of the contractor:
  - a) An aluminum honeycomb screen with 3/16 inch cells, 3/8 inch thick, shall be installed tilting downward, at an angle of fifteen degrees ( $\pm$  two degrees) out from the top, and shall completely cover the message plate. The honeycomb screen shall be covered with a clear, 1/8 inch minimum thickness, acrylic plastic cover supported in an aluminum frame, or with a 1/16 inch nominal thickness, formed, polycarbonate plastic cover. Screen and cover shall be held firmly in place by the use of stainless steel or aluminum clips or stainless steel metal screws.
  - b) A one-inch deep eggcrate type screen and mounting frame of 0.032 inch minimum thickness 5052-H32 aluminum alloy shall be provided to cover the message plates. The screening shall be mounted in a frame constructed of 0.04-inch minimum thickness aluminum alloy. The eggcrate type screen shall be installed parallel to the face of the message plate and shall be held in place by the use of stainless steel screws.
- 3) The screen and frame shall be fabricated from aluminum anodized flat black or may be finished with flat black enamel as specified in Section 91-4.01 of the California State Standard Specifications.
- 4) Alternate methods may be substituted by the contractor for the above screens providing the results are equal to or superior to those obtained with the above specified screens, as determined by the DOT Director.
- 5) The pedestrian signal face "Upraised Hand" shall use a light emitting diode (LED) per Caltrans Standard Specification Section 86-4.07.

E.5.L) *Traffic Signal Conductor*.

- 1) All conductors for traffic signal systems shall conform to the requirements of Section 86 of the California State Specifications, or as specified herein.
- 2) All conductors shall be copper and be rated for 600-volt operation.

- 3) All conductors shall conform to the latest requirements of the National Electric Code (NEC). Conductors shall be labeled by Underwriter's Laboratories, Inc.
- 4) Colored stripes on conductor insulation to identify each phase of vehicle signals, pedestrian signals, pedestrian push buttons, and detectors shall be required.
- 5) All conductors shall be pulled by hand and shall be installed in conduit runs in one operation. The use of winches or other power actuated equipment shall not be permitted.
- 6) The maximum number of wires in the conduit shall conform to the specifications of the National Electric Code.
- 7) #14 AWG conductors shall be used for the following:
  - a) Each traffic signal lamp on each phase.
  - b) Each pedestrian signal indication on each phase.
  - c) Each pedestrian push button and pedestrian push button common installed into the controller.
  - d) Three for spares under each street.
  - e) 12-pair (branches) or 50-pair (main run), or as determined by the County DOT Director, for interconnect.
- 8) #8 AWG conductors shall be used for the following:
  - a) Two for each safety light 120/240V.
  - b) One for equipment ground.
  - c) One neutral for traffic signal.
- 9) #4 AWG conductors shall be used from the utility service point to service cabinet for traffic signals and safety lights.

E.5.M) *Traffic Signal Conduit.*

- 1) Conduit size and cover shall conform to the following:
  - a) Service run conduit shall be two-inch minimum diameter.
  - b) Conduit under any street shall be three-inch minimum diameter and shall have a minimum of twenty-four inches of cover.
  - c) Conduit under sidewalk or planter area shall have a minimum of twenty-four inches of cover.
  - d) Conduit from the main pull box to the controller shall be two (2) three-inch diameter.
  - e) Any signal run and interconnect conduit shall be two-inch minimum diameter.
- 2) All conduits shall be Schedule 40 PVC, except pole risers which shall be Schedule 80 PVC.

- 3) All underground conduits and metal parts shall be continuously bonded and grounded.
- 4) All bends and/or offsets shall be made with factory manufactured sections.
- 5) All empty conduit shall have a one-quarter inch polypropylene rope provided inside along its entire length and extending twenty-four inches out of each end.
- 6) After conduits, wire and rope have been installed, the ends of all conduits terminating in pull boxes shall be sealed with an approved type of sealing compound. Conduits stubbed for future extension shall be capped.