Pursuant to Deputy Directive (DD-103) “Worker and Travelers Safety on the State Highway System”,

The following guidelines are recommended to provide maximum safety considerations for highway workers while providing long lasting features which require less maintenance or safer to access to perform both routine and emergency maintenance works.

These guidelines are recommendations for designers/consultants to follow based on the Highway Design Manual (HDM), Maintenance Manuals and 2010 Standard Plans.

There are 2 categories to consider; **Roadway,** and **Roadside.**

Roadway Category;

A. **Pavement:** (HDM Chapter 600, Sec. 618.1, Sec. 621, Sec. 631.3)

I. Flexible;
1) Hot Mix Asphalt (HMA) Type “A” PG 64-10; or Rubberized HMA (Type Gap Graded “G” or Open Graded “O”); PG 64-16.
2) Max. RHMA (Type “G”) thickness not to exceed 2.1/2”, Min. 1.1.4”.
3) Max. RHMA (Type “O”) thickness not to exceed 1.3/4”, Min. 1.1.4”.
4) Max. Aggregate size, less than ½ the thickness (i.e. 1.1/4” thickness, the max. aggregate size is ½”).
5) Transverse Conform grinding at inlets or edge of gutter/shoulder, If Type “O”, roll to max. Aggregate size thickness and 1.0 foot away from inlets or curb/dikes.
6) Longitudinal conform to same thickness with 400:1 taper.
7) Maintain overlay on shoulders when overlaying the mainline.
8) Place rumble strip outside of the 12-foot lane where practical.
9) Shoulder structural capacity should be evaluated by Material Branch when utilized for construction staging (i.e. shifting lane).

II. Rigid;
1) Conventional concrete for lane replacement or widening.
2) Rapid set Concrete (RSC) for individual panel replacement.
3) Perform grinding and grooving together if the pavement was previously grooved to increase skid resistance or improve drain ability (check the thickness structural capacity tolerance).
4) Do not grind or groove on Bridge Decks, it is OK for approach slabs.
5) PCC ramp termini where truck traffic is high or near major commercial/industrial centers (min. 150’ long).

III. Shoulder;
1) Provide Standard 10 feet paved shoulder (HDM, Sec. 302,305).
2) Provide paved safety edge with shoulder backing on conventional highways, where warranted (edge of pavement drop off more than 2”).

B. Curb;
1) When reconstructing raised median in Conventional Highway, use Type A1 (8” CF) to accommodate for future overlays.

C. Striping/Marker;

1) All pavement striping and markings should be thermoplastic.
2) Do not place retro reflective pavement markers over striping line; place them next to striping, for future refreshing purposes.
3) Removing the existing stripping/markings should result in minimum abrasion to existing surface, any shadow ghost or excess grinding should be covered by appropriate seal coat to pre-existing condition.
4) Recessed markers for rural highways that get significant mud flows. (I.e. SR 74, SR 142). They get removed during mud clearing operation.

D. Truss signs;

1) Increase the vertical clearance by 6" to accommodate for future pavement overlays.
2) New sign panels should be inspected for quality workmanship and specification during "Relief of Maintenance" walkthrough (i.e. protective plastic sheeting creates bubble which reduces visibly at night).

E. Bridge;

1) Abutment Slope Paving**,** Include abutment slope paving and embankment slope paving at structures and approaching slopes where vegetation maintenance would be difficult due to slope.
2) Apply polyester concrete to improve bridge deck skid resistance, and longevity, apply methacrylate to seal surface fine cracking (see Bridge Report for specific recommendations).

Roadside Category;

A. Embankment;

1. 1:4 slope ratio is desired on all fill slope (Max. 1:2) HDM Sec. 304.1.
2. Provide 15 feet wide (minimum 10 feet) path (excluding slope rounding) at the top of fill and cut slope.
3. Provide maintenance access road to face of MSE retaining walls 10 foot minimum, 15 foot preferred. Provide vehicular access gate at each end.

B. Gore point;

1) Absolutely no objects in the gore area (except breakaway EXIT sign).
2) Close Circuit TV (CCTV) cameras and signals on the right side of the ramps are preferred.
3) Continuous narrow medians to be paved entirely with stamped or colored concrete (Absolutely No rock blanket).
4) Standard flat gore paving to 40' width instead of current 25' wide; the 40' width matches the radius of the standard type 'A-6' rotor (40').
5) Sloped gore paving (pave entire area where exceeding 2:1; otherwise unsafe for walking).
6) Any area that is exposed to high traffic along horizontal curves and blind spots (due to visual obstructions such as sound walls); this may be miscellaneous paving areas.

C. Maintenance Vehicle Pullout (MVP) ; HDM CP100, Sec.107.2

1) Construct MVP for following locations;
   i. CCTV
   ii. Drainage facilities access to mainline
   iii. Sign Structural/Changeable Message Sign (CMS)
   iv. Pump Stations access
   v. Landscaping access path
   vi. Any other facilities that require routine maintenance (i.e. irrigation controllers/valves)

D. Roadside facilities;

1) Pull boxes, cabinets, irrigation controls, CCTV to be located outside of the Clear Recovery Zone (i.e. minimum 30' from ETW on Freeway; minimum 20' from ETW on Conventional Highway without curb, 1.5' with curb). Otherwise to be located behind Metal Beam Guard Rail (MBGR). Pull boxes within the recovery zones should be traffic rated.

E. Maintenance Access Road;

Provide access road to detention basins, nearest point of inlets/outlets, and large landscaping areas. Provide 12 feet (15 feet desired, 10 feet minimum) compacted class III crushed aggregate base with min 6" thick for grades less than 5%. Asphalt concrete (AC) paving for grades between 5% and 9%, and Portland Cement Concrete (PCC) paving for grades between 9% and 16% max. Pave the beginning 50 feet with AC or PCC from shoulder side. A 20 feet radius turn around area (180 SY flat areas) should be provided at the bottom of access road.

F. Drainage Facilities;

1) Steep Slope Culverts*:* Maintenance inspects culverts using a mechanical underground camera with limited ability to navigate steep culverts. Where possible, use a maximum slope of 25 percent (S=0.250).

2) Capped Inlets/Buried Junction Boxes*:* Buried junction boxes (Cap Inlet) create problems for Field Maintenance by providing a clogging point that has no surface access for clean, and by creating an impassible point for maintenance inspection equipment (camera crawler). The buried box also makes it difficult or impossible to clean using jet-Roding equipment. Capped inlet under the traveled way can cause pavement problems and traffic control expenses when maintenance is required.

3) Handrails*:* Cable hand railing for employee safety is required at retaining walls, headwalls, and along the sides of the channels where the vertical drop is 4 feet or more (HDM 210.6).

4) Culvert Size*:* 18" diameter is the minimum culvert size to facilitate Caltrans cleaning and inspection equipment. The use of smaller diameter drains in bridges and walls should be minimized when possible.

5) Culverts and Drains in Fire Hazard Areas*:* HDPE and other plastic pipe should not be used for storm drains, wall drains, under-drains or horizontal drains in fire hazard areas, especially near the surface.

6) Access to Large Drain Structures*:* Include access ladders, steps or ramps to existing large drainage channels within the State right-of-way. The current emphasis of inspection and cleaning has identified older facilities that need improved access. When retrofitting, extending, enlarging or connecting to large drainage facilities, keep in mind the State's responsibility to maintain the features and the safe access of maintenance forces.

7) Culvert Grade and/or Alignment Changes**:** Per Highway Design Manual (HDM) section 823.2 "When angle points are unavoidable, maintenance access may be necessary." When it is unavoidable to joint two culverts without surface access, limit vertical and horizontal angle points to 10 degrees or less HDM 838.5(1) (b). Sharper grade or alignment changes may not be traversable by inspection camera equipment. If an alignment change or grade change is used, anchorage and/or thrust blocks may also be needed at the culvert elbows depending on slope and water volume

8) V-ditch Channels*:* Maintenance recommends a 4-foot "walk able" path for maintenance personnel adjacent to v-ditches. For channels greater than 5 feet horizontal, change to a flat bottom (2-foot minimum) trapezoid cross section, so that maintenance personnel can safely walk in the channel while cleaning.

9) Grated Line Drain*:* Limit the use of grated line drain (GLD) where possible. It requires a higher frequency of maintenance than other inlet types. When specifically compared to slotted drain, the GLD takes a greater period to clean because jet-rod equipment is much less efficient in GLD than in slotted drain. Consider the maintenance life cycle costs and personnel safety when selecting equivalent or near equivalent hydraulic capacity features.

10) Short and Wide RCB Culverts*:* 'Low and wide' reinforced concrete box culverts should be avoided due to difficulty accessing and cleaning. This shape has a lower propensity to self-clean, with the energy loss of flows spreading out. If used, the floor cross-slope should be angled, or provided with a low-flow v-section. Provide access to all possible junctions.

11) Labeling Exiting Culverts**:** Identify the material type of existing culverts to be 'collared' or attached to new features. Confirm the existing line is in satisfactory condition to allow connections or extensions.

12) Splash Pads: Install concrete splash pads at the bottom and under the drain outlet of all bridge columns that have drainage pipes for draining the deck runoff.

13) Detention Basin Riser: A cut out section of the pipe can be bolted (1/4 pie) with plates on the riser, and be opened for maintenance purposes for tall riser (minimum 5 feet).
14) Slope Grade: Grade slopes with minimum 5% towards the drainage basin for efficient run-offs drain ability.
15) Place Manholes for longer pipe runs for easier access for jet-roding application, also at angle point both horizontally and vertically.

16) Median drainage; Provide concrete swale (1:5 ratio or flatter) for longitudinal slope greater than 5%.
17) Provide trash rack and debris basin at the inlet of all drainage lines crossing the corridor that are smaller than 60" in diameter.
18) At culverts and drainage system inlets/outlets, crossing highways, locate R/W fence on top of headwall and provide a gate to access inverts.

19) Where centerline profile slopes towards an arterial undercrossing, provide adequate median drainage provisions to prevent overflow onto arterial and erosion at abutments and slope paving.

20) Raked PCCP access ramps shall be provided into bottom of drainage basins. Headwalls should be kept 30 feet from edge of traveled way.

21) Structural section for maintenance access roads shall be designed for fully loaded maintenance equipment.

22) For large open channels provide ramp into channel for maintenance access.

23) Trees should be kept away from drainage facilities, (i.e. inlets/outlets).

24) Provide Culvert Markers to assist crew in locating the culvert openings.

G. Sidewalk;

1) No tree planting within planters (next to sidewalk) due to roots lifting the sidewalk and creating hazardous condition, unless to be maintained by City/County through "Maintenance agreement".

H. Agreements;

1) Any major interchange improvements, widening, landscaping, relinquishments, drainage culvert/channel, non-standard inventory (i.e. sign monument, decorative fence) would require revising/amending respective existing Maintenance Agreement or to execute a new one.
2) Any kind of monument sign triggers initiation of a new maintenance agreement since as the owner of the sign; local agency will be solely responsible for structural integrity, routine maintenance and electrical maintenance of the inventory.

I. Roadside Signs;

1) Check with District Field Maintenance coordinator for those signs that have lost reflectivity to be replaced.

J. Soundwall;

1) First preference: Construct soundwalls on the R/W line.
2) Second preference: Construct soundwalls a couple of feet from the R/W fence, existing soundwall or neighbor's soundwall and relinquish the gap space is then to the neighbors (see Relinquishment below).
3) Else: Construct soundwalls with at least 12-foot clearance to the R/W fence/wall for a maintenance road. Use a minimum of 4 feet only for short stretches when

wider R/W is unattainable. Use of a 4-foot clearance is not justified to avoid inconvenient R/W issues or reduce project delivery time.

4) Do not construct walls with less than 4-foot clearance to the R/W line. Using less than 4-feet makes the space inaccessible for the removal of vegetation, trash and animal carcasses.
5) Safety: Spaces of any width behind soundwalls have the potential for problems for worker safety and neighborhood safety. Maintenance has experienced serious problems in these spaces, not only with drainage, trash and graffiti; but also with bio-hazard drug paraphernalia, homeless persons and their camps. We strongly request that projects get the necessary TECs and neighbors' buy-in to remove existing walls/fences and replace with the correct height soundwall on the R/W line, or provide a relinquishment plan for gap-lands.
6) Include an access gate at every 500 feet in areas where the distance between the soundwall and R/W is less than 12 feet. Make sure there is a workable space to stand on once through the gate, and a ladder on the down side if the soundwall is placed on a retaining wall.
7) Provide double-door gates on R/W fence or soundwall at all vehicular maintenance access roads.
8) Locate soundwalls away from the edge of shoulders.
9) Slopes between the soundwall and roadway should be 1:3 on all fill sections, Maximum 1:2
10) Construct a minimum 10-foot wide flat path (not including slope rounding) at toe and top of fill and cut slopes. Do not run cut or fill slopes directly to the base of a sound or retaining wall. In areas where a 12 foot space adjacent to the wall is unattainable, a minimum 4-foot flat work space is required for maintenance activities.
11) Relinquishment of excess area behind soundwall; Relinquishment of gap-land is feasible if the wall is construct close to the neighbor’s fence. The demolition/relocation of the neighbor’s fence can be included in the construction contract using a TEC area, or assigned as a monetary value awarded the property owner to do their own fencing/relocation. If the property owners are inconsistent with their connections to the back of the soundwall, it could create nuisance landlocked patches, making Caltrans unpopular regardless of the Department’s release from liability.

K. Landscaping;

1) Proposed landscape improvements shall require minimum maintenance and resources;
2) Proposed tree locations shall consider providing additional setback from ETW, EP, Ditches and R/W, above the minimum requirements provided in the Plant Setback Guidelines'
3) Irrigation controllers, valves and other facilities shall be located where safe maintenance access is available and behind physical barriers wherever available
4) On Construction projects, conduct thorough pre-construction "check & test for existing landscape and irrigation deficiencies" review with Construction, Maintenance and Contractor. Record discussions and findings

L. Fence;

1) Provide Pedestrian Gates around Bridges for Inspection Work
2) Provide access gates to enter roadside from frontage roads or cul-de-sacs where available.

M. Vegetation Control;

1) “On projects that include new or reconstructed metal beam guardrail and thrie beam barrier, including single and double barrier, Vegetation Control – Minor Concrete (rubber weed mat can be used in the unaffected locations) should be considered as part of guardrail or barrier design where vegetation control is necessary. The use of this feature should be determined during the Project Initiation Document (PID) phase. Appropriate judgment should be used in weighing the impact to scope, cost, and schedule when incorporation this treatment on projects that have advanced beyond the PID phase”.
2) “Vegetation Control treatment areas are;
    a. Highway Barriers (MBGR, Single or Double Barrier, Thrie Beam Barrier)
    b. Gores
    c. Extended Gore areas
    d. Misc. narrow and small areas(Triangle, Strips, Medians)
    e. Slope paving
    f. Road edge (fire strip, soft shoulder)
    g. Fences
    h. Appurtenances (pull boxes, valve boxes, call boxes)
    i. Large overhead and electrical signs (around footing)”