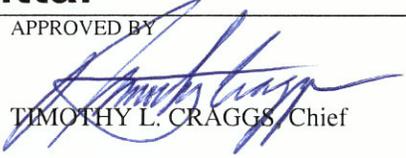


manual change transmittal

		NO.
TITLE DIVISION OF DESIGN HIGHWAY DESIGN MANUAL SIXTH EDITION – CHANGE 06/21/13	APPROVED BY  TIMOTHY L. CRAGGS, Chief	Date Issued: 06/14/13
		Page 1 of 2
SUBJECT AREA Table of Contents; List of Tables; Chapters: 80, 100, and 700	ISSUING UNIT DIVISION OF DESIGN	
SUPERCEDES SEE BELOW FOR SPECIFIC PAGE NUMBERS	DISTRIBUTION ALL HOLDERS OF THE 6TH EDITION, HIGHWAY DESIGN MANUAL	

The Table of Contents; List of Tables; and Chapters: 80, 100, and 700 of the Sixth Edition, Highway Design Manual (HDM) have been revised. The changes to the HDM are summarized below with change sheets available on the Department Design website at: <http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm>. Changes include delegation of Division of Design (DOD) approvals to the District Directors, extended clarification of fence guidance, and various errata corrections. The delegation resulted from a Department-wide Program Review, which recommended an evaluation of DOD approvals that could be delegated to the lowest responsible level in the district, along with accountability for decisions. This revision to the HDM implements the results of the DOD evaluation as provided in Department memorandum dated June 7, 2013, signed by Timothy Craggs, entitled “Division of Design Policy Updates”. These changes and errata are effective June 21, 2013, and shall be applied to on-going projects in accordance with HDM Index 82.5 – Effective Date for Implementing Revisions to Design Standards.

HDM Holders are encouraged to use the most recent version of the HDM available on-line at the above website. Should a HDM Holder choose to maintain a paper copy, the Holder is responsible for keeping their paper copy up to date and current. Using the latest version available on-line will ensure proper reference to the latest design standards and guidance. If you would like to be notified automatically of any significant changes or updates to the HDM, go to <http://www.dot.ca.gov/hq/oppd/hdm/hdmlist.htm>.

A summary of the most significant revisions are as follows:

Index 81.1

Philosophy, Page 80-1

Errata clarification of Project Development process as it applies to all users of the facility and transportation modes.

Index 81.2

Highway Context, Page 80-1

Errata rewording to clarify the flexibility in applying design standards with respect to the context of the facility.

Index 81.3(3)

Urban and Urbanized Areas, Page 80-4

Replaced the often changing website address where urban areas are provided to a more reliable location that provides this and more design information.

- Index 82.2** **Approvals for Nonstandard Design, Page 80-7**
Includes approval authority from mandatory standards as well as decisions requiring other approvals that have been delegated to the District Directors. Delegated approvals are identified in revised Tables 82.1A and 82.1C. Added reference to existing Table 82.1B, Advisory Standards. Added reference to the dispute resolution process contained in Chapter 21 of the Project Development Procedures Manual.
- Index 82.5** **Effective Date for Implementing Revisions to Design Standards, Page 80-8**
First bullet, last sentence, replaced the word “will” to “must” for consistency with Index 82.4.
- Table 82.1A** **Mandatory Standards, Page 80-10**
Revised superscript (2) to indicate mandatory standards that are delegated to the District Director. Added superscript (3) to indicate mandatory standards that are delegated to the State Pavement Engineer. Added superscript (1) to Caltrans-only mandatory standards that were not previously indicated.
- Table 82.1C** **Decisions Requiring Other Approvals, Page 80-18**
Added asterisk to indicate those decisions requiring other approvals that are delegated to the District Director.
- Index 108.3(3)** **Commuter and Light Rail Facilities Within State Right of Way, Page 100-16**
Revised to be consistent with delegation to District Director.
- Topic 701** **Fences, Page 700-1**
Revised fence guidance to define the type, intent, and purpose of fences constructed by the Department. Guidance regarding locked gates was expanded to clarify the special situations and approval requirement when used in access control fences.
- Index 706.1** **Roadside Management, Page 700-7**
Last bullet of Index, errata correction replacing metric units with the equivalent U.S. Customary (English) units.

Enclosures available on the Department Design website at: <http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm>.

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CHAPTER 80 APPLICATION OF DESIGN STANDARDS

Topic 81 - Project Development Overview

Index 81.1 - Philosophy

The Project Development process seeks to provide a degree of mobility to users of the transportation system that is in balance with other values. In the development of transportation projects, social, economic, and environmental effects must be considered fully along with technical issues so that final decisions are made in the best overall public interest. Attention should be given to such considerations as:

- (a) Need to provide transportation for all users (motorists, bicyclists, transit riders, and pedestrians) of the facility and transportation modes.
- (b) Attainment of community goals and objectives.
- (c) Needs of low mobility and disadvantaged groups.
- (d) Costs and benefits of eliminating or minimizing adverse effects on natural resources, environmental values, public services, aesthetic values, and community and individual integrity.
- (e) Planning based on realistic financial estimates.
- (f) The cost, ease, and safety of maintaining whatever is built.

Proper consideration of these items requires that a facility be viewed from the perspectives of the user, the nearby community, and larger statewide interests. For the user, efficient travel, mode selection, and safety are paramount concerns. At the same time, the community often is more concerned about local aesthetic, social, and economic impacts. The general population, however, tends to be interested in how successfully a project functions as part of the overall transportation system and how large a share of available capital resources it consumes. Therefore, individual projects must be selected for

construction on the basis of overall system benefits as well as community goals, plans, and values.

Decisions must also emphasize the connectivity between the different transportation modes so that they work together effectively.

The goal is to increase person and goods throughput, highway mobility and safety in a manner that is compatible with, or which enhances, adjacent community values and plans.

81.2 Highway Context

The context of a highway is a critical factor when developing the purpose and need statement for a project in addition to making fundamental design decisions such as its typical cross section and when selecting the design elements and aesthetic features such as street furniture and construction materials. Designing a highway that is sensitive to, and respectful of, the surrounding context is critical for project success in the minds of the Department and our stakeholders.

A “one-size-fits-all” design philosophy is not Departmental policy. Designers need to be aware of and sensitive to land use, community context and the associated user needs of the facility. In some instances, the design criteria and standards in this manual are based on the land use contexts in which the State highway is located, for instance: large population areas and downtowns in urban areas, small rural towns and communities, suburban commercial/residential areas, and rural corridors. This approach ensures the standards are flexible, and the approach allows and encourages methods to minimize impacts on scenic, historic, archaeological, environmental, and other important resources.

Beyond their intended transportation benefits, State highways can significantly impact the civic, social and economic conditions of local communities. Designing transportation facilities that integrate the local transportation and land uses while making the design responsive to the other needs of the community support the livability of the community and are usually a complementary goal to meeting the transportation needs of the users of the State highway system.

To do this successfully, the designer needs to have an understanding of the area surrounding the

highway and the users of the highway, its function within the regional and State transportation systems, (which includes all transportation modes), and the level of access control needed. To gain this understanding, the designer must consult the Transportation Concept Reports and work with the planning division and the local agencies.

In this manual, the following concepts are used to discuss the context of a highway:

- Place Type - the surrounding built and natural environment;
- Type of Highway - the role the highway plays in terms of providing regional or interregional connectivity and local access; and,
- Access Control - the degree of connection or separation between the highway and the surrounding land use.

A Main Street design is not a solution to creating a specific place type, but a design philosophy to be applied through a community. A main street design serves pedestrians, bicyclists, businesses and public transit with motorized traffic traveling at speeds of 20 to 40 miles per hour. See the Department's Main Streets Guide for more information.

81.3 Place Types

A place type describes the area's physical environment and the land uses surrounding the State highway. The place types described below are intentionally broad. Place types should be agreed upon in partnership with all of the project stakeholders; however, there likely may be more than one place type within the limits of a project. Ultimately, the place types selected can be used to determine the appropriate application of the guidance provided in this manual. These place type definitions are independent of the Federal government definitions of urban and rural areas. See Title 23 United States Code, Section 13 for further information.

Identifying the appropriate place type(s) involves discussions with the project sponsors, ideally through the Project Development Team (PDT) process, and requires coordination with the land use planning activities associated with the on-going local and regional planning activities. Extensive community engagement throughout both the project planning and project development processes

helps to formulate context sensitive project alternatives and transportation facilities that coordinate with the local land uses.

The following place types are used in this manual:

(1) *Rural Areas*. Rural areas are typically sparsely settled and developed. They can consist of protected federal and State lands, agricultural lands, and may include tourist and recreational destinations. However, as rural lands transition into rural communities, they can become more developed and suburban and urban-like by providing for a mixture of housing, commercial, industrial and public institutions. For the use of this manual, rural areas have been subcategorized as Natural Corridors, Developing Corridors and City/Town Centers (Rural Main Streets).

(a) Natural Corridors. Typically, the desire in these corridors is to preserve the natural and scenic countryside while at the same time provide transportation services to support the travel and tourism that occurs when visiting these locations. Examples of this place type are: National/State Forests and Parklands; agricultural lands with scattered farm buildings and residences; and, low density development. See Topic 109 for additional information.

(b) Developing Corridors. State highways traveling through these lands tend to be increasingly clustered with industrial, commercial, and residential areas as they lead into a rural city or town center. These corridors can be a transition zone among the aforementioned areas. Highways associated with these locations help to deliver tourists, but they also need to support the local communities and their local economies. In addition, these highways also serve a role and should be efficient at moving people and goods between regions.

Industrial, commercial and retail buildings tend to be located separately from housing and are typically set back from the highway with parking areas placed in front. Truck traffic on these highways tends to serve the needs of these

industrial, commercial and retail buildings; however, there will be a component of the truck traffic that is transporting their loads inter-regionally. Therefore, corridors in areas that are in transition may need to accommodate design vehicles.

- (c) *City or Town Centers (Rural Main Streets)*. State highways in this scenario are usually a conventional main street through the rural city or town, or they may be the only main street. The use of the State highway in this environment varies depending upon the individual community, as does the mix of buildings, services, businesses, and public spaces. Transit is often present and should be incorporated into the transportation system as appropriate. Transportation improvement projects on these main street highways can be more complicated and costly than similar projects in more rural settings. A balance usually needs to be maintained between the needs of the through traffic and those of the local main street environment. Thus, analyzing the pedestrian and bicyclist needs early in the development of the project and then following through on the agreements during the design of highway projects in these locations can be especially important. Accommodating the pedestrian and bicyclist needs concurrently in projects leads to greater efficiency in the use of funding.
- (2) *Suburban Areas*. Suburban areas lead into and can completely surround urban areas. A mixture of land uses is typical in suburban areas. This land use mixture can consist of housing, retail businesses and services, and may include regional centers such as shopping malls and other similar regional destinations; which are usually associated with suburban communities (cities and towns) that can be connected with larger urban centers and cities. Assessing the needs of pedestrians, bicyclists, and transit users in concert with the vehicular needs of motorists and truck drivers is necessary during the project planning, development and design of highway projects in these locations. Accommodating all of these needs concurrently into a project leads to greater efficiency in the use of funding. For the use of this manual, suburban areas have been categorized as either Lower Density/Residential Neighborhoods or Higher Density/Regional Community Centers (Suburban Main Streets).
- (a) *Lower Density / Residential Neighborhoods*. State highways typically do not cross through this place type. This place type usually feeds users onto the State highway system and is typically under the jurisdiction of a local entity. State highways, if they do interact with this place type, usually just connect at the edges of them where the pedestrians, bicyclists, and motor vehicle operators integrate into the highway system that includes transit facilities.
- (b) *Higher Density / Regional Community Centers (Suburban Main Streets)*. As suburban areas grow they tend to merge together into each other's boundaries. Growth in some locations can create "Megacommunities." While these megacommunities seem to function as individual cities, they typically have multiple distinct community centers that require highways with the capacity to serve not only each center, but the center-to-center traveler needs. These areas typically require the State highway to serve not only the originally urbanized area, but also the newer suburban areas that have been created where the housing, shopping and employment opportunities are all centered. Anticipating and accommodating growth in this place type can be a challenge. State and local governments, the business community and citizens groups, and metropolitan planning organizations all need to agree on how to meet the community needs, and at times the interregional needs of the highway.
- (3) *Urban and Urbanized Areas*. Urban areas generally are the major population centers in the State. Large numbers of people live in these urbanized areas where growth is

expected to continue. Bicycling, transit, and walking are important transportation modes in these areas and as the facilities for pedestrians, transit and bicyclists expand in these areas, the percentage and number of travelers walking, using transit and bicycling is also likely to increase. State agencies and the local governmental entities, the business community and citizens groups, congestion Management Agencies and the local/regional metropolitan planning organization (MPO) need to all agree upon the concept of the transportation facilities being provided so that the community needs can be met.

Urban areas are typically high-density locations such as central business districts, downtown communities, and major activity centers. They have a full range of land uses and are associated with a large diversity of activities. For the use of place types in this manual, urban areas have been categorized as Lower Density Parklands and Residential Neighborhoods and Higher Density Urban Main Streets. Higher Density Urban Main Streets have been further characterized as Community Centers and Downtown Cores.

- (a) Lower Density Parklands and Residential Neighborhoods. Large numbers of people live in these urbanized areas and bicycling, transit and walking are important transportation modes in these areas. Parklands can enhance these neighborhoods and parkland preservation is a concern, as well as, access to support travel and tourism to the parklands.
- (b) High Density Urban Main Streets.
 - Community Centers or Corridor. Strategically improving the design and function of the existing State highways that cross these centers is typically a concern. Providing transportation options to enhancing these urban neighborhoods that combine highway, transit, passenger rail, walking, and biking options are desirable, while they also help promote tourism and shopping.

- Downtown Cores. Similar to community centers, much of the transportation system has already been built and its footprint in the community needs to be preserved while its use may need to be reallocated. Successfully meeting the mobility needs of a major metropolitan downtown core area requires a balanced approach. Such an approach is typically used to enhance the existing transportation network's performance by adding capacity to the highways, sidewalks, and transit stations for all of the users of the system, and/or adding such enhancement features as HOV lanes, BRT, walkable corridors, etc. Right of way is limited and costly to purchase in these locations. Delivery truck traffic that supports the downtown core businesses can also create problems.

The HEPGIS tool on the FHWA website is available to determine if the project is in an urban area. Urban areas are found on the Highway Information tab of the tool.

81.4 Type of Highway

Much of the following terminology is either already discussed in Chapter 20 or defined in Topic 62. The additional information in this portion of the manual is being provided to connect these terms with the guidance that is being provided.

- (1) *Functional Classification.* One of the first steps in the highway design process is to define the function that the facility is to serve. The two major considerations in functionally classifying a highway are access and throughput. Access and mobility are inversely related; as access is increased, mobility decreases. In the AASHTO "A Policy on Geometric Design of Highways and Streets", highways are functionally classified first as either urban or rural. The hierarchy of the functional highway system within either an urban or rural area consists of the following:

- Principal arterial - main movement (high mobility, limited access) Typically 4 lanes or more;
 - Minor arterial - interconnects principal arterials (moderate mobility, limited access) Typically 2 or 3 lanes with turn lanes to benefit through traffic;
 - Collectors - connects local roads to arterials (moderate mobility, moderate access) with few businesses; and,
 - Local roads and streets - permits access to abutting land (high access, limited mobility).
- Designers have the ability to design for all modes of travel (vehicular, bicycle, pedestrian, truck and transit); and,
 - Designers have the flexibility to tailor a project to the unique circumstances that relate to it and its location, while meeting driver expectation.

Designers should balance the interregional transportation needs with the needs of the communities they pass through. The design of projects should, when possible, expand the options for biking, walking, and transit use. In planning and designing projects, the project development team should work with locals that have any livable policies as revitalizing urban centers, building local economies, and preserving historic sites and scenic country roads. The “Main Streets: Flexibility in Planning, Design and Operations” published by the Department should be consulted for additional guidance as should the FHWA publication “Flexibility in Highway Design”.

Early consultation and discussion with the Design Coordinator and the Design Reviewer during the project initiation document (PID) phase is also necessary to avoid issues that may arise later in the project development process. Design Information Bulletin 78 “Design Checklist for the Development of Geometric Plans” is a tool that can be used to identify and discuss design features that may deviate from standard.

The California Road System (CRS) maps are the official functional classification maps approved by Federal highway Administration. These maps show functional classification of roads.

- (2) *Interstate Highways.* The interstate highway system was originally designed to be high-speed interregional connectors and it is a portion of the National Highway System (NHS). In urban and suburban areas, a large percentage of vehicular traffic is carried on the interstate highway system, rather than on the local arterials and streets.
- (3) *State Routes.* The State highway system is described in the California Streets and Highway Code, Division 1, Chapter 2 and they are further defined in this manual in Topic 62.3, Highway Types which provides definitions for freeways, expressways, and highways.

81.5 Access Control

Index 62.3 defines a controlled access highway and a conventional highway. The level of access control plays a part in determining the design standards that are to be utilized when designing a highway. See Index 405.6 for additional access control guidance.

81.6 Design Standards and Highway Context

The design guidance and standards in this manual have been developed with the intent of ensuring that:

Topic 82 - Application of Standards

82.1 Highway Design Manual Standards

- (1) *General.* The highway design criteria and policies in this manual provide a guide for the engineer to exercise sound judgment in applying standards, consistent with the above Project Development philosophy, in the design of projects. This guidance allows for flexibility in applying design standards and approving design exceptions that take the context of the project location into consideration; which enables the designer to tailor the design, as appropriate, for the specific circumstances while maintaining safety.

The design standards used for any project should equal or exceed the minimum given in the Manual to the maximum extent feasible, taking into account costs (initial and life-cycle), traffic volumes, traffic and safety benefits, right of way, socio-economic and environmental impacts, maintenance, etc. Because design standards have evolved over many years, many existing highways do not conform fully to current standards. It is not intended that current manual standards be applied retroactively to all existing State highways; such is neither warranted nor economically feasible. However, when warranted, upgrading of existing roadway features such as guardrail, lighting, superelevation, roadbed width, etc., should be considered, either as independent projects or as part of larger projects. A record of the decision not to upgrade the existing non-standard mandatory or advisory features shall be provided through the exception process (See Index 82.2).

This manual does not address temporary construction features. It is recognized that the construction conditions encountered are so diverse and variable that it is not practical to set geometric criteria. Guidance for use of traffic control devices for temporary construction zones can be found in Part 6 – Temporary Traffic Control of the California Manual on Uniform Traffic Control Devices (California MUTCD). Guidance for the engineering of pavements in temporary construction zones is available in Index 612.6. In this manual, design standards and guidance are categorized in order of importance in development of a State highway system. See Index 82.4 for other mandatory procedural requirements.

(2) *Controlling Criteria.* The FHWA has designated thirteen controlling criteria for selection of design standards of primary importance for highway safety, listed as follows: design speed, lane width, shoulder width, bridge width, horizontal alignment, vertical alignment, grade, stopping sight distance, cross slope, superelevation, horizontal clearance, vertical clearance and bridge structural

capacity. All but the last of these criteria are also designated as geometric criteria.

The design standards related to the 12 geometric criteria are designated as mandatory standards in this manual (see Index 82.1(2) and Table 82.1A).

- (3) *Mandatory Standards.* Mandatory design standards are those considered most essential to achievement of overall design objectives. Many pertain to requirements of law or regulations such as those embodied in the FHWA's 13 controlling criteria (see above). Mandatory standards use the word "shall" and are printed in **Boldface** type (see Table 82.1A).
- (4) *Advisory Standards.* Advisory design standards are important also, but allow greater flexibility in application to accommodate design constraints or be compatible with local conditions on resurfacing or rehabilitation projects. Advisory standards use the word "should" and are indicated by Underlining (see Table 82.1B).
- (5) *Decision Requiring Other Approvals.* There are design criteria decisions that are not bold or underlined text which require specific approvals from individuals to whom such decisions have been delegated. These individuals include, but are not limited to, District Directors, Traffic Liaisons, Design Coordinators or their combination as specified in this manual. These decisions should be documented as the individual approving desires.
- (6) *Permissive Standards.* All standards other than mandatory, advisory, or decisions requiring other approvals, whether indicated by the use of "should", "may", or "can" are permissive.
- (7) *Other.* In addition to the design standards in this manual, see Index 82.7 for general information on the Department's traffic engineering policy, standards, practices and study warrants.

Caution must be exercised when using other Caltrans publications which provide guidelines for the design of highway facilities,

such as HOV lanes. These publications do not contain design standards; moreover, the designs suggested in these publications do not always meet Highway Design Manual Standards. Therefore, all other Caltrans publications must be used in conjunction with this manual.

82.2 Approvals for Nonstandard Design

- (1) *Mandatory Standards.* Design features or elements which deviate from mandatory standards indicated herein require the approval of the Chief, Division of Design. This approval authority has been delegated to the Design Coordinators, except as noted in Table 82.1A where: (a) the mandatory standard has been delegated to the District Director and (b) the mandatory standards in Chapters 600 through 670 requires the approval of the State Pavement Engineer, and may involve coordination with the Design Coordinator.

The current procedures and documentation requirements pertaining to the approval process for those exceptions to mandatory design standards as well as the dispute resolution process are contained in Chapter 21 of the Project Development Procedures Manual (PDPM).

Design exception approval must be obtained pursuant to the instructions in PDPM Chapter 9.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) allowed significant delegation to the states by FHWA to approve and administer portions of the Federal-Aid Transportation Program. SAFETEA-LU further allowed delegation to the State DOT's and in response to this a Joint Stewardship and Oversight Agreement (JSOA) document between FHWA and Caltrans was signed. The JSOA outlines the process to determine specific project related delegation to the Department. The JSOA requires, FHWA approval of exceptions to mandatory design standards related to the 13 controlling criteria on all Interstate projects whether FHWA has oversight responsibilities or not. FHWA approval should be sought as

early in the project development process as possible. However, formal FHWA approval shall not be requested until the appropriate Caltrans representative has approved the design exception.

FHWA approval is not required for exceptions to "Caltrans-only" mandatory standards. Table 82.1A identifies these mandatory standards.

For local facilities crossing the State right of way see Index 308.1.

- (2) *Advisory Standards.* The authority to approve exceptions to advisory standards has been delegated to the District Directors. A list of advisory standards is provided in Table 82.1B. Proposals for exceptions from advisory standards can be discussed with the Design Coordinators during development of the approval documentation. The responsibility for the establishment of procedures for review, documentation, and long term retention of approved exceptions from advisory standards has also been delegated to the District Directors.
- (3) *Decisions Requiring Other Approvals.* The authority to approve specific decisions identified in the text are also listed in Table 82.1C. The form of documentation or other instructions are provided as directed by the approval authority.

82.3 Use of FHWA and AASHTO Standards and Policies

The standards in this manual generally conform to the standards and policies set forth in the AASHTO publications, "A Policy on Geometric Design of Highways and Streets" (2001) and "A Policy on Design Standards-Interstate System" (2005). A third AASHTO publication, the latest edition of the "Roadside Design Guide", focuses on creating safer roadsides. These three documents, along with other AASHTO and FHWA publications cited in 23 CFR Ch 1, Part 625, Appendix A, contain most of the current AASHTO policies and standards, and are approved references to be used in conjunction with this manual.

AASHTO policies and standards, which are established as nationwide standards, do not always

satisfy California conditions. When standards differ, the instructions in this manual govern, except when necessary for FHWA project approval (Index 108.3, Coordination with the FHWA).

82.4 Mandatory Procedural Requirements

Required procedures and policies for which Caltrans is responsible, relating to project clearances, permits, licenses, required tests, documentation, value engineering, etc., are indicated by use of the word "must". Procedures and actions to be performed by others (subject to notification by Caltrans), or statements of fact are indicated by the word "will".

82.5 Effective Date for Implementing Revisions to Design Standards

Revisions to design standards will be issued with a stated effective date. It is understood that all projects will be designed to current standards unless an exception has been approved in accordance with Index 82.2.

On projects where the project development process has started, the following conditions on the effective date of the new or revised standards will be applied:

- For all projects where the PS&E has not been finalized, the new or revised design standards shall be incorporated unless this would impose a significant delay in the project schedule or a significant increase in the project engineering or construction costs. The Design Coordinator or individual delegated authority must make the final determination on whether to apply the new or previous design standards on a project-by-project basis for roadway features.
- For all projects where the PS&E has been submitted to Headquarters Office Engineer for advertising or the project is under construction, the new or revised standards will be incorporated only if they are identified in the Change Transmittal as requiring special implementation.

For locally-sponsored projects, the Oversight Engineer must inform the funding sponsor within 15 working days of the effective date of any changes in mandatory or advisory design standards as defined in Index 82.2.

82.6 Design Information Bulletins and Other Guidance

In addition to the design standards in this manual, Design Information Bulletins (DIBs) establish policies and procedures for the various design specialties of the Department that are in the Division of Design. Some DIBs may eventually become part of this manual, while others are written with the intention to remain as design guidance in the DIB format. References to DIBs are made in this manual by the "base" DIB number only and considered to be the latest version available on the Department Design website. See the Department Design website for further information concerning DIB numbering protocol and postings.

Caution must be exercised when using other Caltrans publications, which provide guidelines for the design of highway facilities, such as HOV lanes. These publications do not contain design standards; moreover, the designs suggested in these publications do not always meet Highway Design Manual Standards. Therefore, all other Caltrans publications must be used in conjunction with this manual.

82.7 Traffic Engineering

The Division of Traffic Operations maintains engineering policy, standards, practices and study warrants to direct and guide decision-making on a broad range of design and traffic engineering features and systems, which are provided to meet the site-specific safety and mobility needs of all highway users.

The infrastructure within a highway or freeway corridor, segment, intersection or interchange is not "complete" for drivers, bicyclists and pedestrians unless it includes the appropriate traffic control devices; traffic safety systems; operational features or strategies; and traffic management elements and or systems. The presence or absence of these traffic elements and systems can have a profound effect on safety and operational performance. As such, they are commonly employed to remediate performance deficiencies and to optimize the overall performance of the "built" highway system.

For additional information visit the Division of
Traffic Operations website at:
<http://www.dot.ca.gov/hq/trafficops/>

**Table 82.1A
Mandatory Standards**

CHAPTER 100	BASIC DESIGN POLICIES	Topic 208	Bridges, Grade Separation Structures, and Structure Approach Embankment
Topic 101	Design Speed	Index 208.1	Bridge Width
Index 101.1	Technical Reductions of Design Speed	208.4	Bridge Sidewalk (Width)
101.1	Selection of Design Speed - Local Facilities ⁽²⁾	208.10	Barriers on Structures with Sidewalks
101.1	Selection of Design Speed - Local Facilities - with Connections to State Facilities	208.10	Bridge Approach Railings ⁽¹⁾
101.2	Design Speed Standards		
Topic 104	Control of Access	CHAPTER 300	GEOMETRIC CROSS SECTION
Index 104.4	Protection of Access Rights ⁽¹⁾	Topic 301	Traveled Way Standards
CHAPTER 200	GEOMETRIC DESIGN AND STRUCTURE STANDARDS	Index 301.1	Lane Width
Topic 201	Sight Distance	301.2	Class II Bikeway Lane Width ⁽¹⁾
Index 201.1	Stopping Sight Distance Standards	301.3	Cross Slopes – New Construction
Topic 202	Superelevation	301.3	Cross Slopes – Resurfacing or widening
Index 202.2	Standards for Superelevation	301.3	Cross Slopes – Unpaved Roadway
202.7	Superelevation on City Streets and County Roads ⁽²⁾	301.3	Algebraic Differences in Cross Slopes
Topic 203	Horizontal Alignment	Topic 302	Shoulder Standards
Index 203.1	Horizontal Alignment - Local Facilities ⁽²⁾	Index 302.1	Shoulder Width
203.1	Horizontal Alignment and Stopping Sight Distance	302.1	Shoulder Width with Rumble Strip
203.2	Standards for Curvature – Minimum Radius	302.2	Shoulder Cross Slopes -Bridge
203.2	Standards for Curvature – Lateral Clearance	302.2	Shoulder Cross Slopes – Left
Topic 204	Grade	302.2	Shoulder Cross Slopes – Paved Median
Index 204.1	Standards for Grade - Local Facilities ⁽²⁾	302.2	Shoulder Cross Slopes - Right
204.3	Standards for Grade ⁽²⁾	Topic 303	Curbs, Dikes, and Side Gutters
204.8	Vertical Falsework Clearances ⁽¹⁾	Index 303.4	Shoulder at Bulbout ⁽²⁾
Topic 205	Road Connections and Driveways	Topic 305	Median Standards
Index 205.1	Sight Distance Requirements for Access Openings on Expressways	Index 305.1	Median Width – Conventional Highways ⁽¹⁾

- (1) Caltrans-only Mandatory Standard.
- (2) Authority to approve deviations from this Mandatory Standard is delegated to the District Director.
- (3) Authority to approve deviations from this Mandatory Standard is delegated to the State Pavement Engineer.

**Table 82.1A
Mandatory Standards (Cont.)**

<p>Topic 307</p> <p>Index 305.1 Median Width – Freeways and Expressways⁽¹⁾</p> <p>Cross Sections for State Highways</p> <p>Index 307.2 Shoulder Standards for Two-lane Cross Sections for New Construction</p> <p>Topic 308</p> <p>Index 308.1 Cross Section Standards for City Streets and County Roads without Connection to State Facilities⁽²⁾</p> <p>308.1 Minimum Width of 2-lane Overcrossing Structures for City Streets and County Roads without Connection to State Facilities⁽²⁾</p> <p>308.1 Cross Section Standards for City Streets and County Roads with Connection to State Facilities^{(1), (2)}</p> <p>308.1 Two-Lane Local Road Lane Width for City Streets and County Roads within Interchange⁽²⁾</p> <p>308.1 Multi-Lane Local Road Lane Width for City Streets and County Roads within Interchange⁽²⁾</p> <p>308.1 Shoulder Width Standards for City Streets and County Roads Lateral Obstructions⁽²⁾</p> <p>308.1 Shoulder Width Standards for City Streets and County Roads with Curbs and Gutter⁽²⁾</p> <p>308.1 Minimum Width for 2-lane Overcrossing at Interchanges⁽²⁾</p> <p>Topic 309</p> <p>Index 309.1 Horizontal Clearances and Stopping Sight Distance</p> <p>309.1 Horizontal Clearances</p> <p>309.2 Vertical Clearances - Major Structures</p> <p>309.2 Vertical Clearances - Minor Structures</p> <p>309.2 Vertical Clearances - Rural and Single Interstate Routing System</p> <p>309.3 Horizontal Tunnel Clearances</p> <p>309.3 Vertical Tunnel Clearances</p> <p>309.4 Lateral Clearance for Elevated Structures⁽¹⁾</p>	<p>309.5 Structures Across or Adjacent to Railroads - Vertical Clearance</p> <p>Topic 310</p> <p>Index 310.1 Frontage Road Width Cross Section^{(1), (2)}</p> <p>CHAPTER 400</p> <p>INTERSECTIONS AT GRADE</p> <p>Topic 404</p> <p>Index 404.2 Design Vehicle–Traveled Way⁽¹⁾</p> <p>404.4 California Legal Design Vehicles on the National Network and on Terminal Access Routes⁽¹⁾</p> <p>Topic 405</p> <p>Index 405.1 Corner Sight Distance – Driver Set Back</p> <p>405.1 Corner Sight Distance at Public Road Intersections</p> <p>405.1 Corner Sight Distance at Private Road Intersections</p> <p>405.2 Left-turn Channelization - Lane Width</p> <p>405.2 Left-turn Channelization - Lane Width – Restricted Urban</p> <p>405.2 Two-way Left-turn Lane Width</p> <p>405.3 Right-turn Channelization – Lane and Shoulder Width</p> <p>CHAPTER 500</p> <p>TRAFFIC INTERCHANGES</p> <p>Topic 501</p> <p>Index 501.3 Interchange Spacing⁽¹⁾</p> <p>Topic 502</p> <p>Index 502.2 Isolated Off-Ramps and Partial Interchanges⁽¹⁾</p> <p>502.3 Route Continuity⁽¹⁾</p>
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(1) Caltrans-only Mandatory Standard.

(2) Authority to approve deviations from this Mandatory Standard is delegated to the District Director.

(3) Authority to approve deviations from this Mandatory Standard is delegated to the State Pavement Engineer.

**Table 82.1A
Mandatory Standards (Cont.)**

Topic 504	Interchange Design Standards
Index 504.2	Location of Freeway Entrances & Exits ⁽¹⁾
504.2	Ramp Deceleration Lane and “DL” Distance ⁽¹⁾
504.3	Ramp Lane Width
504.3	Ramp Shoulder Width
504.3	Ramp Lane Drop Taper Past the Limit Line ⁽¹⁾
504.3	Metered Multi-Lane Ramp Lane Drop Taper Past the Limit Line ⁽¹⁾
504.3	Ramp Meters on Connector Ramps ⁽¹⁾
504.3	Lane Drop Transitions on Connector Ramps ⁽¹⁾
504.3	Distance Between Ramp Intersection and Local Road Intersection ⁽¹⁾
504.4	Freeway-to-freeway Connections - Shoulder Width – 1 and 2-Lane
504.4	Freeway-to-freeway Connections - Shoulder Width – 3-Lane
504.7	Minimum Weave Length ⁽¹⁾
504.8	Access Control along Ramps ⁽¹⁾
504.8	Access Control at Ramp Terminal ⁽¹⁾
504.8	Access Rights Opposite Ramp Terminals ⁽¹⁾

CHAPTER 610 PAVEMENT ENGINEERING CONSIDERATIONS

Topic 612	Pavement Design Life
Index 612.2	Design Life for New Construction and Reconstruction ^{(1), (3)}
612.3	Pavement Design Life for Widening Projects ^{(1), (3)}
612.5	Pavement Design Life for Pavement Roadway Rehabilitation Projects ^{(1), (3)}

Topic 613	Traffic Considerations
Index 613.5	Shoulder Traffic Loading Considerations ^{(1), (3)}

CHAPTER 620 RIGID PAVEMENT	
Topic 622 Engineering Requirements	
Index 622.4	Dowel Bars and Tie Bars for New or Reconstructed Rigid Pavements ^{(1), (3)}
Index 622.8	Transitions and Terminal Anchors for CRCP ^{(1), (3)}
Topic 625 Engineering Procedures for Pavement and Roadway Rehabilitation	
Index 625.1	Limits of Paving on Resurfacing Projects ^{(1), (3)}
Topic 626 Other Considerations	
Index 626.2	Tied Rigid Shoulder Standards ^{(1), (3)}
626.2	Tied Rigid Shoulders or Widened Slab Standards ^{(1), (3)}
626.2	Tied Rigid Shoulders or Widened Slab at Ramps and Gore Standard ^{(1), (3)}

CHAPTER 630 FLEXIBLE PAVEMENT	
Topic 633 Engineering Procedures for New & Reconstruction Projects	
Index 633.1	Enhancements for Pavement Design Life Greater Than 20 Years ^{(1), (3)}
Topic 635 Engineering Procedures for Flexible Pavement and Roadway Rehabilitation	
Index 635.1	Limits of Paving on Resurfacing Projects ^{(1), (3)}

CHAPTER 640 COMPOSITE PAVEMENTS	
Topic 645 Engineering Procedures for Pavement and Roadway Rehabilitation	
Index 645.1	Limits of Paving on Overlay Projects ^{(1), (3)}

- (1) Caltrans-only Mandatory Standard.
- (2) Authority to approve deviations from this Mandatory Standard is delegated to the District Director.
- (3) Authority to approve deviations from this Mandatory Standard is delegated to the State Pavement Engineer.

**Table 82.1A
Mandatory Standards (Cont.)**

CHAPTER 700	MISCELLANEOUS STANDARDS	1003.1	Physical Barriers Adjacent to Class I Bikeways ^{(1), (2)}
Topic 701	Fences	1003.1	Class I Bikeway in Medians ^{(1), (2)}
Index 701.2	Fences on Freeways and Expressways ⁽¹⁾	1003.1	Class I Bikeway Design Speeds ^{(1), (2)}
		1003.1	Stopping Sight Distance ⁽²⁾
CHAPTER 900	LANDSCAPE ARCHITECTURE	1003.1	Obstacle Posts or Bollards in Bicycle Paths ⁽²⁾
Topic 902	Planting Guidelines	CHAPTER 1100	HIGHWAY TRAFFIC NOISE ABATEMENT
Index 902.3	Trees In Conventional Highway Medians, Distance From Longitudinal End of Median ⁽¹⁾	Topic 1102	Design Criteria
902.3	The Planting of Trees in Conventional Highway Medians, Less Than 35 mph Posted Speeds ⁽¹⁾	Index 1102.2	Horizontal Clearance to Noise Barrier
902.3	The Planting of Trees in Conventional Highway Medians, 45 mph or Less Posted Speeds ⁽¹⁾	1102.2	Noise Barrier on Safety Shape Concrete Barrier ⁽¹⁾
902.3	The Planting of Trees in Conventional Highway Medians, Greater Than 45 mph Posted Speeds ⁽¹⁾		
Topic 903	Safety Roadside Rest Area Design Standards and Guidelines		
Index 903.5	Rest Area Ramp Design		
Topic 904	Vista Point Standards and Guidelines		
Index 904.3	Vista Point Ramp Design		
CHAPTER 1000	BICYCLE TRANSPORTATION DESIGN		
Topic 1003	Design Criteria		
Index 1003.1	Class I Bikeway Widths ^{(1), (2)}		
1003.1	Class I Bikeway Shoulder Width ^{(1), (2)}		
1003.1	Class I Bikeway Horizontal Clearance ^{(1), (2)}		
1003.1	Class I Bikeway Structure Width ^{(1), (2)}		
1003.1	Class I Bikeway Vertical Clearance ^{(1), (2)}		
1003.1	Class I Bikeway Minimum Separation From Edge of Traveled Way ^{(1), (2)}		

<p>(1) Caltrans-only Mandatory Standard.</p> <p>(2) Authority to approve deviations from this Mandatory Standard is delegated to the District Director.</p> <p>(3) Authority to approve deviations from this Mandatory Standard is delegated to the State Pavement Engineer.</p>
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**Table 82.1B
Advisory Standards**

CHAPTER 100	BASIC DESIGN POLICIES	202.7	Superelevation on City Streets and County Roads
Topic 101	Design Speed	Topic 203	Horizontal Alignment
Index 101.1	Selection of Design Speed - Local Facilities	Index 203.1	Horizontal Alignment - Local Facilities
101.1	Selection of Design Speed - Local Facilities - with Connections to State Facilities	203.3	Alignment Consistency and Design Speed
101.2	Design Speed Standards	203.5	Compound Curves
Topic 104	Control of Access	203.5	Compound Curves on One-Way Roads
Index 104.5	Relation of Access Opening to Median Opening	203.6	Reversing Curves – Transition Length
Topic 105	Pedestrian Facilities	203.6	Reversing Curves – Transition Rate
Index 105.2	Minimum Sidewalk Width – Next to a Building	Topic 204	Grade
105.2	Minimum Sidewalk Width – Not Next to a Building	Index 204.1	Standards for Grade - Local Facilities
105.5	New Construction, Two Curb Ramp Design	204.3	Standards for Grade
Topic 107	Roadside Installations	204.3	Ramp Grades
Index 107.1	Standards for Roadway Connections	204.4	Vertical Curves – 2 Percent and Greater
107.1	Number of Exits and Entrances Allowed at Roadway Connections	204.4	Vertical Curves – Less Than 2 Percent
CHAPTER 200	GEOMETRIC DESIGN AND STRUCTURE STANDARDS	204.5	Decision Sight Distance at Climbing Lane Drops
Topic 201	Sight Distance	204.6	Horizontal and Vertical Curves Consistency in Mountainous or Rolling Terrain
Index 201.3	Stopping Sight Distance on Sustained Grades	Topic 205	Road Connections and Driveways
201.7	Decision Sight Distance	Index 205.1	Access Opening Spacing on Expressways
Topic 202	Superelevation	205.1	Access Opening Spacing on Expressways – Location
Index 202.2	Superelevation on Same Plane for Rural Two-lane Roads	Topic 206	Pavement Transitions
202.2	Superelevation on Class II and III Bikeways	Index 206.3	Lane Drop Transitions
202.5	Superelevation Transition	206.3	Lane Width Reductions
202.5	Superelevation Runoff	Topic 208	Bridges, Grade Separation Structures, and Structure Approach Embankment
202.5	Superelevation in Restrictive Situations	Index 208.3	Decking of Bridge Medians
202.6	Superelevation of Compound Curves	208.6	Minimum Height of Pedestrian Undercrossings
		208.6	Class I Bikeways Exclusive Use

**Table 82.1B
Advisory Standards (Cont.)**

208.10	Protective Screening on Overcrossings	Topic 310	Frontage Roads
208.10	Bicycle Railing Locations	Index 310.2	Outer Separation – Urban and Mountainous Areas
Topic 210	Earth Retaining Systems	310.2	Outer Separation – Rural Areas
Index 210.6	Cable Railing	CHAPTER 400	INTERSECTIONS AT GRADE
CHAPTER 300	GEOMETRIC CROSS SECTION	Topic 403	Principles of Channelization
Topic 301	Traveled Way Standards	Index 403.3	Angle of Intersection
Index 301.2	Class II Bikeway Lane Width	403.6	Optional Right-Turn Lanes
301.3	Algebraic Differences of Cross Slopes at Various Locations	403.6	Right-Turn-Only Lane and Bike Lane
Topic 303	Curbs, Dikes, and Side Gutters	Topic 404	Design Vehicles and Related Definitions
303.1	Use of Curb with Posted Speeds of 40 mph and Greater	Index 404.4	STAA Design Vehicles on the National Network and on Terminal Access Routes
303.3	Dike Selection	404.4	California Legal Design Vehicle Accommodation
303.4	Bulbout Design	404.4	45-Foot Bus and Motorhome Design Vehicle
Topic 304	Side Slopes	Topic 405	Intersection Design Standards
Index 304.1	Side Slopes 4:1 or Flatter	Index 405.1	Corner Sight Distance at Unsignalized Public Road Intersections
304.1	18 ft Minimum Catch Distance	405.1	Decision Sight Distance at Intersections
Topic 305	Median Standards	405.4	Traffic Island Pedestrian Refuge
Index 305.1	Median Pedestrian Refuge Island	405.5	Emergency Openings and Sight Distance
305.1	Median Width Freeways and Expressways	405.5	Median Opening Locations
305.1	Median With Conventional Highways	CHAPTER 500	TRAFFIC INTERCHANGES
305.2	Median Cross Slopes	Topic 504	Interchange Design Standards
Topic 308	Cross Sections for Roads Under Other Jurisdictions	Index 504.2	Ramp Entrance and Exit Standards
Index 308.1	Cross Section Standards for City Streets and County Roads without Connection to State Facilities	504.2	Collector-Distributor Deceleration Lane and “DL” Distance
Topic 309	Clearances	504.2	Paved Width at Gore
Index 309.1	Clear Recovery Zone	504.2	Contrasting Surface Treatment
309.1	Horizontal Clearance	504.2	Auxiliary Lanes
309.1	Safety Shaped Barriers at Retaining, Pier, or Abutment Walls	504.2	Freeway Exit Nose Design Speed
309.1	High Speed Rail Clearance		
309.5	Structures Across or Adjacent to Railroads - Vertical Clearance		

Table 82.1B
Advisory Standards (Cont.)

504.2	Decision Sight Distance at Exits and Branch Connections	504.4	Profile Grades on Freeway-to-freeway Connectors
504.2	Design Speed and Alignment Consistency at Inlet Nose	504.4	Single-lane Freeway-to-freeway Connector Design
504.2	Freeway Ramp Profile Grades	504.4	Single-lane Connector Widening for Passing
504.2	Differences in Pavement Cross Slopes at Freeway Entrances and Exits	504.4	Volumes Requiring Branch Connectors
504.2	Vertical Curves Beyond Freeway Exit Nose	504.4	Merging Branch Connector Design
504.2	Crest Vertical Curves at Freeway Exit Terminal	504.4	Diverging Branch Connector Design
504.2	Sag Vertical Curves at Freeway Exit Terminal	504.4	Merging Branch Connector Auxiliary Lanes
504.2	Ascending Entrance Ramps with Sustained Upgrades	504.4	Diverging Branch Connector Auxiliary Lanes
504.3	Ramp Terminus Design Speed	504.4	Freeway-to-freeway Connector Lane Drop Taper
504.3	Ramp Lane Drop Taper At 6-foot Separation Point	504.5	Auxiliary Lanes
504.3	Ramp Lane Drop Location	504.6	Mainline Lane Reduction at Interchanges
504.3	Metered Single-Lane Entrance Ramps Truck Volumes and Grades	504.8	Access Control at Ramp Terminal
504.3	Metered Multi-Lane Entrance Ramps Lane Drop		
504.3	Metered Multi-Lane Entrance Truck Volumes and Sustained Grades		
504.3	Ramp Terminals and Grade		
504.3	Ramp Terminals and Sight Distance		
504.3	Free Right-Turns at Ramp Terminals		
504.3	Distance between Ramp Intersection and Local Road Intersection		
504.3	Entrance Ramp Lane Drop		
504.3	Single-Lane Ramp Widening for Passing		
504.3	Two-lane Exit Ramps		
504.3	Two-lane Exit Ramps and Auxiliary Lanes		
504.3	Distance Between Successive On-ramps		
504.3	Distance Between Successive Exits		
504.4	Freeway-to-freeway Connections Design Speed		

<p>CHAPTER 610</p> <p>Topic 612</p> <p style="padding-left: 40px;">Index 612.6</p> <p>CHAPTER 620</p> <p>Topic 625</p> <p style="padding-left: 40px;">Index 625.1</p> <p>CHAPTER 630</p> <p>Topic 635</p> <p style="padding-left: 40px;">Index 635.1</p>	<p>PAVEMENT ENGINEERING CONSIDERATIONS</p> <p>Pavement Design Life</p> <p>Traffic Loading for Temporary Pavements and Detours</p> <p>RIGID PAVEMENT</p> <p>Engineering Procedures for Pavement and Roadway Rehabilitation</p> <p>Repair of Existing Pavement Distresses</p> <p>FLEXIBLE PAVEMENT</p> <p>Engineering Procedures for Flexible Pavement and Roadway Rehabilitation</p> <p>Repair of Existing Pavement Distresses</p>
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Table 82.1B Advisory Standards (Cont.)

CHAPTER 640	COMPOSITE PAVEMENTS
Topic 645	Engineering Procedures for Pavement and Roadway Rehabilitation
Index 645.1	Repair of Existing Pavement Distresses
CHAPTER 700	MISCELLANEOUS STANDARDS
Topic 701	Fences
Index 701.2	Fences on Freeways and Expressways
CHAPTER 900	LANDSCAPE ARCHITECTURE
Topic 902	Planting Guidelines
Index 902.1	Planting on Freeway Medians
902.2	Sight Distance to Mature Planting
902.2	Clear Recovery Zone to Mature Planting
902.2	Minimum Setback of Trees
902.3	The Planting of Trees On Conventional Highway Roadsides, Various Posted Speeds and Conditions
Topic 904	Vista Point Standards and Guidelines
Index 904.3	Road Connections to Vista Points
CHAPTER 1000	BICYCLE TRANSPORTATION DESIGN
Topic 1003	Bikeway Design Criteria
Index 1003.1	Class I Bikeway Horizontal Clearance

Table 82.1C
Decision Requiring Other Approvals

CHAPTER 100	BASIC DESIGN POLICIES	Topic 208.10	Bridge Barriers and Railing
		Index 208.10	Barrier Separation and Bridge Rail Selection
Topic 103	Design Designation	208.10	Concrete Barrier Type 80
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108.2	Transit Loading Facilities - ADA		
108.3	Rail Crossings*		
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		CHAPTER 300	GEOMETRIC CROSS SECTION
		Topic 303	Curbs, Dikes, and Side Gutters
		Index 303.4	Busbulbs
		Topic 304	Side Slopes
		Index 304.1	Side Slopes – Erosion Control
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		309.2	Vertical Clearance on National Highway System
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		CHAPTER 500	TRAFFIC INTERCHANGES
		Topic 502	Interchange Types
		Index 502.2	Single Point Interchange Interchanges
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		Topic 503	Interchange Procedure
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		Index 504.3	HOV Preferential Lane
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* Authority to approve deviations from this “Decision Requirement” is delegated to the District Director.

Table 82.1C
Decision Requiring Other Approvals (Cont.)

504.3	Enforcement Areas and Maintenance Pullouts - Length	CHAPTER 800	HIGHWAY DRAINAGE DESIGN
504.6	Mainline Lane Reduction	Topic 805	Preliminary Plans
CHAPTER 600	PAVEMENT ENGINEERING	Index 805.1	Requires FHWA Approval
Topic 604	Roles and Responsibilities for Pavement Engineering	805.2	Bridge Preliminary Report
Index 604.2	Standard Plans	805.4	Unusual Hydraulic Structures
604.2	Supplemental District Standards	805.5	Levees and Dams Formed by Highway Fills
Topic 606	Research and Special Designs	805.6	Geotechnical
Index 606.1	Research and Experimentation – Pilot Projects	Topic 808	Selected Computer Programs
606.1	Research and Experimentation – Special Designs	Index 808.1	Table 808.1
CHAPTER 610	PAVEMENT ENGINEERING CONSIDERATIONS	CHAPTER 820	CROSS DRAINAGE
Topic 614	Other Considerations	Topic 829	Other Considerations
Index 614.6	Compaction	Index 829.9	Dams
CHAPTER 620	RIGID PAVEMENT	CHAPTER 830	TRANSPORTATION FACILITY DRAINAGE
Topic 626	Other Considerations	Topic 837	Inlet Design
Index 626.2	Shoulder – Widened Slab	Index 837.2	Inlet Types
CHAPTER 700	MISCELLANEOUS STANDARDS	CHAPTER 850	PHYSICAL STANDARDS
Topic 701	Fences	Topic 853	Pipe Liners and Linings for Culvert Rehabilitation
Index 701.1	Fence Type and Location	Index 853.4	Alternative Pipe Liner Materials
701.2	Locked Gates - Maintenance Force Use	CHAPTER 870	CHANNEL AND SHORE PROTECTION – EROSION CONTROL
701.2	Locked Gates - Used by Utility Companies*	Topic 872	Planning and Location Studies
701.2	Locked Gates - Used by Other Public Agencies or by Non-Utility Entities – FHWA Approval Required on Interstates	Index 872.3	Site Consideration
Topic 706	Roadside Treatment	Topic 873	Design Concepts
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		CHAPTER 900	LANDSCAPE ARCHITECTURE
		Topic 901	General
		Index 901.1	Landscape Architecture Program - Approvals

* Authority to approve deviations from this “Decision Requirement” is delegated to the District Director.

Table 82.1C
Decision Requiring Other Approvals (Cont.)

Topic 902	Planting Guidelines
Index 902.3	Median Planting
902.3	Tree Species in Conventional Highway Median
902.3	Planting of Large Trees in Medians
902.3	Planting on Barriers
Topic 903	Safety Roadside Rest Areas Standards and Guidelines
Index 903.1	Deviation From Minimum Standard
903.6	Wastewater Disposal
Topic 904	Vista Point Standards and Guidelines
Index 904.1	Site Selection
904.3	Sanitary Facilities
Topic 905	Park and Ride Standards and Guidelines
Index 905.1	Site Selection
CHAPTER 1000	BICYCLE TRANSPORTATION DESIGN
Topic 1003	Miscellaneous Criteria
Index 1003.5	Bicycle Path at Railroad Crossings
CHAPTER 1100	HIGHWAY TRAFFIC NOISE ABATEMENT
Topic 1101	General Requirements
Index 1101.2	Objective – Extraordinary Abatement

* Authority to approve deviations from this “Decision Requirement” is delegated to the District Director.

complete report should be incorporated in the final environmental document. It should include:

- A map showing the section of freeway involved and the locations at which transit loading facilities are being considered.
 - A complete discussion of all public meetings held.
 - Data on type of transit service provided, both at present and after completion of the freeway.
 - Estimate of cost of each facility, including any additional cost such as right of way or lengthening of structures required to accommodate the facility.
 - Number of transit trips or buses per day and the number of on and off passengers per day served by the transit stops and the number estimated to use the proposed facilities.
 - District's recommendation as to the provision of transit loading facilities. If the recommendation is in favor of providing transit loading facilities, drawings showing location and tentative geometric designs should be included.
- (e) The DES-Structure Design has primary responsibility for the structural design of transit loading facilities involving structures. See Index 210.7. See also DIB 82 for instructions on submitting rail and transit station plans to the Department of General Services – Division of the State Architect (DSA) for review and approval of pedestrian facilities with regard to accessibility features. Accessible paths of travel must be provided to all pedestrian facilities, including shelters, tables, benches, drinking fountains, telephones, vending machines, and information kiosks. The path of travel from designated accessible parking, if applicable, to accessible facilities should be as short and direct as practical, must have an even surface, and must include curb ramps, marked aisles and crosswalks, and other features as required to facilitate use of the facility by individuals using wheelchairs, walkers or other mobility aids. The Department of General Services, Division of the State Architect, as well as the California Department of Transportation enforce the California Building Code (Title 24) for the various on-site improvements.
- (f) A cooperative agreement should be used to document the understanding between the Department and any local agency which desires a transit facility. The agreement covers items such as funding, ownership, maintenance, and legal responsibility.
- (g) Detailed design requirements can be obtained from the transit authority having jurisdiction over the transit facility. See Index 504.3(6) for design standards related to bus loading facilities on freeways.
- (2) *Conventional Highway Application.* This guidance is applicable to projects involving transit loading facilities on conventional highways as authorized in Section 148 of the Streets and highways Code. Instructions pertaining to the provisions for Bus Rapid Transit (BRT) in conventional highway corridors are covered in other Departmental policy and directives.
- (a) The selection of transit facilities on conventional highways should follow the general outline as noted above for transit facilities on freeways. Transit facilities shall be approved by the District Director as part of the authorizing document (PSR/PP, PR, PSSR, etc.).
- (b) A cooperative agreement should be used to document the understanding between the Department and any local agency which desires a transit facility. The agreement covers items such as funding, ownership, maintenance, and legal responsibility.
- (c) Detailed design requirements can be obtained from the transit authority having jurisdiction over the transit facility.

(d) See also DIB 82 for instructions on submitting rail and transit station plans to the Department of General Services – Division of the State Architect (DS) for review and approval of pedestrian facilities with regard to accessibility features. Accessible paths of travel must be provided to all pedestrian facilities, including shelters, tables, benches, drinking fountains, telephones, vending machines, and information kiosks. The path of travel from designated accessible parking for persons with disabilities, if applicable, to accessible facilities should be as short and direct as practical, must have an even surface, and must include curb ramps, marked aisles, and crosswalks, and other features as required to facilitate use of the facility with wheelchairs, walkers and other mobility aides. See Topic 404 for guidance regarding the Design Vehicle, and Index 626.4(3) for structural section guidance for bus pads.

108.3 Commuter and Light Rail Facilities Within State Right of Way

(1) *General.* These facilities may cross or operate parallel to a highway or other multi modal facility owned and operated by the Department. The following guidance covers all rail facilities, and all transportation facilities owned and operated by the Department. See the Project Development Procedures Manual for additional information and procedures regarding encroachments within State right of way. See Index 309.1(4) for high speed rail guidance.

(2) *Rail Crossings.* Ideally, rail crossings of transportation facilities should be grade separated. Grade separations must not impact the ability of the Department to operate and maintain its facilities, which includes the ability to expand the existing transportation facilities in the future. All rail crossings are to be approved by the District Director. See the California MUTCD for guidance regarding traffic controls for grade crossings.

(3) *Parallel Rail Facilities.* Rail facilities may be sited within Department right of way when feasible alternatives do not exist for separate facilities. As necessary, rail facilities may be located within the median. If rail facilities are located in the median, they must not impact the ability of the Department to reasonably operate and maintain its facilities, which includes the ability to expand the existing transportation facilities in the foreseeable future. All parallel rail facilities are to be approved by the District Director.

(4) *Design Standards.* Transit facilities are to be designed and constructed per the standards contained elsewhere in this manual and exceptions are to be documented as discussed in Chapter 80.

(5) *Cooperative Agreements.* The design and construction of rail facilities within the Department right of way should be covered in a cooperative agreement. Subsequent maintenance and operations requirements should be addressed in a maintenance agreement or encroachment permit as necessary.

108.4 Bus Loading Facilities

(1) *General.* A bus stop is a marked location for bus loading and unloading. Bus stops may be midblock, adjacent to, but before an intersection (near side) or adjacent to but after an intersection (far side). The far side location is preferred as pedestrians may cross the intersection behind the bus, allowing the bus to re-enter the travel stream following a break in traffic caused by the signal timing.

(2) *Design Standards.* Transit facilities are to be designed and constructed per the standards contained elsewhere in this manual and exceptions are to be documented as discussed in Chapter 80.

Bus stops and busbays (see Index 303.4(3) for busbays) should have pavement structures designed in accordance with Index 626.4(3). See the “Guide for Geometric Design of Transit Facilities on Highways and Streets”,

CHAPTER 700 MISCELLANEOUS STANDARDS

Topic 701 - Fences

Index 701.1 - Type, Intent and Purpose of Fences

- (1) *Purpose of Fences.* Fences constructed by the Department serve the purposes of either establishing control of access, providing visual demarcation or re-establishing private property lines.

Where the purpose of the fence is access control, installation is intended to establish that access is restricted; such fencing is not intended to serve as a complete physical barrier. The adjacent private property owner will assume responsibility for the construction of any fencing or other facilities necessary to contain their personal property.

- (2) *Type and Intent of Fences.* The type and intent of fences should be as described herein and in the Standard Plans and Standard Specifications.

Fence materials, including gates, installed anywhere within the State right of way are considered Departmental fences and are owned, controlled and maintained by Caltrans forces.

As a right of way consideration, Caltrans may construct fences and gates outside the State right of way. Fences and gates constructed outside the State right of way are considered private fences and are owned, controlled and maintained by the external property owner where Caltrans retains neither rights nor obligations for such fences once constructed.

- (a) Fences for freeway and expressway access control are Departmental fences commonly placed immediately inside the State right of way to help enforce observance of the acquired access rights. See Index 701.2 for more detailed guidance.
- (b) Median fences are Departmental fences constructed to help prevent indiscriminate crossings of the median by vehicles or pedestrians. These fences are a subset of

freeway and expressway access control fences. See Index 701.2 for more detailed guidance.

- (c) Private fences may be constructed adjacent to conventional highways if provided via right of way agreement. Placement is typically parallel to the State right of way and outside Caltrans property. See Index 701.3 for more detailed guidance.

Private fences may also be allowed within Caltrans right of way to restrict access to a private facility crossing or as an aesthetic enhancement of Departmental fence. Neither of these situations is common and should be avoided if possible. See Indexes 701.2(3)(e) and 701.3.

- (d) Temporary fences are commonly used during project construction to temporarily control access and/or create a visual screen. Temporary fences are also commonly used during reconstruction of either Departmental or private fences. See Index 701.4 for more detailed guidance.

- (e) Environmentally Sensitive Area (ESA) fence is a specialty type of temporary Departmental fence, placed within the limits of a construction project and used to identify the location of sensitive biologic resources while establishing a visible boundary. Orange fabric is used to ensure contractor personnel awareness of the ESA location. See Index 701.5 for more detailed guidance.

- (f) Species protection fences are Departmental fences placed within Caltrans right of way and used to prohibit movement of specific threatened or endangered species onto the highway. These fences are unique in composition to the species being addressed. Species protection fences may be placed for either permanent or temporary applications. See Indexes 701.2(3)(b) and 701.5 for more detailed guidance.

- (g) Enclosure fences are Departmental fences of various types used to secure the perimeter around equipment storage areas from theft or vandalism, provide a perimeter around maintenance stations or

other facilities, or otherwise enclose areas intended for Caltrans use. See Index 701.5 for more detailed guidance.

- (3) *Approval.* The District Director has the authority and responsibility for approval of fence type and location within the standards stated herein.

701.2 Freeway and Expressway Access Control Fence

- (1) *Placement.* **Departmental fences shall be provided on freeways and expressways to control access, except as otherwise provided under paragraph (3)(e) below. Freeway fencing or equivalent access control should extend to the limit of the legal access control on local streets at ramp termini.**

- (2) *Standard Fence Types.* The standard types of freeway fence are:

- (a) Chain Link Fencing--Type CL-6 fence or equivalent access control should be used along the right of way and in the outer separation in urban or developed areas.
- (b) Other Fencing--In rural areas, fences on freeways normally should be either Barbed Wire, (Type BW), or Wire Mesh, (Type WM), on either wood or metal posts. Wood posts may be more aesthetic than metal posts, depending on the surrounding terrain.
- (c) Median Fencing--Type CL-4 fence, with the distance from the ground to the bottom tension wire increased to 6 inches, should be used where median fencing is required.

- (3) *Exceptions to Standard Fence Types.*

- (a) If walls or fences equal to or better than the standard fence in durability, maintenance requirements, and dimensions exist along the right of way line, the standard fence may be omitted or removed. To avoid a gap in the access control, standard fences should be securely joined to the existing fence or wall at its terminals, if the access control line extends beyond these points.
- (b) Fences of special design may be installed where needed for wild animal control.

- (c) In special cases, where improvements are scattered, the area is aesthetically sensitive, and a lower fence would be in keeping with the height of adjacent property fence, a Type CL-4 fence may be substituted for Type CL-6 along the right of way in locations where Type CL-6 would otherwise be used.

- (d) Fencing may be omitted in remote areas where access control appears unnecessary.

- (e) In special cases, nonstandard fencing may be considered at freeway ramp terminals on local streets when the adjacent property either is, or is proposed to be, developed in such a way that the owner feels that standard fencing is aesthetically objectionable. If it is concluded that the objection is valid, a more compatible facility may be substituted, subject to the following controls:

- Preference should be given to retaining the standard fence along the ramp to the end of the curb return or beginning of the taper on the local road. Where this is not reasonable, there may be substituted a fence or wall of equal or better durability and utility that is at least 4 feet high relative to the grade of freeway right of way line. Walls, ornamental iron fences with closely spaced members, or chain link fences are examples of acceptable possibilities.
- Along the local road, beyond the end of the curb return or the beginning of the taper, a facility of somewhat lower standards may be employed, if considered appropriate. The minimum allowable height is 2.5 feet above the grade at the edge of the right of way. In addition to the fence types suitable for use along the ramp, split rail fences, wooden picket fences, and permanent planter boxes are examples of possibilities. The intent is to delineate the access control line and discourage access violations in an effective manner.

- Generally, all costs for the removal of the existing freeway fence and the installation and future maintenance of a nonstandard fence are to be the property owner's responsibility under the terms of the encroachment permit authorizing the substitution. On new construction, the property owner is to assume similar costs and responsibilities subject to a credit for the value of a standard fence.

(4) *Location of Fences.* Normally, fences on freeways should be placed adjacent to, but on the freeway side of the right of way line.

Fences in the outer separation normally should be placed as shown in Figure 307.4 so that the area outside of the fence may be relinquished to the local agency.

When viewed at a flat angle, chain link fencing restricts sight distance. This fact should be considered in the location of such fencing at intersections. To eliminate hand maintenance, right-angle jogs should be avoided.

(5) *Locked Gates.* Locked gates may be provided in access control fences in special situations. A proposal for a locked gate must address a necessity. Although openings controlled by locked gates do not constitute access openings in the usual sense of access control, they must be shown on the plans. When locked gates are proposed there must be a specific reason for each gate. All gates must be kept locked and secured. Locked gates fall into two categories:

(a) Locked gates to be used exclusively for access by highway maintenance forces do not require FHWA approval and may be approved by the District Director. The integrity and security of this access must always be assured. Maintenance forces must also keep gates locked when not being used for the access of persons or equipment. When locked gates are to be used exclusively by highway maintenance forces, one or more of the following criteria apply:

- A circuitous route would be eliminated.

- The gate access would minimize the exposure of maintenance workers to highway traffic.
- Parking is available outside the gate.
- The gate would allow slow moving equipment to be kept off the highway.
- The site is not accessible to maintenance personal or equipment from the freeway.

(b) Proposals for locked gates to be used by utility companies must be submitted to the District Director for approval. The gate submittal must present all pertinent facts and alternate solutions.

Locked gates to be used by other public agencies or by non-utility entities require FHWA approval if the gate is on an Interstate route.

When proposals for locked gates requiring FHWA approval are included in the plans for new construction, including landscaping projects, FHWA approval of such gates will be included in FHWA approval of the project PS&E. Subsequent installations requiring FHWA approval must be submitted separately to FHWA by the Division of Design after approval by the Chief, Division of Design.

701.3 Private Fences

(1) *Placement.* Caltrans will construct or pay the cost of fences on private property only as a right of way consideration to mitigate damages. Caltrans' construction of such fences should be limited to:

- (a) The reconstruction or replacement of existing fences.
- (b) The construction of fences across property that had been previously enclosed by fences.

These criteria apply to all private as well as public lands.

(2) *Private Fences Inside the State Right of Way.* Private fences may be constructed within the State right of way via Encroachment Permit to restrict access to facilities (e.g., canals)

crossing under or through Department-owned property. A Maintenance Agreement must be executed to provide for future maintenance of the fence and allow access to the private utility.

701.4 Temporary Fences

- (1) *Placement.* Temporary fences are located where necessary in accordance with construction contractor activities and where the right of way rights have been acquired.
- (2) *Types of Fences.* Temporary fence design should conform to the needs of the situation and the length of time to be used. In most access control or demarcation applications the fence fabric will conform to permanent fence standards, while lesser requirements may apply to posts and post footings to more readily accommodate removal when no longer needed.

Temporary fence used during reconstruction of private fences must be of a type adequate to meet the permanent private fence purposes.

701.5 Other Fences

- (1) *ESA and Species Protection Fences.* District Environmental Unit staff must specify the required placement limits and locations for ESA and species protection fences.

ESA fence material requirements are described in Section 14 of the Standard Specifications.

Species protection fences will be uniquely designed to meet the needs of the target species. District Environmental staff will provide information on the necessary design parameters. In many instances, species protection fence will be able to be directly attached to existing freeway or expressway access control fence and thus preclude the need for separate posts. Where species protection fence is to be constructed along conventional highways, it must be constructed inside the State right of way and should not be attached to any private fence that may exist.

- (2) *Enclosure Fences.* Because these fences are commonly intended to provide security for Caltrans facilities, the facility type and location will often dictate the fence design to be used. Standard chain link (CL-6) fence is most common, but additions (barbed wire extension

arms) or alternative designs may be considered. Typically District Maintenance or Traffic Operations will specify any unique design requirements for enclosure fences as they will assume responsibility after construction.

Topic 702 - Miscellaneous Traffic Items

702.1 References

- (1) *Guardrail and Crash Cushions.* See Chapter 7 of the Traffic Manual.
- (2) *Markers.* See Part 3 of the California Manual on Uniform Traffic Control Devices (California MUTCD).
- (3) *Truck Escape Ramps.* See Traffic Bulletin No. 24, (1986) and the NCHRP Report 178.
- (4) *Mailboxes.* See the AASHTO Roadside Design Guide, 3rd Edition, Chapter 11, "Erecting Mailboxes on Streets and Highways".

Topic 703 - Special Structures and Installation

703.1 Truck Weighing Facilities

The Division of Traffic Operations coordinates the design and construction of truck weighing facilities with the California Highway Patrol in Sacramento. Typical plans showing geometric details of these facilities are available from the Headquarters Division of Traffic Operations. Districts should refer truck weighing facility maintenance issues to their District maintenance units.

See Index 107.1 for additional details on roadway connections for truck weighing facilities.

703.2 Rockfall Restraining Nets

Rockfall Restraining Nets are protective devices designed to control large rockfall events and prevent rock from reaching the traveled way. The systems consist of rectangular panels of woven wire rope vertically supported by steel posts and designed with frictional brake elements capable of absorbing and dissipating high energies. For additional information on the characteristics and applications for rockfall restraining nets, designers

should contact the Division of Engineering Services - Geotechnical Services (DES-GS).

Topic 704 - Contrast Treatment

704.1 Policy

In general, delineation should be composed of the standard patterns discussed in Part 3 of the California MUTCD.

Markings include lines and markings applied to the pavement, raised pavement markers, delineators, object markers, and special pavement treatments.

Contrast treatment is designed primarily to provide a black color contrast with an adjacent white surface. Normally, contrast treatment should be used only in special cases such as the following:

- (a) To provide continuity of surface texture for the guidance of drivers through construction areas.
- (b) To provide added emphasis on an existing facility where driver behavior has demonstrated that standard signs and markings have proven inadequate.

When contrast treatment is applied, a slurry seal should be used.

See Part 3 of the California MUTCD for additional information on contrast treatment.

Topic 705 - Materials and Color Selection

705.1 Special Treatments and Materials

Special materials or treatments, such as painted concrete, or vinyl-clad fences, are sometimes proposed for aesthetic reasons, or to comply with special requirements.

The following guidelines are to be used for the selection of these items:

- (a) Concrete should not be painted unless exceptional circumstances exist, due to the continuing and expensive maintenance required. Concrete subject to unintentional staining should be textured during construction to minimize the visibility of stains, if other methods of controlling stain-producing runoff or dripping cannot be accomplished.

- (b) Vinyl-clad fences are sometimes specified for aesthetic reasons. The cost of this material is higher than that of galvanized steel. Special consideration should be given to the life-cycle cost and maintainability of vinyl-clad fencing prior to selection for use. The use of black or green vinyl-clad mesh for access control fencing, safety fencing at the top of retaining walls, and pedestrian overcrossing fencing is acceptable.

705.2 Colors for Steel Structures

Colors for steel bridges and steel sign structures may be green, gray, or neutral tones of brown, tan, or light blue.

Criteria for selection of colors are:

- (a) General continuity along any given route.
- (b) Coordination of color schemes with adjacent Districts for interdistrict routes.
- (c) Requests from local agencies for improvement of aesthetics in their community.

Color selection for steel bridges should be mutually satisfactory to the Division of Engineering Services and the District. The Division of Engineering Services (DES) will initiate the color selection process by submitting the proposed color to the District Landscape Architect for review. The color for steel sign structures will be selected by the District Landscape Architect.

Topic 706 - Roadside Treatment

706.1 Roadside Management

A key concept in roadside management is that roadway and roadside design should consider the full life-cycle cost of transportation improvements including the long-term cost of maintenance. The design alternative with the lowest initial construction cost may not be the best solution if this approach will include high recurring maintenance costs. Designers should strive to select design approaches that do not require extensive recurring long-term activities.

A second key roadside management concept is that roadway and roadside design should contribute to the safety of Department maintenance workers by incorporating techniques that eliminate or reduce worker exposure to traffic. More specifically, these

management concepts include the following techniques:

- Eliminate the need for recurrent maintenance activities such as vegetation control, herbicide application, pruning, mowing and graffiti removal;
- Facilitate the automation of recurrent maintenance activities such as herbicide application, mowing and litter collection;
- Locate facilities that require recurrent maintenance activity outside the clear recovery zone, or within protected areas;
- Provide safe maintenance worker access to facilities that require recurrent maintenance activity.

To implement this second roadside management concept, the following conditions must be considered in roadway and roadside design projects:

- Metal beam guardrail, including standard railing, terminal system end treatments, guard railing at structure approach and departures, and at fixed objects should include vegetation control. For more detailed information regarding placement of vegetation control consult with both the District Landscape Architect and District Maintenance. See the Standard Plans for minor concrete vegetation control.
- Thrie beam barrier, including single thrie beam barrier, double thrie beam barrier, at structure approach and at fixed objects should include vegetation control. For more detailed information regarding placement of vegetation control consult with both the District Landscape Architect and District Maintenance. See the Standard Plans for minor concrete vegetation control.
- Unpaved narrow strips often result from the construction of noise barriers or concrete barriers beyond the paved shoulder edge. Unpaved strips 15 feet or less in width, parallel and immediately adjacent to the roadway, should be paved to the barrier or wall. Paving these areas eliminates the need for manual vegetation control, and allows automated

equipment to remove litter and debris. Pavement requirements are consistent with the guidance contained in this manual. Contrasting surface treatment such as markings, delineation, or color may also be provided so drivers can distinguish these areas from those intended for vehicular use.

- Unpaved areas greater than 15 feet in width may include vegetation control techniques such as weed control mats, patterned asphalt or stamped concrete paving, or the planting of low maintenance vegetation such as native grasses. Consult the District Landscape Architect and District Maintenance to select and appropriate vegetation control technique.
- Plants, which at maturity may encroach upon required site distances, should be removed. Consult the District Landscape Architect to identify potential encroaching plant material.
- Noise barriers should be designed with a textured aesthetic treatment or planted with vines to reduce maintenance required to control graffiti. Index 902.3 of this manual and the Project Development Procedures Manual contain information of the planting on noise barriers.
- Unpaved area beyond the gore pavement should be paved as per Index 504.2(2).
- Roadside facilities that require recurring maintenance, such as irrigation controllers, electrical controllers, backflow preventers, and valve boxes, should not be placed on the outside of horizontal curves, near gore areas, near auxiliary lanes, or near ramp termini. The designer should strive to place these facilities outside the clear recovery zone, or within a protected area if placement outside the clear recovery zone is not feasible.
- When placing roadside facilities that require recurring maintenance, the designer should strive to include improvements that facilitate safe maintenance access such as maintenance vehicle pullouts, maintenance access paths, walk gates and vehicle gates. It is preferred that access be provided from outside the right-of-way for all facilities that require maintenance access.

- When placing noise barriers in areas with a narrow right of way, the designer should consider locating a concrete safety shape barrier 3 feet from the face of the noise barrier to provide protected maintenance access to planting and irrigation facilities.

Formal safety reviews for roadside management issues should be accomplished as discussed in Index 110.8. Consult the District Landscape Architect and District Maintenance unit early during design development to identify and address potential roadside management issues, such as avoiding the redundant placement of roadside facilities, or allow for the consolidation of roadside facilities.

706.2 Vegetation Control

Weed control fabric or soil sterilant chemicals may be placed under pavement to prevent weed growth through medians, traffic islands, and other paved areas.

The Division of Maintenance is responsible for the selection of herbicides. Approval is required for any changes from the currently approved Standard Specifications and Standard Special Provisions for pesticides and herbicides.

Since soil sterilants may be transported by water, they should not be used where they may affect environmentally sensitive areas, habitat, native vegetation, landscape plantings, agricultural crops, adjacent residential, commercial or recreation areas, streams, or water bodies.

Before specifying soil sterilants, the District Landscape Architect should be consulted to determine the possibility of future planting.

706.3 Topsoil

In areas of new construction, quality existing topsoil should be stockpiled and spread during the final stages of construction. The native brush should be crushed or chipped and mixed with the stockpiled soil to maximize natural or organic matter in the soil. Since topsoil contains beneficial microorganisms and seed, it is best to stockpile it in shallow windrows and planted with temporary erosion control so that oxygen can penetrate the soil.

706.4 Irrigation Crossovers for Highway Construction Projects

Irrigation crossovers normally consist of a conduit with a waterline crossover and sprinkler control conduit with pull wire. Irrigation crossovers should be provided under new roadways and ramps when future highway planting is anticipated. The District Landscape Architect should be consulted to determine the need for such crossovers as well as size and location. Attention should also be given to extending existing conduits when widening or modifying roadways and ramps.

The following factors should be considered in sizing and locating crossovers:

- (a) A standard irrigation crossover consists of a minimum size of 8-inch diameter nominal (DN) conduit, with a 3-inch DN water supply line and a 2-inch DN sprinkler control conduit with pull wire. Sizes of irrigation crossovers and water supply lines are usually larger when nonpotable water is to be used.
- (b) Irrigation crossovers are typically spaced 1,000 feet apart on freeways where future highway planting is anticipated. Undercrossings may be considered alternative crossing opportunities.
- (c) Drainage facilities should not be used for waterline crossings.

Standard details and special provisions for the irrigation crossover should be furnished by the District Landscape Architect to the Project Engineer for highway construction projects.

706.5 Water Supply Line (Bridge) and Sprinkler Control Conduit for Bridge

Water supply line and sprinkler control conduit with pull wire should be provided in new bridge structures.

The District Landscape Architect should be consulted to determine the need for such water supply lines and sprinkler control conduits such as size and location.

Attention should also be given to modifying, changing existing, or installing new water supply lines and sprinkler control conduits when widening or modifying bridge structures.

The following factors should be considered in sizing and locating water supply lines and sprinkler control conduits:

- (a) Generally, locate on the side of the bridge, nearest the water source.
- (b) Consider the maximum water demand and number of irrigation controller stations anticipated to be used. The water supply line should be a minimum 3-inch DN and the conduit for the sprinkler control conduit should be a minimum 2-inch DN and contain a pull wire.
- (c) Ductile iron pipe is required for the water supply line for pipes 4-inch DN or larger because of its superior strength and flexible joints.

706.6 Water Supply for Future Roadside Rest Areas, Vista Points, or Planting

Provision for a permanent water supply should be included in the major construction project. In the preparation of a major highway construction project, consideration should be given to using the water source needed for construction as part of a future permanent water supply system. If this appears to be a feasible solution, consider such factors as:

- (a) Probability of a future planting, vista point, or roadside rest project.
- (b) Economy.
- (c) Possible reduction in the flexibility of the highway contractor's operation.

The District Landscape Architect should be consulted.

Topic 707 - Slope Treatment Under Structures

707.1 Policy

Structure end slope should be treated to:

- (a) Protect slopes from erosion.
- (b) Improve aesthetics.
- (c) Reduce long term maintenance costs.

Caltrans maintenance, landscape architecture, materials, design, and other affected units will

furnish input to determine slope treatment needed at each site. Local agency input should be obtained for urban undercrossings.

All types of slope treatments require adequate drainage facilities for water from the upper roadway. Inadequate drainage is a major source of slope erosion.

707.2 Guidelines for Slope Treatment

- (a) Full slope paving shall be installed where it is anticipated that erosion by pedestrians, wind, storm water, or other causes will occur. High landscape maintenance costs caused by inadequate moisture, sunlight, instability to establish vegetation etc., may also justify the use of full slope paving in lieu of planting. The District Landscape Architect will provide aesthetic input and waterline crossover conduit as well as locations for slope paving.
- (b) Landscaped structure end slopes may be justified when adjacent slopes are landscaped and when landscaping is compatible with adjacent development. Conditions must exist where plants would have a strong likelihood of survival.
- (c) Bare slopes have minimum initial costs and higher maintenance costs which vary with the site. Bare structure end slopes may be justified at rural sites and other areas where anticipated maintenance activity will be low and there is little likelihood for erosion. Appropriate drainage design is critical when slopes are left bare.
- (d) Adequate drainage facilities must be provided to prevent saturation of abutment foundation materials and damage to slope treatment.
- (e) Additional protection may be required at stream crossings to provide for flow velocity.

707.3 Procedure

Based on consultation with the District Landscape Architect and Structures Bridge Architect and in consideration of economic and aesthetic factors, the District will determine, and set forth with the bridge site plan submittal, the type of slope treatment indicating whether:

- (a) The Division of Engineering Services is to design the slope treatment with the bridge and include the cost in the Structure items; or
- (b) The District will design the slope treatment and include the details with the road plans.