

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 specific to a certain place type, but is a design philosophy to be applied on State highways that also function as community streets. A “Main Street” design serves pedestrians, bicyclists, businesses and public transit with motorized traffic operating at speeds of 20 to 40 miles per hour. See the Department’s “Main Street, California” document 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).

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:

- 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 Project Delivery Coordinator and the District Design Liaison 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.

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 are to 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) *Absolute Requirements.* Design guidance related to requirements of law, policy, or statute that do not allow exception are phrased by the use of “is required”, “without exception”, “are to be”, “is to be”, “in no event”, or a combination of these terms.
- (3) *Controlling Criteria.* The FHWA has designated the following ten controlling criteria for projects on the National Highway

System (NHS) as comprehensive design standards which cover a multitude of design characteristics, allowing flexibility in application:

- Design Speed
- Lane Width
- Shoulder Width
- Horizontal Curve Radius
- Superelevation Rate
- Stopping Sight Distance
- Maximum Grade
- Cross Slope
- Vertical Clearance
- Design Loading Structural Capacity (non geometric)

Design loading structural capacity criteria applies to all NHS facility types. See the Technical Publications – DES Manuals for further information.

The remaining geometric criteria listed above are applicable to the NHS as follows: (1) On high-speed roadways (Interstate highways, other freeways, and roadways with design speeds of greater than or equal to 50 mph), all the geometric criteria apply. The stopping sight distance criteria applies to horizontal alignments and vertical alignments except for sag vertical curves; and (2) On low-speed roadways (non-freeways with design speeds less than 50 mph), only the design speed criteria applies.

The two speed categories stated above that FHWA designates match the high- and low-speed definitions in Index 62.8(13) when considering that design speed and posted speed are set in 5 mph increments.

The design standards related to the geometric criteria are identified in Table 82.1A among other important geometric standards in this manual regardless of the design speed of the roadway and whether or not the roadway is part of the NHS.

- (4) *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 ten controlling criteria (see Index 82.1(3)). In addition to the FHWA's ten controlling criteria are "Caltrans-only" mandatory standards that have been identified by Caltrans as most essential pertaining to requirements of State law, policy or objectives. Mandatory standards use the word "shall" and are printed in **Boldface** type (see Table 82.1A).
- (5) *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).
- (6) *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, Project Delivery Coordinators or their combination as specified in this manual. These decisions should be documented as the individual approving desires.
- (7) *Permissive Standards.* All standards other than absolute requirements, mandatory, advisory, or decisions requiring other approvals, whether indicated by the use of "should", "may", or "can" are permissive.
- (8) *Other Caltrans Publications.* 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.

- (9) *Transportation Facilities Under the Jurisdiction of Others.* Generally, if the local road or street is a Federal-aid route it should conform to AASHTO standards; see Topic 308 – Cross Sections for Roads Under Other Jurisdictions. Occasionally though, projects on the State highway system involve work on adjacent transportation facilities that are under the jurisdiction of cities and counties. Some of these local jurisdictions may have published standards for facilities that they own and operate. The guidance in this manual may be applicable, but it was prepared for use on the State highway system. Thus, when project work impacts adjacent transportation facilities that are under the jurisdiction of cities and counties, local standards and AASHTO guidance must be used in conjunction with this manual to encourage designs that are sensitive to the local context and community values. Agreeing on which standards will be used needs to be decided early in the project delivery process and on a project by project basis.

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 District Directors for projects on conventional highways and expressways, and for certain other facilities in accordance with the current District Design Delegation Agreement. Approval authority for mandatory design standards on all other facilities has been delegated to the Project Delivery 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, or, (c) specifically delegated to the District

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Directors per the current District Design Delegation Agreements and may involve coordination with the Project Delivery Coordinator. See the HQ Division of Design website for the most current District Design Delegation Agreements.

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 Moving Ahead for Progress in the 21st Century Act (MAP-21) of 2012 allowed significant delegation to the states by FHWA to approve and administer portions of the Federal-Aid Transportation Program. MAP-21 further allowed delegation to the State DOT's and in response to this a Stewardship and Oversight Agreement (SOA) document between FHWA and Caltrans was signed. The SOA outlines the process to determine specific project related delegation to Caltrans. In general, the SOA delegates approval of exceptions to mandatory design standards related to the ten controlling criteria on all Interstate projects whether FHWA has oversight responsibilities or not to Caltrans. Exceptions to this delegation would be for projects of FHWA Division or Corporate interest which are determined on a project by project basis. See Index 43.2 for additional information. Consultation with FHWA should be sought as early in the project development process as possible. However, formal FHWA approval, if applicable, 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. Where FHWA approval of a design exception is required, only cite the mandatory standards that are identified by the FHWA as ten controlling criteria, see Index 82.1(3).

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 District Design Liaison 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.
- (4) *Permissive Standards.* A record of deviation from permissive standards and the disclosure of the engineering decisions in support of the deviation should be documented and placed in the project file. This principle of documentation also applies when following other Division of Design guidance, e.g., Design Information Bulletins and Design Memos. The form of documentation and other instructions on long term retention of these engineering decisions are to be provided as directed by the District approval authority.
- (5) *Local Agencies.* Cities and counties are responsible for the design decisions they make on transportation facilities they own and operate. The responsible local entity is delegated authority to exercise their engineering judgment when utilizing the applicable design guidance and standards, including those for bicycle facilities established by Caltrans pursuant to the Streets and Highways Code Sections 890.6 and 890.8 and published in this manual. For further information on this delegation and the delegation process, see the Caltrans Local Assistance Procedures Manual, Chapter 11.

82.3 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" (2011) 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 108.7, Coordination with the FHWA).

The use of publications and manuals that are developed by organizations other than the FHWA and AASHTO can also provide additional guidance not covered in this manual. The use of such guidance coupled with sound engineering judgment is to be exercised in collaboration with the guidance in this manual.

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 or otherwise noted by separate Design Memorandum.

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 Project Delivery 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 Caltrans Publications

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/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 ⁽¹⁾
Index 101.1	Technical Reductions of Design Speed	208.4	Bridge Sidewalk (Width) ⁽¹⁾
101.1	Selection of Design Speed - Local Facilities ⁽²⁾	208.10	Barriers on Structures with Sidewalks ⁽¹⁾
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
		Index 301.1	Lane Width
		301.2	Class II Bikeway Lane Width ⁽¹⁾
		301.3	Cross Slopes – New Construction
		301.3	Cross Slopes – Resurfacing or widening
		301.3	Cross Slopes – Unpaved Roadway
		301.3	Algebraic Differences in Cross Slopes
CHAPTER 200	GEOMETRIC DESIGN AND STRUCTURE STANDARDS	Topic 302	Shoulder Standards
Topic 201	Sight Distance	Index 302.1	Shoulder Width
Index 201.1	Stopping Sight Distance Standards	302.1	Shoulder Width with Rumble Strip
Topic 202	Superelevation	302.2	Shoulder Cross Slopes -Bridge
Index 202.2	Standards for Superelevation	302.2	Shoulder Cross Slopes – Left
202.7	Superelevation on City Streets and County Roads	302.2	Shoulder Cross Slopes – Paved Median
Topic 203	Horizontal Alignment	302.2	Shoulder Cross Slopes - Right
Index 203.1	Horizontal Alignment - Local Facilities ⁽²⁾	Topic 305	Median Standards
203.1	Horizontal Alignment and Stopping Sight Distance	Index 305.1	Median Width – Conventional Highways ⁽¹⁾
203.2	Standards for Curvature – Minimum Radius	305.1	Median Width – Freeways and Expressways ⁽¹⁾
203.2	Standards for Curvature – Lateral Clearance		
Topic 204	Grade		
Index 204.1	Standards for Grade - Local Facilities		
204.3	Standards for Grade		
204.8	Vertical Falsework Clearances ⁽¹⁾		
Topic 205	Road Connections and Driveways		
Index 205.1	Sight Distance Requirements for Access Openings on Expressways		

Design exception approval of Mandatory Standards for nonfreeway facilities has been delegated to the Districts. In addition, some District delegations included Mandatory Standards applicable to freeways. See your District Design Delegation Agreement for specific delegation.

(1) Caltrans-only Mandatory Standard.

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

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

Topic 307	Cross Sections for State Highways	Topic 310	Frontage Roads
Index 307.2	Shoulder Standards for Two-lane Cross Sections for New Construction	Index 310.1	Frontage Road Width Cross Section
Topic 308	Cross Sections for Roads Under Other Jurisdictions	CHAPTER 400	INTERSECTIONS AT GRADE
Index 308.1	Cross Section Standards for City Streets and County Roads without Connection to State Facilities	Topic 404	Design Vehicles
308.1	Minimum Width of 2-lane Overcrossing Structures for City Streets and County Roads without Connection to State Facilities ⁽¹⁾	Index 404.2	Design Vehicle–Traveled Way ⁽¹⁾
308.1	Cross Section Standards for City Streets and County Roads with Connection to State Facilities	Topic 405	Intersection Design Standards
308.1	Two-Lane Local Road Lane Width for City Streets and County Roads within Interchange	Index 405.1	Corner Sight Distance – Driver Set Back
308.1	Multi-Lane Local Road Lane Width for City Streets and County Roads within Interchange	405.1	Corner Sight Distance at Public Road Intersections
308.1	Shoulder Width Standards for City Streets and County Roads Lateral Obstructions	405.1	Corner Sight Distance at Private Road Intersections
308.1	Shoulder Width Standards for City Streets and County Roads with Curbs and Gutter	405.2	Left-turn Channelization - Lane Width
308.1	Minimum Width for 2-lane Overcrossing at Interchanges ⁽¹⁾	405.2	Left-turn Channelization - Lane Width – Restricted Urban
Topic 309	Clearances	405.2	Two-way Left-turn Lane Width
Index 309.1	Horizontal Clearances and Stopping Sight Distance	405.3	Right-turn Channelization – Lane and Shoulder Width
309.1	Horizontal Clearances ⁽¹⁾	CHAPTER 500	TRAFFIC INTERCHANGES
309.2	Vertical Clearances - Major Structures	Topic 501	General
309.2	Vertical Clearances - Minor Structures	Index 501.3	Interchange Spacing ⁽¹⁾
309.2	Vertical Clearances - Rural and Single Interstate Routing System	Topic 502	Interchange Types
309.3	Horizontal Tunnel Clearances ⁽¹⁾	Index 502.2	Isolated Off-Ramps and Partial Interchanges ⁽¹⁾
309.3	Vertical Tunnel Clearances	502.3	Route Continuity ⁽¹⁾
309.4	Lateral Clearance for Elevated Structures ⁽¹⁾	Topic 504	Interchange Design Standards
309.5	Structures Across or Adjacent to Railroads - Vertical Clearance	Index 504.2	Location of Freeway Entrances & Exits ⁽¹⁾
		504.2	Ramp Deceleration Lane and “DL” Distance ⁽¹⁾

Design exception approval of Mandatory Standards for nonfreeway facilities has been delegated to the Districts. In addition, some District delegations included Mandatory Standards applicable to freeways. See your District Design Delegation Agreement for specific delegation.

(1) Caltrans-only Mandatory Standard.

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

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

504.3	Ramp Lane Width	Topic 625	Engineering Procedures for Pavement Rehabilitation
504.3	Ramp Shoulder Width		
504.3	Ramp Lane Drop Taper Past the Limit Line ⁽¹⁾	Index 625.2	Limits of Paving on Resurfacing Projects ^{(1), (2)}
504.3	Metered Multi-Lane Ramp Lane Drop Taper Past the Limit Line ⁽¹⁾	Topic 626	Other Considerations
504.3	Ramp Meters on Connector Ramps ⁽¹⁾	Index 626.2	Tied Rigid Shoulder Standards ^{(1), (2)}
504.3	Metered Connector Lane Drop ⁽¹⁾	626.2	Tied Rigid Shoulders or Widened Slab Standards ^{(1), (2)}
504.3	Distance Between Ramp Intersection and Local Road Intersection ⁽¹⁾	626.2	Tied Rigid Shoulders or Widened Slab at Ramps and Gore Standard ^{(1), (2)}
504.4	Freeway-to-freeway Connections – Shoulder Width – 1 and 2-Lane	CHAPTER 630	FLEXIBLE PAVEMENT
504.4	Freeway-to-freeway Connections – Shoulder Width – 3-Lane	Topic 635	Engineering Procedures for Flexible Pavement Rehabilitation
504.7	Minimum Weave Length ⁽¹⁾	Index 635.2	Limits of Paving on Resurfacing Projects ^{(1), (2)}
504.8	Access Control along Ramps ⁽¹⁾	CHAPTER 700	MISCELLANEOUS STANDARDS
504.8	Access Control at Ramp Terminal ⁽¹⁾	Topic 701	Fences
504.8	Access Rights Opposite Ramp Terminals ⁽¹⁾	Index 701.2	Fences on Freeways and Expressways ⁽¹⁾
CHAPTER 610	PAVEMENT ENGINEERING CONSIDERATIONS	CHAPTER 900	LANDSCAPE ARCHITECTURE
Topic 612	Pavement Design Life	Topic 902	Planting Guidelines
Index 612.2	Design Life for New Construction and Reconstruction ^{(1), (2)}	Table 902.3	Large Tree Setback Requirements on Conventional Highways – Median with Curb ⁽¹⁾
612.3	Pavement Design Life for Widening Projects ^{(1), (2)}	902.3	Large Tree Setback Requirements on Conventional Highways – Median with Barrier ⁽¹⁾
612.5	Pavement Design Life for Pavement Roadway Rehabilitation Projects ^{(1), (2)}	902.3	The Planting of Trees From Manholes on Conventional Highway Medians ⁽¹⁾
Topic 613	Traffic Considerations		
Index 613.5	Shoulder Traffic Loading Considerations ^{(1), (2)}		
613.5	Depth of Shoulder Pavement Structural Section ^{(1), (2)}		
CHAPTER 620	RIGID PAVEMENT		
Topic 622	Engineering Requirements		
Index 622.5	Transitions and Terminal Anchors for CRCP ^{(1), (2)}		
Index 622.7	Dowel Bars and Tie Bars ^{(1), (2)}		

Design exception approval of Mandatory Standards for nonfreeway facilities has been delegated to the Districts. In addition, some District delegations included Mandatory Standards applicable to freeways. See your District Design Delegation Agreement for specific delegation.

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

Table 82.1A Mandatory Standards (Cont.)

902.3 The Planting of Trees From the Longitudinal End of Conventional Highway Medians⁽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⁾
- 1003.1 Class I Bikeway Shoulder Width⁽¹⁾
- 1003.1 Class I Bikeway Horizontal Clearance⁽¹⁾
- 1003.1 Class I Bikeway Structure Width⁽¹⁾
- 1003.1 Class I Bikeway Vertical Clearance⁽¹⁾
- 1003.1 Class I Bikeway Minimum Separation From Edge of Traveled Way⁽¹⁾
- 1003.1 Physical Barriers Adjacent to Class I Bikeways⁽¹⁾
- 1003.1 Class I Bikeway in Freeway Medians⁽¹⁾
- 1003.1 Class I Bikeway Design Speeds⁽¹⁾
- 1003.1 Stopping Sight Distance
- 1003.1 Bikeway Shoulder Slope⁽¹⁾
- 1003.1 Obstacle Posts or Bollards in Bicycle Paths⁽¹⁾

CHAPTER 1100 HIGHWAY TRAFFIC NOISE ABATEMENT

Topic 1102 Design Criteria

- Index 1102.2 Horizontal Clearance to Noise Barrier⁽¹⁾
- 1102.2 Noise Barrier on Safety Shape Concrete Barrier⁽¹⁾

Design exception approval of Mandatory Standards for nonfreeway facilities has been delegated to the Districts. In addition, some District delegations included Mandatory Standards applicable to freeways. See your District Design Delegation Agreement for specific delegation.

(1) Caltrans-only Mandatory Standard.

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

**Table 82.1B
Advisory Standards**

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

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

	208.10	Protective Screening on Overcrossings		309.1	Safety Shaped Barriers at Retaining, Pier, or Abutment Walls
	208.10	Bicycle Railing Locations		309.1	High Speed Rail Clearance
Topic 210		Earth Retaining Systems		309.5	Structures Across or Adjacent to Railroads – Vertical Clearance
Index	210.6	Cable Railing			
CHAPTER 300		GEOMETRIC CROSS SECTION	Topic 310		Frontage Roads
Topic 301		Traveled Way Standards	Index	310.2	Outer Separation – Urban and Mountainous Areas
Index	301.2	Class II Bikeway Lane Width		310.2	Outer Separation – Rural Areas
	301.3	Algebraic Differences of Cross Slopes at Various Locations	CHAPTER 400		INTERSECTIONS AT GRADE
Topic 303		Curbs, Dikes, and Side Gutters	Topic 403		Principles of Channelization
	303.1	Use of Curb with Posted Speeds of 40 mph and Greater	Index	403.3	Angle of Intersection
	303.3	Dike Selection		403.6	Optional Right-Turn Lanes
	303.4	Bulbout Design		403.6	Right-Turn-Only Lane and Bike Lane
Topic 304		Side Slopes	Topic 404		Design Vehicles and Related Definitions
Index	304.1	Side Slopes 4:1 or Flatter	Index	404.4	STAA Design Vehicles on the National Network, Terminal Access, California Legal, and Advisory routes
	304.1	18 ft Minimum Catch Distance		404.4	California Legal Design Vehicle Accommodation
Topic 305		Median Standards		404.4	45-Foot Bus and Motorhome Design Vehicle
Index	305.1	Median Width Freeways and Expressways – Urban	Topic 405		Intersection Design Standards
	305.1	Median Width Freeways and Expressways – Rural	Index	405.1	Corner Sight Distance at Unsignalized Public Road Intersections
	305.1	Median Width Conventional Highways – Urban and Rural Main Streets		405.1	Decision Sight Distance at Intersections
	305.1	Median Width Conventional Highways – Climbing or Passing Lanes		405.3	Curve Radius for Free Right-Turn with Pedestrian Crossing
	305.2	Median Cross Slopes		405.4	Pedestrian Refuge by Area Place Type
Topic 308		Cross Sections for Roads Under Other Jurisdictions		405.5	Emergency Openings and Sight Distance
Index	308.1	Cross Section Standards for City Streets and County Roads without Connection to State Facilities		405.5	Median Opening Locations
Topic 309		Clearances		405.10	Entry Speeds – Single and Multilane Roundabouts
Index	309.1	Clear Recovery Zone – Necessary Highway Features			
	309.1	Clear Recovery Zone – Discretionary Fixed Objects			
	309.1	Horizontal Clearance			

Table 82.1B
Advisory Standards (Cont.)

CHAPTER 500	TRAFFIC INTERCHANGES	504.3 Metered Multi-Lane Entrance Ramps Auxiliary Lane on Sustained Grades and Certain Truck Volumes
Topic 504	Interchange Design Standards	504.3 Metered Freeway-to-Freeway Connector Lane Drops
Index	504.2 Ramp Entrance and Exit Standards	504.3 Ramp Terminals and Grade
	504.2 Collector-Distributor Deceleration Lane and "DL" Distance	504.3 Ramp Terminals and Sight Distance
	504.2 Paved Width at Gore	504.3 Distance between Ramp Intersection and Local Road Intersection
	504.2 Contrasting Surface Treatment	504.3 Entrance Ramp Lane Drop
	504.2 Auxiliary Lanes	504.3 Single-Lane Ramp Widening for Passing
	504.2 Freeway Exit Nose Design Speed	504.3 Two-lane Exit Ramps
	504.2 Decision Sight Distance at Exits and Branch Connections	504.3 Two-lane Exit Ramps and Auxiliary Lanes
	504.2 Design Speed and Alignment Consistency at Inlet Nose	504.3 Distance Between Successive On-ramps
	504.2 Freeway Ramp Profile Grades	504.3 Distance Between Successive Exits
	504.2 Differences in Pavement Cross Slopes at Freeway Entrances and Exits	504.4 Freeway-to-freeway Connections Design Speed
	504.2 Vertical Curves Beyond Freeway Exit Nose	504.4 Profile Grades on Freeway-to-freeway Connectors
	504.2 Crest Vertical Curves at Freeway Exit Terminal	504.4 Single-lane Freeway-to-freeway Connector Design
	504.2 Sag Vertical Curves at Freeway Exit Terminal	504.4 Single-lane Connector Widening for Passing
	504.2 Ascending Entrance Ramps with Sustained Upgrades	504.4 Volumes Requiring Branch Connectors
	504.3 Ramp Terminus Design Speed	504.4 Merging Branch Connector Design
	504.3 Ramp Lane Drop Taper At 6-foot Separation Point	504.4 Diverging Branch Connector Design
	504.3 Ramp Lane Drop Location	504.4 Merging Branch Connector Auxiliary Lanes
	504.3 Metered Entrance Ramps (1 GP + 1 HOV Preferential Lane) Auxiliary Lane	504.4 Diverging Branch Connector Auxiliary Lanes
	504.3 Metered Entrance Ramps (1 GP + 1 HOV Preferential Lane) Auxiliary Lane on Sustained Grades and Certain Truck Volumes	504.4 Freeway-to-freeway Connector Lane Drop Taper
	504.3 HOV Preferential Lane Restrictive Condition Auxiliary Lane	504.6 Mainline Lane Reduction at Interchanges
	504.3 Metered Multi-Lane Entrance Ramps Lane Drop	504.8 Access Control at Ramp Terminal
	504.3 Metered Multi-Lane Entrance Ramps Auxiliary Lane	

Table 82.1B Advisory Standards (Cont.)

CHAPTER 610	PAVEMENT ENGINEERING CONSIDERATIONS	1003.1	Class I Bikeway in State Highway or Local Road Medians
Topic 612	Pavement Design Life		
Index 612.6	Traffic Loading for Temporary Pavements and Detours		
CHAPTER 620	RIGID PAVEMENT		
Topic 625	Engineering Procedures for Pavement Rehabilitation		
Index 625.2	Rigid Pavement Rehabilitation Strategies		
CHAPTER 640	COMPOSITE PAVEMENTS		
Topic 645	Engineering Procedures for Pavement Rehabilitation		
Index 645.1	Empirical Method		
CHAPTER 700	MISCELLANEOUS STANDARDS		
Topic 701	Fences		
Index 701.2	Fences on Freeways and Expressways		
CHAPTER 900	LANDSCAPE ARCHITECTURE		
Topic 902	Planting Guidance		
Index 902.2	Clear Recovery Zone Planting of Large Trees on Freeways and Expressways, Including Interchanges		
902.2	Minimum Tree Setback		
Table 902.3	Large Tree Setback Requirements on Conventional Highways - Roadside		
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
Topic 103	Design Designation	Index 208.10	Barrier Separation and Bridge Rail Selection
Index 103.2	Design Period	208.10	Concrete Barrier Type 80
Topic 108	Coordination With Other Agencies	208.10	Concrete Barrier Type 80SW
Index 108.2	Transit Loading Facilities – Location	208.11	Deviations from Foundation and Embankment Recommendations
108.2	Transit Loading Facilities - ADA	210.4	Cost Reduction Incentive Proposals
108.3	Rail Crossings*		
108.3	Parallel Rail Facilities*		
108.5	Bus Rapid Transit – Location and ADA		
108.7	Coordination With the FHWA - Approvals		
Topic 110	Special Considerations	CHAPTER 300	GEOMETRIC CROSS SECTION
Index 110.1	Overload Category	Topic 303	Curbs, Dikes, and Side Gutters
110.8	Safety Review Items and Employee Exposure	Index 303.4	Busbulbs
110.10	Proprietary Items	Topic 304	Side Slopes
110.10	Proprietary Items – On Structure	Index 304.1	Side Slopes – Erosion Control
110.10	Proprietary Items – National Highway System	304.1	Side Slopes – Structural Integrity
		309.2	Vertical Clearance on National Highway System
		309.2	Vertical Clearance Above Railroad Facilities
		309.5	Horizontal and Vertical Clearances at Railroad Structures
Topic 111	Material Sites and Disposal Sites	CHAPTER 500	TRAFFIC INTERCHANGES
Index 111.1	Mandatory Material Sites on Federal-aid Projects	Topic 502	Interchange Types
111.6	Mandatory Material Sites and Disposal Sites on Federal-aid Projects	Index 502.2	Single Point Interchange Interchanges
		502.2	Other Types of Interchanges
Topic 116	Bicyclists and Pedestrians on Freeway	Topic 503	Interchange Procedure
Index 116	Bicycles and Pedestrians on Freeways	Index 503.2	Interchange Geometrics
CHAPTER 200	GEOMETRIC DESIGN AND STRUCTURE STANDARDS	Topic 504	Interchange Design Standards
Topic 204	Grade	Index 504.3	HOV Preferential Lane
Index 204.8	Grade Line of Structures – Temporary Vertical Clearances	504.3	Modification to Existing HOV Preferential Lanes
		504.3	Enforcement Areas and Maintenance Pullouts – Required Enforcement Area
Topic 205	Road Connections and Driveways	504.3	Enforcement Areas and Maintenance Pullouts – Removal
Index 205.1	Conversion of a Private Opening		

* 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 614.5	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
Index 706.2	Vegetation Control	Index 873.1	Introduction
		873.3	Armor Protection
		CHAPTER 900	LANDSCAPE ARCHITECTURE
		Topic 901	General
		Index 901.1	Landscape Architecture Program - Approvals

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Table 82.1C

Decision Requiring Other Approvals (Cont.)

Topic 902	Planting Guidelines
Index 902.3	Plant Selection, Setback and Spacing
Table 902.3	Large Tree Setback Requirements on Conventional Highway Medians in Main Street Context
Table 902.3	Planting of Large Trees on Conventional Highway Medians – With Barrier and Posted Speed Greater Than 45mph
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

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