Local Programs Procedures

LPP 16-02 **Manual Update**
Subject: **Design Guidance**

Reference: *Local Assistance Procedures Manual*
Chapter 11, "Design Guidance"

Effective Date: April 8, 2016

Approved: **Original Signed By**
Ray Zhang, Chief
Division of Local Assistance

WHAT IS AN LPP?

LPPs are Local Programs Procedures. These documents are used to deploy policy and procedure updates to the *Local Assistance Procedures Manual (LAPM)*. They are numbered according to calendar year and order in which they were released. For example, this is the second LPP issued in 2016.

PURPOSE

The purpose of this LPP is to update Chapter 11, "Design Guidance," of the *LAPM* and related exhibits.

BACKGROUND

Significant changes to Chapter 11 have been made. Design standards, regulations, laws, external guidance, and references have changed since the last update and Caltrans' emphasis on context sensitive solutions and flexible design philosophy has advanced. This LPP is a result of the need to address these changes.

POLICY AND PROCEDURE

Chapter 11 has been rewritten in its entirety for clarity and condensed to reduce redundancy with external guidance. This LPP significantly impacts the following areas:

- Americans with Disabilities Act
- Bicycle and pedestrian facilities

- Design standards
- Design decisions
- Drainage
- Bridges and other structures

The following exhibits have been created or revised:

- Exhibit 11-A, "Geometric Design Guidelines for Local 3R Projects"
- Exhibit 11-B, "Bridges and Other Structures"
- Exhibit 11-F, "Sample Design Fact Sheet"

The following exhibits will no longer be used and have been deleted:

- Exhibit 11-C, "Foundation Investigations for Design"
- Exhibit 11-D, "Preliminary Hydrologic-Hydraulic Review Summary"
- Exhibit 11-E, "Checklist for Drainage Studies and Reports"

This LPP impacts all Local Assistance infrastructure projects. A summary of significant changes to Chapter 11 is provided in the table below.

ACCESSIBILITY

These new procedures are incorporated into the *LAPM* and can be found on the Division of Local Assistance (DLA) website at http://www.dot.ca.gov/hq/LocalPrograms/lam/lapm.htm.

To receive notifications of DLA updates, please subscribe to the DLA list server at http://www.dot.ca.gov/hq/LocalPrograms/sub.htm.

Comments and suggestions for improvement to publication updates may be submitted to Odell Frazier at odell.frazier@dot.ca.gov.

SUMMARY OF SIGNIFICANT CHANGES

LAPM CH. 11	Previous Page No.	Change
General Comment	All	Clarifying grammatical edits, hyperlink updates, and typo corrections were made to the entire chapter. Several subsections were combined, retitled or rearranged. Retitled chapter to Design Guidance.
Section 11.1 Introduction	11-1 11-1 11-2	Updated paragraph 1 to include multimodal considerations. Updated definitions of Alteration and Design Alternative. Removed definition of Controlling Criteria. Updated definition of 3R, added note to Standard Specification definition.

Chapter 11 **Design Guidance**

CONTENTS

SECTION/SUBJECT **PAGE**

11.1 Introduction....1
Definitions....1
11.2 Design Guidance for Local Assistance Projects....3
New and Reconstruction Projects....3
Resurfacing, Restoration and Rehabilitation (3R) Projects....4
Bridges and Other Structures....4
11.3 Standard Plans....4
11.4 Standard Specifications....5
11.5 Design Decisions....5
Projects on the SHS....5
Projects not on the SHS....6
Bridge Design and Details....6
Signs and Markings....6
11.6 Other Considerations....7
Highway Cross Drainage, Hydraulic, and Hydrologic Design....7
Floodplain Encroachment....7
Bicycle and Pedestrian Facilities....7
Accessibility and the Americans with Disabilities Act....8
Intelligent Transportation Systems/Traffic Signal Controllers....8
11.7 References....9
AASHTO....9
Caltrans....9
FHWA....10
Other....11

EXHIBITS

Exhibits applicable to this chapter can be found at:
http://www.dotca.gov/hq/LocalPrograms/lam/forms/lapmforms

Exhibit 11-A Geometric Design Guidelines for Local 3R projects
Exhibit 11-B Bridges and Other Structures
Exhibit 11-C Deleted (Formerly Foundation Investigations for Design)
Exhibit 11-D Deleted (Formerly Preliminary Hydrologic/Hydraulic Review Summary)
Exhibit 11-E Deleted (Formerly Checklist for Drainage Studies and Reports)
Exhibit 11-F Sample Design Fact Sheet

CHAPTER 11 **Design Guidance**

11.1 INTRODUCTION

The purpose of this chapter is to provide statewide design guidance applicable to local agency administered federal-aid transportation projects. These guidlines and procedures should be considered in the design of transportation projects and applied with enigneering knowledge, experience, and judgement to provide a safe, sustainable, integrated, and efficient transportation system.

Definitions

Alteration – In this manual, an alteration, as applicable to the Americans with Disabilities Act (ADA), is a change to a roadway made by, on behalf of, or for the use of a public accommodation or commercial roadway that affects or could affect the usability of the roadway, or part thereof. Alterations include, but are not limited to, remodeling, renovation, rehabilitation, reconstruction, historic restoration, and changes or rearrangement of the structural parts or elements. The following roadway treatments are considered by the Federal Highway Administration (FHWA) to be an alteration:

- Addition of New Layer of Hot Mix Asphalt
- Hot Mix Asphalt and Concrete Rehabilitation and Reconstruction
- Cape Seals
- Hot In-Place Recycling
- Microsurfacing / Thin Lift Overlay
- Mill & Fill / Mill & Overlay
- Reconstruction
- Open-Graded Friction Course

Design Standards – The adopted design standards, including: highway design specifications, standard plans, construction contract specifications, statewide bridge design procedures, and other procedures, guides, and references listed herein for application in the geometric, structural, pavement, and hydraulic design of local agency highway transportation projects.

Design Decision –A documented decision to use alternative highway design elements in place of applicable design guidance. Documented alternative decisions to the applicable highway design guidance are documented and retained in project files.

New Construction - A new transportation facility that did not previously exist along a highway segment. The addition of appurtenances to an existing facility, such as striping, signs, signals, noise barriers, etc. is not considered new construction.

Preventive Maintenance – Roadway activities that include but are not limited to joint and shoulder rehabilitation, heater re-mix, seal coats, corrective grinding of Portland Cement Concrete (PCC) pavement, and restoration of drainage systems.

Reconstruction - Involves the following:

- Replacement of existing pavement structure
- Addition of a lane (except climbing or auxiliary lanes)
- Significant change in horizontal and/or vertical alignment
- Reconstruction of an interchange by adding moves or relocating ramps (widening ramps for storage, turning movements, or ramp metering are not included)
- Replacement of an entire bridge or the major parts of an existing bridge (in such a manner that it is effectively a new bridge)
- Seismic retrofit projects for the following:
    - Major or unusual structures (all tunnels, unusual and movable bridges, unusual hydraulic or geotechnical structures, or bridges with a total deck area greater than 125,000 square feet)
    - Construction cost greater than $5 million per structure
- Major modifications to Traffic Management Centers

Resurfacing, Restoration, or Rehabilitation (3R) Work – Work which does not fall into the defined categories for new construction, reconstruction, or preventive maintenance, and typically involves the improvement of highway pavement surfaces through resurfacing, restoration, or rehabilitation. Specifically, 3R work is defined as the following:

- Resurfacing - placing additional hot mix asphalt concrete over a structurally sound highway or bridge that needs treatment to extend its useful service life.
- Restoration - returning a road, structure, or collateral facility to the condition existing after original construction.
- Rehabilitation - providing some betterments, such as upgrading guardrail or widening shoulders.

The 3R work is generally regarded as heavy, nonroutine maintenance work designed to preserve and extend the roadway service life for at least ten years and enhance safety where reasonable. However, the work may include selective improvements to highway geometry and other roadway features, including safety appurtenances, and still be considered 3R work.

Construction Contract Specifications – The directions, provisions, and requirements contained in the contract documents for a specific construction project. Included are various proposal conditions, contract administration provisions, required construction methods, and technical requirements for materials.

Standard Specifications – A published document that contains commonly used construction contract specifications developed for use as a reference for construction contract documents.

Note: In this manual, "current" *Caltrans Standard Specifications* is understood to mean *Caltrans Standard Specifications* inclusive of all current revisions, amendments, and standard special provisions, unless otherwise stated.

Standard Plans – A collection of plan details developed for use as a reference for construction contract documents. Included are standard abbreviations, symbols, design notes, design conditions and data, construction details, specifications, layouts, and measurement and payment details.

11.2 Design Guidance for Local Assistance Projects

New and Reconstruction Projects

Title 23 of the Code of Federal Regulations (CFR) part 625 designates the standards, policies, and standard specifications that are acceptable for application in the geometric design of Local Assistance projects. The standards are dependent on the type and location of the project.

Projects on the State Highway System (SHS)

Local agency new or reconstruction projects on the SHS must be designed in accordance with the current *Caltrans Highway Design Manual* and other Caltrans Division of Design standards, policies, and procedures.

Projects on the National Highway System (NHS)

Local agency new or reconstruction projects on the NHS and not on the SHS must be designed in accordance with the FHWA adopted edition of the *American Association of State Highway and Transportation Officials (AASHTO) A Policy on Geometric Design of Highways and Streets.*

Projects <u>not</u> on the NHS

Local agency new or reconstruction projects not on the NHS may be designed in accordance with locally developed design standards or the current *Caltrans Highway Design Manual* or the current FHWA-adopted *American Association of State Highway and Transportation Officials (AASHTO) A Policy on Geometric Design of Highways and Streets*.

Local agency developed design standards may be used on local agency new or reconstruction projects not on the NHS if:

- The standards have been approved by the County Board of Supervisors or the City Council.
- The standards are signed by the City/County Public Works Director who is a California licensed Civil Engineer. If the Public Works Director is not licensed, the standards may be signed by the local agency's highest level licensed Civil Engineer. Standards may be signed by a consultant on retainer as the City/County Engineer if such individual is licensed and is responsible directly to the Public Works Director or City/County Manager.

- The standards are reviewed for possible updating whenever the applicable AASHTO standards are updated.

Resurfacing, Restoration and Rehabilitation (3R) Projects

In accordance with 23 CFR 625.4(a)(3), the geometric design standards for resurfacing, restoration, and rehabilitation (3R) projects on the NHS other than freeways shall be the procedures and the design or design criteria established for individual projects, groups of projects, or all non-freeway 3R projects in a state, and as approved by the FHWA. Below are the standards approved by FHWA.

Projects on the SHS

Local agency 3R projects on the SHS must be designed in accordance with the geometric standards and guidance provided by Caltrans Design Information Bulletin 79-03 (DIB-79).

Projects <u>not</u> on the SHS

Local agency 3R projects not on the SHS must be designed in accordance with the geometric standards and guidance provided in Exhibit 11-A, "Geometric Design Guidelines for Local 3R Projects."

Bridges and Other Structures

All local agency bridge and structure projects must be designed in accordance with the current Caltrans adopted edition of the *AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications with California Amendments* and Caltrans bridge design manuals, policies, standards, and guidance in accordance with 23 CFR 625.4(b). Additional information applicable to the design of bridge and other structures is provided in Exhibit 11-B, "Bridges and Structures."

11.3 STANDARD PLANS

For all local agency projects on the SHS, the *Caltrans Standard Plans* must be used.

The following standard plans are acceptable for use on local agency projects not on the SHS:

- Current edition of *Caltrans Standard Plans*
- Current edition of the *Standard Plans for Public Works Construction*, developed by the Public Works Standards, Inc.
- Local agency developed standard plans

Local agency developed standard plans may be used on local agency new or reconstruction projects not on the NHS if:

- The standards have been approved by the County Board of Supervisors or the City Council.
- The standards are signed by the City/County Public Works Director who is a California licensed Civil Engineer. If the Public Works Director is not licensed, the

standards may be signed by the local agency's highest level licensed Civil Engineer. Standards may be signed by a consultant on retainer as the City/County Engineer if such individual is licensed and is responsible directly to the Public Works Director or City/County Manager.

11.4 STANDARD SPECIFICATIONS

For locally agency projects on the SHS, the current *Caltrans Standard Specifications* must be used.

The following standard specifications are acceptable for use on local agency projects not on the SHS:

- Current *Caltrans Standard Specifications*
- Current edition of the *Standard Specifications for Public Works Construction*, developed by the Public Works Standards, Inc.
- Local agency developed standard specifications

Local agency developed standard specifications may be used on local agency new or reconstruction projects not on the NHS if:

- The standards been approved by the County Board of Supervisors or the City Council.
- The standards are signed by the City/County Public Works Director who is a California licensed Civil Engineer. If the Public Works Director is not licensed, the standards may be signed by the local agency's highest level licensed Civil Engineer. Standards may be signed by a consultant on retainer as the City/County Engineer if such individual is licensed and is responsible directly to the Public Works Director or City/County Manager.

11.5 DESIGN DECISIONS

Flexibile and a context-sensitive approaches which considers the full range of project needs and the impacts to the community and natural and human environment are encouraged. Alternatives to design guidance are a useful tool that may be employed to achieve a balance of project needs and community values. Local agencies must evaluate, approve, and document design decisions.

Projects on the SHS

Local agency projects on the SHS must follow the design alternative approval procedures outlined in Chapter 21, "Exceptions to Design Standards," of the *Caltrans Project Development Procedures Manual*.

Alternatives to accessibility design standards on SHS projects are outlined in the current edition of Caltrans DIB-82, "Pedestrian Accessibility Guidelines for Highway Projects."

Projects not on the SHS

For local agency projects not on the SHS and either on or off the NHS, the approval of design alternatives is delegated to City and County Public Works Directors. Approval of design alternatives on local agency federal-aid highway transportation projects must be signed by the Public Works Director or the person to whom approval authority has been delegated. The person with approval authority must be a licensed Civil Engineer in the State of California. The approval authority for design alternatives may be delegated to a private consulting firm that is on retainer as a City or County Engineer if such individual is licensed and responsible directly to the Public Works Director or City/Country Manager.

Design alternative processes may vary, but the fundamental steps should include:

- Determining the cost and impacts of meeting the design criteria.
- Developing and evaluating the potential consequences and risks of alternatives that may fall outside of design guidance.
- Evaluating potential mitigation features.
- Reviewing, documenting, and approving the use of proposed alternatives.

Documentation should be signed, stamped with engineer's seal, approved by Director of Public Works or the person whom approval authority has been delegated, and retained in projects files for at least three years from acceptance of final voucher per 23 CFR 710.201(f). A sample design fact sheet including other information to document is shown in Exhibit 11-F, "Sample Design Fact Sheet."

A tracking system for design decisions should be implemented by local agencies to retrieve project information quickly and accurately. The data should include:

- Project description
- Project location
- Nonstandard features approved
- Indication if future commitments have been made

Bridge Design and Details

Local agency proposed bridge or structure design alternatives must follow the procedures outlined in Exhibit 11-B.

Signs and Markings

Alternatives to mandatory signs and markings as defined in the *California Manual on Uniform Traffic Control Devices* (CA MUTCD) may be permitted if a proposal to experiment with non-standard devices is submitted to and approved by the FHWA and California Traffic Control Devices Committee prior to implementation.

11.6 Other Considerations

Highway Cross Drainage, Hydraulic, and Hydrologic Design

For local agency funded projects on the SHS, project cross drainage, hydraulic, and hydrologic design must be designed in accordance with the current edition of the *Caltrans Highway Design Manual*.

For local agency highway projects not on the SHS, it is recommended to design project cross drainage, hydraulic, and hydrologic design in accordance with the current edition of the *Caltrans Highway Design Manual*. Local agencies may refer to the current editions of the *AASHTO Highway Drainage Guidelines* for a general discussion of drainage and the AASHTO *Drainage Manual* for more detailed guidance on highway hydraulic design. FHWA's Hydraulic Engineering website contains several other useful references regarding drainage, hydraulic, and hydrologic design.

Floodplain Encroachment

Local agencies have the following options for meeting the base floodplain encroachment evaluation requirements of 23 CFR 650:

1. Follow the procedures and guidance provided in Topic 804, "Floodplain Encroachments," of the *Caltrans Highway Design Manual*, or
2. Provide their own Floodplain Evaluation Report following general policy guidance provided in 23 CFR 650.

For further guidance on preparing a Location Hydraulic Study and a Floodplain Evaluation Report, refer to the Chapter 17, "Floodplains of the Standard Environmental Reference."

Copies of the "Location Hydraulic Study" and the "Summary of Floodplain Encroachment" forms can be found on Caltrans Local Assistance NEPA Assignment and Environmental Compliance website.

Bicycle and Pedestrian Facilities

Local agencies are encouraged to incorporate designs that help ensure the needs of non-motorized users in all programming, planning, construction, maintenance, operations, and project development activities and products.

Design guidance for bikeway projects is provided in Chapters 100, 200, 300, and 1000 of the *Caltrans Highway Design Manual* and *AASHTO Guide for Development of Bikeway Facilities*. Publications such as the *National Association of City Transportation Official (NACTO) Urban Street Design Guide*, *NACTO Urban Bikeway Design Guide*, and the *Institute of Transportation Engineers (ITE) Designing Urban Walkable Thoroughfares* are resources that can also be referenced when making planning and design decisions on local streets and roads. Alternatives to bikeway design guidance must meet the criteria outlineds in Section 891 of the California Streets and Highways Code.

Accessibility and the Americans with Disabilities Act

State and local governments, regardless of whether they receive federal funds, are required to comply with the federal 2010 ADA Standards, Title 24 of the California Code of Regulations (which contain California building regulations), or local codes, whichever provides the greatest access. Private-funded improvements within the public right of way are also required to comply with whichever code offers the greatest access or protections to individuals with disabilities. If discrepancies are found between federal, state, or local requirements, the discrepancies should be brought to the attention of the District Local Assistance Engineer.

In accordance with Section 4454(b)(a) of the California Government Code, "Approval of Plans and Specifications," local agency plans and specifications with pedestrian facilities to be constructed with state funds must be reviewed and approved by DSA. Local agency plans and specifications of pedestrian facilities within the state highway rights of way, excluding rail and transit systems, can be reviewed and approved (certified) by Caltrans in place of Division of the State Architect (DSA). Approval of the plans and specifications by DSA will require fees be paid directly to DSA. DSA regional offices can be found at this website: http://www.dsa.dgs.ca.gov/UniversalDesign/default.htm

The Accessible Parking and Curb Ramp plans included in *Caltrans Standard Plans* are approved FHWA for the SHS. Refer to the most current version of DIB-82 for further direction and discussion on the use of these standard plans.

The U.S. Department of Justice and the Federal Access Board both have very comprehensive websites committed to accessible design. The websites include ADA design standards and a design guide. The websites are respectively located at: http://www.ada.gov/ and http://www.access-board.gov/guidelines-and-standards.

Intelligent Transportation Systems/Traffic Signal Controllers

In accordance with 23 CFR 940, "Intelligent Transportation System Architecture and Standards," all Intelligent Transportation Systems (ITS) projects must adhere to ITS Standards. The choice of ITS Standards hinges on the development of a Regional ITS Architecture. For details on ITS Standards see Caltrans' Local Assistance ITS Program website.

Section 21401 of the California Vehicle Code also requires:

(a) Except as provided in Section 21374, only those official traffic control devices that conform to the uniform standards and specifications promulgated by the Department of Transportation shall be placed upon a street or highway. (b) Any traffic signal controller that is newly installed or upgraded by the Department of Transportation shall be of a standard traffic signal communication protocol capable of two-way communications. A local authority may follow this requirement. (c) In recognition of the state and local interests served by the action made optional for a local authority in subdivision (b), the Legislature encourages local agencies to continue taking the action formerly mandated by this section. However nothing in this subdivision may be construed to impose any liability on a local agency that does not continue to take the formerly mandated action.

Communication standards for traffic signal controllers are available from the National Transportation Communications for ITS Protocol. Other ITS elements to enhance pedestrian safety at intersections can be found at: http://www.walkinginfo.org.

11.7 REFERENCES

Refer to Exhibit 11-B for references related to bridges and other structures.

AASHTO

- *A Policy on Geometric Design of Highways and Streets*
  https://bookstore.transportation.org/category_item.aspx?id=DS&gclid=CLTK3eXey8MCFUeEfgodu3UAPQ

- *Drainage Manual*
  https://bookstore.transportation.org/item_details.aspx?ID=2153

- *Guide for Achieving Flexibility in Highway Design*
  https://bookstore.transportation.org/collection_detail.aspx?ID=31

- *Guide for the Development of Bicycle Facilities*
  https://bookstore.transportation.org/collection_detail.aspx?ID=116

- *Guide for the Planning, Design and Operation of Pedestrian Facilities*
  https://bookstore.transportation.org/collection_detail.aspx?ID=131

- *Highway Drainage Guidelines*
  https://bookstore.transportation.org/collection_detail.aspx?ID=102

- *Roadside Design Guide*
  https://bookstore.transportation.org/collection_detail.aspx?ID=105

Caltrans

- *California Manual on Uniform Traffic Control Devices (CA MUTCD)*
  http://www.dot.ca.gov/hq/traffops/engineering/mutcd/

- *Complete Intersections: A Guide to Reconstructing Intersections and Interchanges for Bicyclists and Pedestrians*
  http://nacto.org/docs/usdg/complete_intersections_caltrans.pdf

- *Construction Contract Standards (Plans and Specifications)*
  http://www.dot.ca.gov/hq/esc/oe/construction_standards.html

- *Deputy Directive 64-R2, Complete Streets - Integrating the Transportation System*
  http://dbfs.onramp.dot.ca.gov/directors-policy

- *Design Information Bulletin 79-03 (DIB-79) - Design Guidance and Standards for Roadway Rehabilitation Projects, current edition*
  http://www.dot.ca.gov/hq/oppd/dib/dibprg.htm

- *Design Information Bulletin 82-05 (DIB-82) - Pedestrian Accessibility Guidelines for Highway Projects*
  http://www.dot.ca.gov/hq/oppd/dib/dibprg.htm

- *Director's Policy DP-05, Multimodal Alternatives Analysis*
  http://dbfs.onramp.dot.ca.gov/directors-policy

- *Director's Policy DP-22, Context Sensitive Solutions*
  http://dbfs.onramp.dot.ca.gov/directors-policy

- *Flexible Pavement Structural Section Guide for California Cities and Counties*
  http://dot.ca.gov/hq/maint/Pavement/Offices/Pavement_Engineering/Local_Agencies.html

- *Highway Design Manual*
  http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm

- *Main Street California, a Guide for Improving Community and Transportation Vitality*
  http://www.dot.ca.gov/hq/LandArch/mainstreet/main_street_3rd_edition.pdf

- NEPA Assignment and Environmental Compliance website
  http://www.dot.ca.gov/hq/LocalPrograms/env1.htm

- *Project Development Procedures Manual*
  http://www.dot.ca.gov/hq/oppd/pdpm/pdpmn.htm

- *Standard Environmental Reference (SER) Standard Plans*
  http://www.dot.ca.gov/ser/

- *Temporary Pedestrian Facilities Handbook*
  http://www.dot.ca.gov/hq/construc/safety/Temporary_Pedestrian_Facilities_Handbook.pdf

FHWA

- 23 United States Code, Section 109 – Standards
  https://www.fhwa.dot.gov/map21/docs/title23usc.pdf

- 2010 ADA Standards Website
  http://www.ada.gov/2010ADAstandards_index.htm

- *Accommodating Bicycle Pedestrian Travel: A Recommended Approach*
  http://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/design.cfm

- *Designing Sidewalks and Trails for Access (Part 2)*, FHWA-EP-01 027
  http://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/sidewalk2/

- *FHWA Contract Administration Core Curriculum Participant's Manual and References Guide, 2006*
  http://www.fhwa.dot.gov/programadmin/contracts/cacc.pdf

- FHWA Hydraulic Engineering Home Page
  http://www.fhwa.dot.gov/engineering/hydraulics/

- FHWA Performance Based Practical Design Website
  http://www.fhwa.dot.gov/design/pbpd/

- FHWA Separated Bike Lane Planning and Design Guide
  https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/separated_bikelane_pdg/separatedbikelane_pdg.pdf

Other

- Designing Safer Roads - Practices for Resurfacing, Restoration and Rehabilitation, Special Report 214, Transportation Research Board
  http://onlinepubs.trb.org/onlinepubs/sr/sr214/sr214_001_fm.pdf

- *Designing Urban Walkable Thoroughfares: A Context Sensitive Approach*, Institute of Transportation Engineers
  http://library.ite.org/pub/e1cff43c-2354-d714-51d9-d82b39d4dbad

- *Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way*, US Access Board
  http://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way/proposed-rights-of-way-guidelines

- *Recommended Procedures for the Safety Performance Evaluation of Highway Features, Report 350* , National Cooperative Highway Research Program
  http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_350-a.pdf

- *Roadside Safety, Transportation Research Record 1065*, Transportation Research Board
  http://trid.trb.org/view.aspx?id=309335

- *Standard Plans for Public Works Construction*, developed and promulgated by the American Public Works Association, Southern California Chapter, and the Associated General Contractors of California, Southern California Districts
  https://www.bnibooks.com/product/2012-standard-plans-for-public-works-construction

- *Standard Specifications for Public Works Construction*, developed and promulgated by the American Public Works Association, Southern California Chapter, and the Associated General Contractors of California, Southern California District
  https://www.bnibooks.com/product/2015-greenbook-standard-specifications-for-public-works-construction

- *Urban Bikeway Design Guide*, National Association of City Transportation Officials
  http://nacto.org/publication/urban-bikeway-design-guide/

- *Urban Street Design Guide*, National Association of City Transportation Officials
  http://nacto.org/publication/urban-street-design-guide/

EXHIBIT 11-A GEOMETRIC DESIGN GUIDELINES FOR LOCAL 3R PROJECTS (OFF THE SHS)

Table 11-1: Lane and Shoulder Widths Arterial Roads and Streets

Design Year Volume (ADT)	Design Speed (mph)	Lane Width (feet)	Shoulder Width [a] (feet)	Total Roadway Width (feet)
Low Volumes:				
1 - 750 ADT	All	10	2	24
High Volumes:				
751 - 2,000 ADT	All	12	2 [b]	28 [c]
Over 2,000 ADT	All	12	6 [b]	36 [c]

[a] All shoulders on rural and urban arterials to be paved.
[b] Reduce by 1 foot for highways on mountainous terrain.
[c] Reduce by 2 feet for highways on mountainous terrain.

Table 11-2: Lane and Shoulder Widths Collector Roads and Streets

Design Year Volume (ADT)	Design Speed [a] (mph)	Lane Width (feet)	Shoulder Width [b] (feet)	Total Roadway Width (feet)
Low Volumes:				
1 - 750 ADT	All	10	2	24
High Volumes:				
751 - 2,000 ADT	Under 50	10	2 [c]	24 [d]
	50 and over	12	2 [c]	28 [d]
Over 2,000 ADT	All	12	4 [c]	32 [d]

[a] Highway segments should be classified as "under 50" only if most vehicles have an average speed of less than 50 mph over the length of the segment
[b] All shoulders on collector roads and streets to be paved.
[c] Reduce by 1 foot for highways on mountainous terrain.
[d] Reduce by 2 feet for highways on mountainous terrain.

Table 11-3: Lane and Shoulder Widths Local Roads and Streets

Design Year Volume (ADT)	Design Speed [a] (mph)	Lane Width (feet)	Shoulder Width (feet)	Total Roadway Width (feet)
Low Volumes:				
1 - 750 ADT	All	10	2	24
High Volumes:				
751 - 2,000 ADT	Under 50	10	2 [b]	24 [c]
	50 and over	12	2 [b]	28 [c]
Over 2,000 ADT	All	12	4 [b]	32 [c]

[a] Highway segments should be classified as "under 50" only if most vehicles have an average speed of less than 50 mph over the length of the segment.
[b] Reduce by 1 foot for highways on mountainous terrain.
[c] Reduce by 2 feet for highways on mountainous terrain.

Table 11-4: Lane Widths Urban Roads and Streets

Type of Lane	Minimum Width(feet)
Curb Lane	
No Parking Anytime [a]	11
Part-time Use (peak hour/high volume/low speed)	9
With Parking	19
Interior Lane	10
Lane Adjacent to Median	
Raised Curb	10
Painted Median	10
Left-Turn Lane	
One-Way (one lane only)	10
Two-Way (continuous)	10
Bicycle Lane (Within Roadway)	
One-Way	4
Bicycle Lane and Parking (One-Way)	12

[a] A 1 foot curb lane, with up to 2 feet wide gutter, may be used at intersections.

Table 11-5: Bridges on Arterial Roads and Streets

Design Year Volume (ADT)	Minimum Usable Bridge Width [a]
1 - 750	Width of approach lanes [b]
751 - 2,000	Width of approach lanes plus 2 feet each side
2,001 - 6,000	Width of approach lanes plus 4 feet each side
Over 6,000	Width of approach lanes plus 8 feet each side

[a] If lane widening is planned as part of a 3R project, the usable bridge width should be compared with the planned width of the approaches after they are widened.
[b] Minimum usable bridge width to be 24 feet.

Table 11-6: Bridges on Collector Roads and Streets

Design Year Volume (ADT)	Minimum Usable Bridge Width [a]
1 - 750	Width of approach lanes [b]
751 - 2,000	Width of approach lanes plus 2 feet each side
2,001 - 6,000	Width of approach lanes plus 4 feet each side
Over 6,000	Width of approach lanes plus 8 feet each side

[a] If lane widening is planned as part of a 3R project, the usable bridge width should be compared with the planned width of the approaches after they are widened.

[b] Minimum usable bridge width to be 24 feet.

Table 11-7: Bridges on Local Roads and Streets

Design Year Volume (ADT)	Minimum Usable Bridge Width [a]
1 - 750	Width of approach lanes
751 - 2,000	Width of approach lanes plus 2 feet each side
Over - 2,000	Width of approach lanes plus 4 feet each side

[a] If lane widening is planned as part of a 3R project, the usable bridge width should be compared with the planned width of the approaches after they are widened.

Table 11-8: Horizontal and Vertical Alignment Arterial Roads and Streets

Design Speed (mph)	Minimum Stopping Sight Distance (feet)	Minimum Radius of Horizontal Curve (feet)		Maximum Grade (%)					
		Super-Elevation 10% (a)	Super-Elevation 8% (b)	Rural			Urban		
				Level	Rolling	Mountains	Level	Rolling	Mountains
30	200	230	250	...	...	...	8	9	11
40	275	430	470	...	...	...	7	8	10
50	400	695	765	4	5	7	6	7	9
60	525	1,090	1,205	3	4	6	5	6	8

[a] Generally, superelevation should not exceed 10 percent.

[b] Superelevation should not exceed 8 percent where snow and ice conditions prevail.

Table 11-9: Horizontal and Vertical Alignment Collector Roads and Streets

	Minimum Stopping	Minimum Radius of Horizontal Curve (feet)		Maximum Grade (%)					
Design	Sight	Super-	Super-	Rural			Urban		
Speed (mph)	Distance (feet)	elevation 10% (a)	elevation 8% (b)	Level	Rolling	Mountains	Level	Rolling	Mountains
20	125	100	105	7	10	12	9	12	14
30	200	230	250	7	9	10	9	11	12
40	275	430	470	7	8	10	9	10	12
50	400	695	765	6	7	9	7	8	10
60	525	1,090	1,205	5	6	8	6	7	9

[a] Generally, superelevation should not exceed 10 percent.
[b] Superelevation should not exceed 8 percent where snow and ice conditions prevail.

Table 11-10: Horizontal and Vertical Alignment Local Roads and Streets

	Minimum Stopping	Minimum Radius of Horizontal Curve (feet)		Maximum Grade (%)		
Design	Sight	Super-	Super-	Rural		
Speed (mph)	Distance (feet)	Elevation 10% (a)	elevation 8% (b)	Level	Rolling	Mountains
20	125	100	105	8	11	16
30	200	230	250	7	10	14
40	275	430	470	7	9	12
50	400	695	765	6	8	10
60	525	1,090	1,205	5	6	...

[a] Generally, superelevation should not exceed 10 percent.
[b] Superelevation should not exceed 8 percent where snow and ice conditions prevail.

Exhibit 11-B Bridges and Structures

Definitions

Bridge – As defined in 23 Code of Federal Regulations (CFR) 650.305, a bridge is defined as:

> *A structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening.*

Bridge Length – The greater dimension of a structure measured along the center of the roadway between backs of abutment backwalls or between ends of bridge floors.

Bridge Roadway Width – The clear width of a structure measured at right angles to the center of the roadway between the bottom of curbs or, if curbs are not used, between the inner faces of parapet or railing.

Other Structures – Any structure, other than a "bridge," as defined above, that is related to a local agency highway or transportation project, including but not limited to:

- Structures designed as a bridge, but not meeting the bridge definition noted above
- Culverts not meeting the bridge definition noted above
- Earth retaining structures
- Underground structures
- Pedestrian and/or bicycle structures
- Transit structures

Statewide Design Standards for Bridges and Structures

Local agency funded highway transportation projects with bridges and structures on the State Highway System (SHS) must be designed in accordance with current SHS standards in the Caltrans bridge design and geotechnical manuals.

All local bridge and structure projects off the SHS and either on or off the National Highway System (NHS) must be designed in accordance with the current Caltrans adopted edition of the *AASHTO Local and Resistance Factor Design (LRFD) Bridge Design Specifications with California Amendments.*

Caltrans bridge design manuals, policies, standards, and guidance are available on the Caltrans Division of Engineering Services (DES) website under Technical Publications. The Caltrans *Geotechnical Manual* is available on the Caltrans DES website under Geotechnical Services.

The following bridge design policies, criteria, and standards address bridge design:

- The current Caltrans adopted edition of the *AASHTO LRFD Bridge Design Specifications with California Amendments*
- The current version of the Caltrans Seismic Design Criteria (SDC)
- The current releases to the Caltrans Bridge Memo to Designers (MTD)

The MTD serves as a supplement to the Caltrans adopted edition of the *AASHTO LRFD Bridge Design Specifications with California Amendments* and the Caltrans' Seismic Design Criteria. Caltrans MTDs are technical policies and procedures particular to California and assist the Structure Designer in the interpretation and application of structural and seismic design standards.

The following Caltrans bridge design manuals are considered Caltrans bridge design guidance, where guidance includes current Caltrans procedures and technical practices:

- *Bridge Design Practice Manual*
- *Bridge Design Details*
- *Bridge Design Aids*

Bridge Design Alternatives

Structural Capacity - Alternatives to the criteria contained herein for the structural capacity of bridges, bridge railings, and other structures are not allowed. Alternatives to bridge design detailing are permitted as long as they do not impact structural capacity.

Geometric Standards - Alternatives to accepted geometric standards are allowed. For alternatives to geometric criteria, see Design Decisions described in Section 11.2. Design decisions that would result in the construction of a federally funded new bridge with a Sufficiency Rating of less than 80 are not allowed.

Railroad Bridges

Local agencies should consider developing project-specific design criteria for local bridge projects carrying rail traffic.

Bridge Railing

Local agency funded highway transportation projects on the SHS must use a current Caltrans approved bridge railing. Current Caltrans approved bridge railings and associated details can be found within the current *Caltrans Standard Plans* and current Caltrans Bridge Standard Detail Sheets, commonly referred to as XS sheets.

For local bridge projects off the NHS, bridge railing designs must either meet the crash testing requirements of *NCHRP Report 350* or *AASHTO Manual for Assessing Safety Hardware (MASH)*, or can be geometrically and structurally evaluated as equal to a crash-tested system. For more information on bridge railing types tested under *NCHRP Report 350* or *AASHTO MASH*, or for bridge railing that has been evaluated as equal to a crash-tested system, refer to both the AASHTO Task Force 13, *A Guide to Standardized Bridge Rail Hardware* and the FHWA Bridge Railings webpage.

For local bridge projects on the NHS, bridge railing designs must meet the crash testing requirements of *NCHRP Report 350* or *AASHTO MASH*. Any new proposed bridge railing design that has not been previously approved under *NCHRP Report 350* must meet *AASHTO MASH* testing requirements.

Foundation Investigation for Design

A foundation investigation and report must be completed for all local agency bridge projects with major rehabilitation or replacement unless the engineer in responsible charge of design documents that site conditions clearly indicate the report is unnecessary. Federal funds will not participate in any construction change orders or claims relating to inadequate foundation investigations when such a waiver has been exercised. In addition, federal participation in future repair costs resulting from the inadequate foundation investigation will be made on a project-by-project basis.

The following reports are part of the foundation investigation:

- Structures Preliminary Geotechnical Report (SPGR)
- Preliminary Foundation Report (PFR) – Type Selection Process
- Foundation Report (FR) – Final PS&E Process

For further guidance refer to *Foundation Report Preparatin for Bridge Foundations* and *Guidelines for Structures Foundation Reports.*

Bridge and Culvert Hydraulic Design

Local agency funded highway transportation projects with bridges and structures on the SHS must be designed in accordance with current SHS standards in the Caltrans bridge design manuals, *Caltrans Geotechnical Manual* and *Caltrans Highway Design Manual*.

All local bridge and structure projects off the SHS and either on or off the NHS must be designed in accordance with the current Caltrans adopted edition of the *AASHTO LRFD Bridge Design Specifications with California Amendments*.

The goal of hydraulic design for bridges and structures is to convey surface and stream waters originating upstream of the drainage facility to the downstream side without significant upstream and downstream impacts in a manner that meets regulatory requirements.

The local agency must use sound engineering judgment in selecting and applying their project-specific hydraulic criteria in order to design the most cost-effective project considering the importance of the facility, safety, federal and state regulations, environmental requirements, legal obligations, and ease of maintenance.

The following resources are available to assist local agencies in hydraulics and hydrologic design:

- Caltrans Highway Design Manual
- FHWA Hydraulic Engineering Circular (HEC) Publications
  Section 11.3 Highway Cross Drainage, Hydraulic, and Hydrologic Design of the

LAPM
- FHWA Hydraulic Engineering Website
- Central Valley Flood Protection Board Website
- NOAA Fisheries Website
- California Department of Fish and Game Website

The local agency must document their selected project-specific hydraulic and hydrologic design criteria within the following two bridge hydraulic reports:

- Preliminary Hydraulic Report (during the project planning phase)
- Final Hydraulic Report (during the project design phase)

The Scour Data Table must be shown on the plans for new projects and on the As-Built Plans for projects going to construction after November 16, 2015.

References

AASHTO

- *Guide Specifications for Bridge Railings*
  https://bookstore.transportation.org/CATEGORY_ITEM.ASPX?ID=DS&GCLID=CLTK3EXEY8MCFUEEFGODU3UAPQ

- *LRFD Bridge Design Specifications*
  https://bookstore.transportation.org/HOME.ASPX

- *LRFD Guide Specification for the Design of Pedestrian Bridges*
  https://bookstore.transportation.org/home.aspx

- *Standard Specifications for Highway Bridges,*
  https://bookstore.transportation.org/category_item.aspx?id=DS&gclid=CLTK3eXey8MCFUeEfgodu3UAPQ

- *Task Force 13, A Guide to Standardized Bridge Rail Hardware*
  http://www.aashtotf13.org/

Caltrans

- *Bridge Design Aids*
  http://www.dot.ca.gov/hq/esc/techpubs/index.html

- *Bridge Design Details*
  http://www.dot.ca.gov/hq/esc/techpubs/index.html

- *Bridge Design Practice Manual*
  http://www.dot.ca.gov/hq/esc/techpubs/index.html

- *Bridge Memo to Designers*

http://www.dot.ca.gov/hq/esc/techpubs/index.html

- *Bridge Rails and Barriers, A Reference Guide for Transportation Projects in the Coastal Zone*
  http://www.dot.ca.gov/hq/LandArch/16_la_design/aesthetics/barriers/pdf/Caltrans_Bridge_Rails_and_Barriers.pdf

- *Bridge Standard Details Sheets* (XS Sheets)
  http://www.dot.ca.gov/hq/esc/techpubs/index.html

- *California Amendments (to the AASHTO LRFD Bridge Design Specification) – current edition*
  http://www.dot.ca.gov/hq/esc/techpubs/manual/bridgemanuals/ca-to-aashto-lrfd-bds/caalbds_v4.html

- *California Bank and Shore Rock Slope Protection Design,*
  http://www.dot.ca.gov/hq/oppd/hydrology/hydroidx.htm

- *Caltrans Division of Engineering Services (DES) Technical Publications*
  http://www.dot.ca.gov/hq/esc/

- *Caltrans Geotechnical Manual*
  http://www.dot.ca.gov/hq/esc/geotech/geo_manual/manual.html

- *Foundation Report Preparation for Bridge Foundations*
  http://www.dot.ca.gov/hq/esc/osfp/current-issues/new-foundation-manuals/new-foundations-manuals.htm

- *Guidelines for Structures Foundation Reports*
  http://www.dot.ca.gov/hq/esc/osfp/current-issues/new-foundation-manuals/new-foundations-manuals.htm

- *Standard Plans*
  http://www.dot.ca.gov/hq/esc/oe/project_plans/HTM/stdplns-US-customary-units-new15.htm

- *Soil and Rock Logging Manual*
  http://www.dot.ca.gov/hq/esc/geotech/sr_logging_manual/srl_manual.html

FHWA

- *23 CFR Part 650 Bridges, Structures and Hydraulics*
  http://www.ecfr.gov/cgi-bin/text-idx?rgn=div5&node=23:1.0.1.7.28

- *FHWA Bridge Railing*
  http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/bridgerailings/

- *Hydraulic Engineering*
  http://www.fhwa.dot.gov/engineering/hydraulics/

Other

- *California Derpartment of Fish and Game*
  http://www.wildlife.ca.gov/

- *Central Valley Flood Protection Borad Home*
  http://www.cvfpb.ca.gov/

- *NOAA Fisheries*
  http://www.nmfs.noaa.gov/

Exhibit 11-F Sample Design Fact Sheet

Dist: _____ Date: _____

Co: _____ Prepared by: _____

Rte: _____

Project Cost: _____

1. **Existing Conditions**

2. **Proposed Work and Non Standard Features**

3. **Standard for Which Alternative is Required**

4. **Collision Analysis**

5. **Design Year Traffic Volumes**

6. **Added Cost to Make Standard**

7. **Description of Any Additional Work to Enhance Safety**

8. **Reason for Requesting Alternative**

Alternative Approved: _____ Date: _____

PUBLIC WORKS DIRECTOR (or DELEGATE TITLE)

Distribution: Original retained in project files

INSTRUCTIONS FOR DESIGN FACT SHEET

1. Existing Conditions

Describe existing facility. Number of lanes, median width, shoulder width, etc. Describe width of adjoining sections if that information is relevant, for example on 3R projects.

2. Proposed Work and Non Standard Features

Describe work to be done. Resurfacing, shoulder widening, bridge widening, etc. Describe the non- standard design element that required the alternative.

3. Standard for Which Alternative is Required

Be specific. Name the source, i.e., 3R Criteria, *Instructions for AASHTO Green Book Implementation*, or *Highway Design Manual*.

4. Collision Analysis

Describe the type(s) of collisions that are occurring and what effect the design alternative is expected to have on them.

5. Design Year Traffic Volumes

If a 3R project, use construction year. Otherwise, use design year (usually 20 years in the future).

6. Added Cost to Make Standard

Show what it would cost to meet the standard for which the alternative is being requested. If more than one quadrant is involved in the approach rail design request, cost shall be broken down on a per quadrant basis.

The Fact Sheet should also be accompanied with a detailed drawing of the bridge site along with topographical features (right of way lines, side road widths, physical obstructions, etc.) 100 feet from beginning and ending of the bridge.

7. Description of Any Additional Work to Enhance Safety

Mention any additional work which would qualify for safety enhancement such as median barrier, guardrail upgrade, slope flattening, super correction, elimination of roadside obstacles, additional lane and shoulder width, alignment improvement, etc.

8. Reason for Requesting Alternative

Be thorough, but brief. These are some, but not all of the reasons the alternative has been granted in the past: high cost, environmental sensitivity, low accident rates, and postponement of bridgework.

The Design Fact Sheet must be signed, stamped with engineer's seal, approved by Director of Public Works or the person whom approval authority has been delegated, and retained in the project files.