

Chapter 11 Design Guidance

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Exhibits

[Exhibit 11-A: Geometric Design Guidelines for Local 3R Projects \(Off the SHS\)](#)

[Exhibit 11-B: Bridges and Structures](#)

[Exhibit 11-F: Sample Design Fact Sheet](#)

All LAPM Exhibits are located at:

<https://dot.ca.gov/programs/local-assistance/forms/local-assistance-procedures-manual-forms>

Chapter 11 Design Guidance

11.1 Introduction

The purpose of this chapter is to provide statewide design guidance applicable to Local Public Agency (LPA) administered federal-aid transportation projects. These guidelines and procedures should be considered in the design of transportation projects and applied with engineering knowledge, experience, and judgement to provide a safe, sustainable, integrated, and efficient transportation system.

11.2 Design Guidance for Local Assistance Projects

New and Reconstruction Projects

23 CFR 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.

New construction involves building a new facility that did not previously exist along a highway segment including new roadways, alignments, interchanges or grade separation crossings and new parking lots or safety roadside rest areas. The addition of appurtenances to an existing facility, such as striping, signs, signals, noise barriers, etc. is not considered new construction.

Reconstruction replaces the entire existing pavement structure with an equivalent or increased new pavement structure and rebuilding of adjacent operational and roadside features. Reconstruction is typically warranted when the roadway has become functionally and structurally obsolete. Reconstruction features typically include significant change to the horizontal or vertical alignment of the highway and may include the addition of lanes.

Reconstruction differs from lane/shoulder replacement roadway rehabilitation options in that lane/shoulder replacements typically involve replacing portions of the roadway width, whereas reconstruction is the removal and replacement of the entire roadway width. Incidental rebuilding of existing pavements for rehabilitation to conform to bridges, existing pavement, or to meet vertical clearance standards is considered rehabilitation and not reconstruction. Storm and earthquake damage repairs (i.e., catastrophic) also are not considered reconstruction projects.

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

Projects on the State Highway System (SHS)

LPA 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)

LPA 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) [Policy on Geometric Design of Highways and Streets](#).

Projects not on the NHS

LPA 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 AASHTO [Policy on Geometric Design of Highways and Streets](#).

LPA developed design standards may be used on LPA 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 LPA'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 3R projects on the NHS must be the procedures and the design or design criteria established for individual projects, groups of projects, or all 3R projects in a state, and as approved by the FHWA. Below are the standards approved by FHWA.

3R work 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.

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 wherever reasonable. However, the work may include selective improvements to highway geometry and other roadway features, including safety appurtenances, and still be considered 3R work.

Projects on the SHS

LPA 3R projects on the SHS must be designed in accordance with the geometric standards and guidance provided by Caltrans [Design Information Bulletin 79-04 \(DIB 79-04\)](#).

Projects not on the SHS

LPA 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 \(Off the SHS\)](#).

Bridges and Other Structures

All LPA 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 bridges and other structures is provided in [Exhibit 11-B: Bridges and Structures](#).

11.3 Standard Plans

The Caltrans Standard Plans must be used for all LPA projects on the SHS.

The following standard plans are acceptable for use on LPA 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.
- LPA developed standard plans

LPA developed standard plans may be used on LPA new or reconstruction projects not on the SHS 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 LPA'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 LPA projects on the SHS, the current Caltrans Standard Specifications must be used.

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

- Current [Caltrans Standard Specifications](#)
- Current edition of the Standard Specifications for Public Works Construction
- LPA developed standard specifications

LPA developed standard specifications may be used on LPA 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 LPA'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

Flexible and context-sensitive approaches which consider 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. LPAs must evaluate, approve, and document design decisions.

Projects on the SHS

LPA projects on the SHS must follow the design alternative approval procedures outlined in Caltrans Project Development Procedures Manual (PDPM) [Chapter 21: Design Decision Standards](#).

Alternatives to accessibility design standards on SHS projects are outlined in Caltrans [DIB-82: Pedestrian Accessibility Guidelines for Highway Projects](#).

Projects not on the SHS

For LPA 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 LPA 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 an engineer's seal, approved by the 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 LPAs 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

LPA proposed bridge or structure design alternatives must follow the procedures outlined in [Exhibit 11-B: Bridge and Structures](#).

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 LPA 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 LPA 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](#). LPAs 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

LPAs 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 for local projects can be found on the [Caltrans Local Assistance Environmental Issues website](#).

Bicycle and Pedestrian Facilities

LPAs 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 Officials (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 outlined 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](#). The best practice is for the City or other local public entity conducting the work, the State transportation agency, and FHWA to work together to come to an agreement on reasonable determination, document their policies, and apply that determination consistently in their locality.

Certain types of resurfacing treatments must be considered an alteration that triggers the requirement to add curb ramps if it involves work on a street or roadway spanning from one intersection to another, and includes overlays of additional material to the road surface, with or without milling. Regardless of whether there is curb-to-curb resurfacing of the street or roadway in general, resurfacing of a crosswalk also requires the provision of curb ramps at that crosswalk.

The following roadway treatments are considered an alteration:

- Open-graded Surface Course
- Cape Seals
- Mill & Fill / Mill & Overlay
- Hot In-Place Recycling
- Microsurfacing / Thin Lift Overlay

- Addition of New Layer of Asphalt
- Asphalt and Concrete Rehabilitation and Reconstruction
- New Construction

Treatments that serve solely to seal and protect the road surface, improve friction, and control splash and spray must be considered maintenance because they do not significantly affect the public's access to or usability of the road.

The following types of treatments are considered maintenance:

- Crack Filling and Sealing
- Surface Sealing
- Chip Seals
- Slurry Seals
- Fog Seals
- Scrub Sealing
- Joint Crack Seals
- Joint Repairs
- Dowel Bar Retrofit
- Spot High-Friction Treatments
- Diamond Grinding
- Pavement Patching

In some cases, the combination of several maintenance treatments occurring at or near the same time may qualify as an alteration and would trigger the obligation to provide curb ramps. More information on treatments that are considered an alteration triggering the requirement to add curb ramps can be found at <https://www.ada.gov/doj-fhwa-ta-glossary.htm>.

In accordance with Section 4454(b)(a) of the California Government Code, Approval of Plans and Specifications, LPA plans and specifications with pedestrian facilities to be constructed with state funds must be reviewed and approved by the Division of the State Architect (DSA). LPA plans and specifications of pedestrian facilities within the state highway right of way, excluding rail and transit systems, can be reviewed and approved (certified) by Caltrans in place of DSA. Approval of the plans and specifications by DSA will require fees be paid directly to DSA. DSA regional offices can be found at: <https://www.dgs.ca.gov/DSA/Resources/Page-Content/Resources-List-Folder/Accessibility-Plan-Review>.

The Accessible Parking and Curb Ramp plans included in [Caltrans Standard Plans](#) are FHWA-approved 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 including ADA design standards (<http://www.ada.gov/>) and design guidance (<https://www.access-board.gov/guidance.html>).

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 refer to the 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 must be placed upon a street or highway.
- (b) Any traffic signal controller that is newly installed or upgraded by the Department of Transportation must 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 LPAs to continue taking the action formerly mandated by this section. However nothing in this subdivision may be construed to impose any liability on the LPA 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 [pedbikeinfo.org](#).

11.7 References

Refer to [Exhibit 11-B: Bridge and Structures](#) for references related to bridges and other structures.

AASHTO

A Policy on Geometric Design of Highways and Streets
<https://store.transportation.org/Item/CollectionDetail?ID=180>

Drainage Manual
<https://store.transportation.org/Item/PublicationDetail?ID=5219>

Guide for Achieving Flexibility in Highway Design
<https://store.transportation.org/Item/CollectionDetail?ID=31>

Guide for the Development of Bicycle Facilities
<https://store.transportation.org/Item/CollectionDetail?ID=116>

Guide for the Planning, Design and Operation of Pedestrian Facilities
<https://store.transportation.org/Item/CollectionDetail?ID=224>

Highway Drainage Guidelines
<https://store.transportation.org/Item/PublicationDetail?ID=1747>

Roadside Design Guide
<https://store.transportation.org/Item/CollectionDetail?ID=105>

Caltrans

California Manual on Uniform Traffic Control Devices (CA MUTCD)
<https://dot.ca.gov/programs/safety-programs/camutcd>

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)
<https://dot.ca.gov/programs/design/ccs-standard-plans-and-standard-specifications>

Design Information Bulletin 79-04 (DIB-79) - Design Guidance and Standards for Major Pavement Roadway Rehabilitation Projects
<https://dot.ca.gov/-/media/dot-media/programs/design/documents/signed-dib-79-04-posting-030123-a11y.pdf>

Director's Policy DP-37 - Complete Streets
<https://dot.ca.gov/-/media/dot-media/programs/esta/documents/complete-streets/dp-37-complete-streets-a11y.pdf>

Flexible Pavement Structural Section Guide for California Cities and Counties
<https://worldcat.org/title/932236136>

Highway Design Manual
<https://dot.ca.gov/programs/design/manual-highway-design-manual-hdm>

Main Street California, a Guide for Improving Community and Transportation Vitality
<https://dot.ca.gov/programs/design/lap-landscape-architecture-and-community-livability/lap-main-street-california>

NEPA Assignment and Environmental Compliance website
https://www.environment.fhwa.dot.gov/nepa/program_assignment.aspx

Project Development Procedures Manual
<https://dot.ca.gov/programs/design/manual-project-development-procedures-manual-pdpm>

Standard Environmental Reference (SER) Standard Plans
<https://dot.ca.gov/programs/environmental-analysis/standard-environmental-reference-ser>

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>

Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way, US Access Board

<https://www.access-board.gov/webinars/2023/10/05/accessibility-guidelines-for-pedestrian-facilities-in-the-public-right-of-way/>

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/products/standard-plans-for-public-works-construction-2021-edition?_pos=2&_sid=1911b0503&_ss=r

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/collections/public-works/products/2021-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/>