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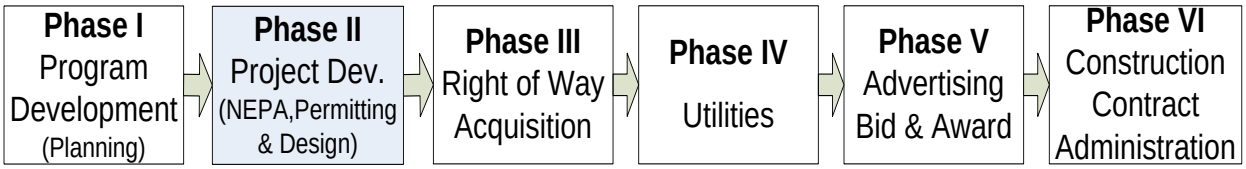
SECTION B NON-CERTIFIED AGENCY

Chapter 9 General Design Requirements

This chapter and the following two chapters of the *LAG Manual* relate to the design phase of FHWA funded projects:

- Chapter 9, General Design Requirements;
- Chapter 10, Design Approval; and
- Chapter 11, Plans, Specifications and Estimates (PS&E).

In the sequence of project delivery, design occurs after program development and prior to bid and award.



A. OVERVIEW

This chapter covers the design phase and standards for federally funded projects on the local public agency (LPA) transportation system. For these projects, the American Association of State Highway and Transportation Officials (AASHTO) guidelines have been adopted as the design standard.

Design standards for projects on the state highway system must conform to the requirements detailed in ODOT's current Highway Design Manual.

The approving agency identified for the various phases of work is indicated in the Approval Authority Matrix in Chapter 2, Section A of this *LAG Manual*.

LPA projects on the state highway system have different standards that apply to the design of:

- New Construction / Reconstruction (4-R) projects; and
- Resurfacing, Restoration and Rehabilitation (3-R) projects.

Each of these standards is defined in separate sections below. LPAs should determine which standards apply before beginning their project design.

For FHWA funded projects, AASHTO standards apply based on the functional classification of the roadway. Additional classification information is available on ODOT's "Federal Functional

Classification" website. Generally, context sensitive design concepts should be considered for all project designs. Further information related to context sensitive design can be found at the Oregon Transportation and Growth Management website.

Qualifying low-volume local agency roadways with Average Daily Traffic less than 400 (ADT ≤ 400) may use the AASHTO Low Volume Road Guide. AASHTO manuals can be purchased at the AASHTO Bookstore website.

B. PAVEMENTS

To be eligible for federal funding, pavements shall be designed to provide a service life of 20 years for new or reconstructed pavements and 15 years for rehabilitated pavements. Any departure from these service life requirements will be considered a design deviation. See the "Deviations" Section below for additional details on the design exception process. Refer to ODOT's *Pavement Design Guide* for additional information.

C. VALUE ENGINEERING

FHWA defines Value Engineering as "the systematic application of recognized techniques by a multi-disciplined team which identifies the function of a product or service; establishes a worth for that function; generates alternatives through the use of creative thinking; and provides the needed functions, reliably, at the lowest overall cost."

It is encouraged that value engineering be used, as needed, throughout project development, construction, operation and maintenance. Value Engineering analysis should be considered on high cost and major projects or where its use has a high potential for public benefit. The need for value engineering should be determined on a project-by-project basis. Projects over $25 million must include Value Engineering analysis during the design phase. See Chapter 10, Design Approval in this *LAG Manual* for additional Value Engineering information.

D. NEW CONSTRUCTION / RECONSTRUCTION PROJECTS (4-R)

A reconstruction project is designed to meet the minimum design standards for new construction for the functional class. Reconstruction includes significant changes in cross section or shifts in both vertical and horizontal alignment. If 50 percent or more of the project length involves reconstruction type work, the project will be considered reconstruction. Reconstruction may require acquisition of additional right of way and may include all items of work usually associated with new construction, including items "1" through"16" below. New Construction/Reconstruction (4R) projects on routes under State jurisdiction shall be designed to the 4R standards found in ODOT's *Highway Design Manual*. Projects on other routes shall be designed to the standards found in the current version of AASHTO's A Policy on Geometric Design of Highways and Streets. As noted above, AASHTO manuals can be purchased at the AASHTO Bookstore website. If it is not clear which standard should be used, contact the

Regional Local Agency Liaison. It is important that the standards chosen are appropriate for the functional classification of the road in question.

1. Roadside Inventory

A Roadside Inventory (see ODOT's Highway Design Manual) is an integral part of all projects and should include:

- Upgrading existing substandard roadway design elements;
- Improving existing operational features;
- Reducing the potential hazard of existing roadside features;
- Upgrading bridge safety features.

Under MAP-21 there are new Americans with Disabilities Act (ADA) requirements as well.

2. Pavement Type Determination

ODOT must approve all pavement designs. The determination of pavement type is of major importance in the development of plans for any urban street and road paving improvement.

Refer to ODOT's Pavement Design Guide for additional information.

3. Structural Design

Design procedures shall conform to Load Resistance Factor Design (LRFD) Bridge Design Specifications (4th Edition 2007) published by the American Association of State Highway and Transportation Officials (AASHTO).methodology and Oregon Standard Drawings, published by Oregon Department of Transportation Standards Engineer. Bridge deck protection is required for all FHWA funded bridge construction. The recommended protective systems are outlined in ODOT's Bridge Design/Drafting Manual, *section* **1.1.20.5 Deck Overlays**

4. Construction Specifications

All federally funded, non-certified LPA projects shall be constructed in conformance with the current edition of the Oregon Standard Specifications for Construction See Chapter 11, Plans, Specifications and Estimate (PS&E) in Section B of this *LAG Manual*.

5. Traffic Control

All traffic control devices shall conform to the Manual on Uniform Traffic Control Devices and the Oregon Supplement to the Manual on Uniform Traffic Control Devices. Projects on the State Highway system shall conform to ODOT standards as per the ODOT Traffic Manual and other applicable manuals. Traffic control poles and foundations should be checked by a structural engineer or responsible manufacturer.

6. Clear Zone

The clear zone is the roadside border area starting at the edge of the travel lane that is available for safe use by errant vehicles. See ODOT's Highway Design Manual for further clear zone discussion.

Refer to the AASHTO Roadside Design Guide for criteria for establishing clear zone distances, discussions of roadside features and data on roadside barriers. If the guidelines in the Roadside Design Guide are not followed, the design exception process outlined in the "Deviations" Section below shall be followed. The AASHTO Roadside Design Guide is available at the AASHTO Bookstore.

7. Geometric Cross-Section

It is desirable that all new construction provides embankment slopes and ditch fore slopes of 1:4 or flatter. Embankment slopes of 1:3 or steeper may be used when achieving flatter slopes has been demonstrated to be impractical. Reference ODOT's Highway Design Manual.

8. Vertical Clearance

Refer to the appropriate section of AASHTO's A Policy on Geometric Design of Highways and Streets for the required vertical clearance for each functional classification of roadway. AASHTO manuals can be purchased at the AASHTO Bookstore.

Motor Carrier Transportation Division staff plays a critical role approving highway restriction requests and working with the Communications Division to keep the trucking industry informed of construction project impacts. Motor Carrier Division staff also identifies key routes and types of truck loads that may be operating in and around projects, provides feedback regarding clearances for freight loads, and helps find detours and alternate routes. Contact ODOT staff such as region mobility liaisons for more information.

9. Bridge Approach Railings

Approach guardrail is required at all bridge ends and shall be made structurally continuous with the bridge railing.

Guardrail layouts have been developed for use when an intersecting roadway or private approach exists within the limit of the standard bridge approach guardrail. See ODOT's Standard Drawings and Standard Details website for additional information.

10. Bridge Railings

Only bridge rail designs that have been successfully crash tested (or their equivalents) shall be used on federally funded new construction or reconstruction projects. ODOT's Bridge Design/Drafting Manual contains guidelines and performance levels for bridge railing along with examples of bridge rail designs that have been crash tested.

11. Illumination

Consider roadway illumination for high activity pedestrian areas (bus stops, crosswalks, etc.), locations with a high number of night-time accidents, interchanges, etc. Low energy consumption designs should be considered as the maintenance and operation costs of illumination systems may exceed the installation costs. Lighting levels should be designed according to Illuminating Engineering Society Standards (IESNA) (RP8). Light poles and foundations should be checked by a structural engineer, foundations engineer and/or responsible manufacturer.

12. Pedestrian Facilities

In urban areas, sidewalks are desirable on both sides of the street, as stated in the Oregon Bicycle and Pedestrian Plan.

13. Bicycle Facilities

The Oregon Bicycle and Pedestrian Plan establishes bikeway design and construction standards, establishes guidelines for traffic control devices on bikeways and recommends illumination standards. Bikeways should be incorporated into projects where appropriate. See ODOT's Bicycle/Pedestrian website for information related to bicycle facility laws, standards, grants, contacts, etc.

14. Sidewalks and Ramps

All sidewalks, ramps and driveways shall meet the accessibility requirements of the Americans with Disabilities Act. Reference ODOT's Standard Drawings for additional guidance.

15. Drainage and Hydraulic Design

Refer to ODOT's Hydraulics Manual.

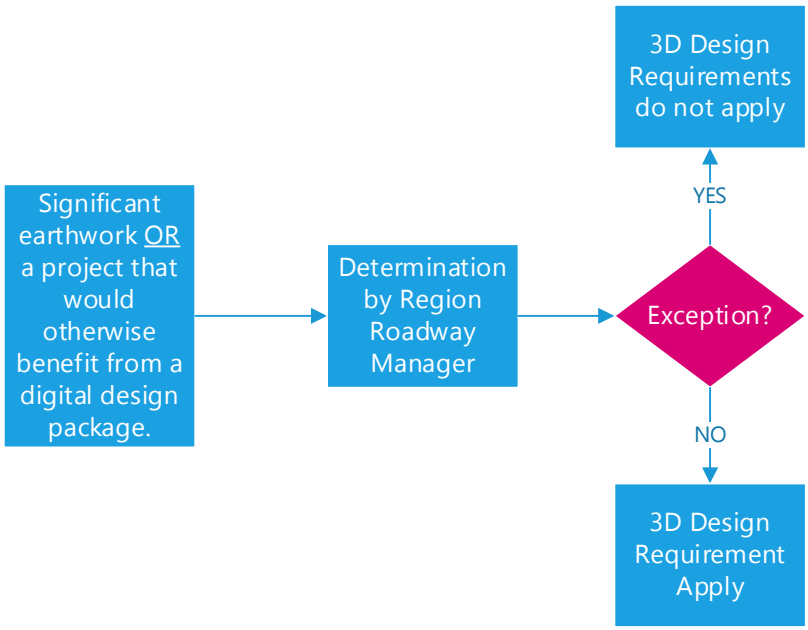
16. 3D Digital Data

LPAs projects awarded through ODOT's Office of Project Letting (OPL) are required to follow ODOT's process for delivery of roadway digital design documents. Refer to ODOT's Highway Design Manual Chapter 16 and accompanying Appendix M which provides clarification

concerning the required content, process/workflows, delivery timelines, and quality control of digital 3D roadway design data for Oregon's Statewide Transportation Improvement Program (STIP) projects awarded through ODOT's Office of Project Letting.

While ODOT's preference is to use the Bentley suite, other design software can produce the LandXML format. For example, an LPA or their consultant can provide all the 3D design documents in the LandXML format with the AutoCAD suite.

Flow chart for determining if 3D Digital Data requirements apply:



E. RESURFACING RESTORATION AND REHABILITATION (3-R) PROJECTS

Resurfacing, restoration and rehabilitation projects on routes under State jurisdiction shall be designed to ODOT's "3-R" standards found in ODOT's Highway Design Manual. 3-R projects on other routes may be designed to ODOT 3-R or AASHTO standards. Care should be taken to ensure that the standards chosen are appropriate for the functional classification of the road in question. Additional design guidance for 3-R projects may be found in Transportation Research Board Special Report #214.

1. Roadside Inventory

A Roadside Inventory (see ODOT's Highway Design Manual) is an integral part of all projects and should include:

- Upgrading existing substandard roadway design elements;
- Improving existing operational features;
- Reducing the potential hazard of existing roadside features;
- And upgrading bridge safety features.

Under MAP-21 there are new Americans with Disabilities Act (ADA) requirements as well.

2. Super elevation

In order to provide the same degree of safety and comfort on 3-R projects as on any other project, super elevation, including transitions, should be provided. Chapter III of AASHTO's A Policy on Geometric Design of Highways and Streets, contains in-depth discussions on pavement cross slope and super elevation selection. AASHTO manuals can be purchased at the AASHTO Bookstore website.

Rebuilding horizontal curves to larger radii and appropriate super elevation should always be considered, especially when accident data indicates that a problem exists.

3. Pavement

Pavement design should use the minimum depth practical to achieve a structural section capable of carrying projected loads over the design period. Refer to ODOT's Pavement Design Guide for complete information.

4. Geometric Cross-Section

Fill and cut slopes may be affected as a result of proposed work on the roadway and shoulder surfaces. Refer to the AASHTO *Roadside Design Guide* for guidance in appropriate slope selection. AASHTO manuals can be purchased at the AASHTO Bookstore website.

5. Alignment

Alignment improvements should be undertaken in cases where the number of accidents has been high and where previously installed warning signs, markings or other devices have not proven effective.

6. Curvature

If the calculated design speed for a particular horizontal or vertical curve is less than 15 mph below the designated speed limit of the adjacent sections and the location is not an identified high accident location, proper signs and markings informing drivers of the condition may be used in lieu of reconstruction to meet standards for the assumed design speed. When the difference is 15mph or more, or when the design speed of the horizontal or vertical curve is less than 20mph, corrective action should be undertaken. If improvement is not practicable,

additional signs and markings and other provisions must be used to provide for proper speed transition.

Sight distance on horizontal curves and at intersections can often be improved by minor cut slope flattening or selective clearing or both.

7. Grades

Grades generally do not need to be flattened on 3-R projects. Steep grades and restricted horizontal or vertical curvature in combination, however, may warrant investigation.

8. Clear Zone

For safety, it is desirable to provide a roadside recovery area that is as wide as practical. But since 3-R projects are constrained by topographic features and right of way, considerable judgment must be used. The clear zone must be given particular attention at identified high roadside accident locations (fixed object accidents). An adequate clear zone at some horizontal curves, especially those at the end of a downgrade, should be provided if practicable. See the AASHTO Roadside Design Guide and ODOT's Highway Design Manual.

9. 3D Digital Data

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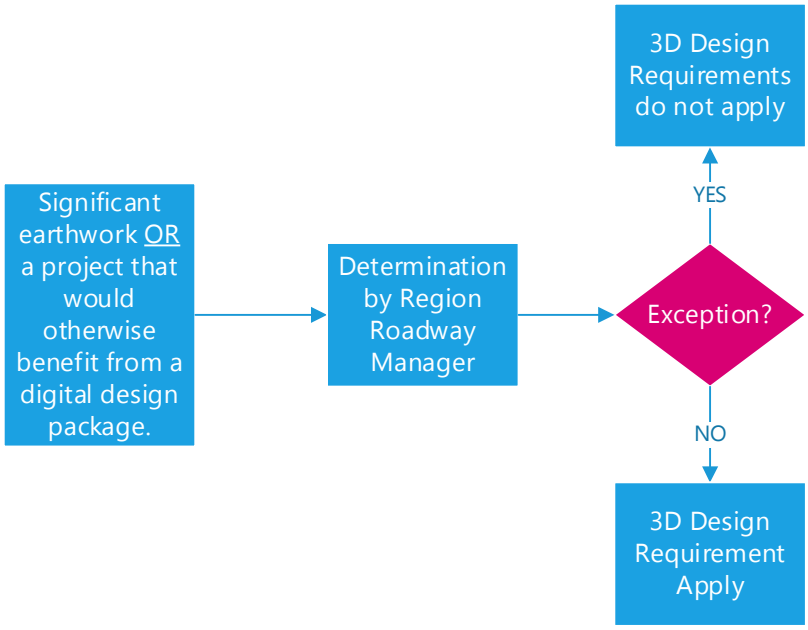

F. GEOMETRIC DESIGN OF VERY LOW-VOLUME LOCAL ROADS (ADT<400)

Design standards for low volume LPA roadways can be found in the AASHTO Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400) manual. AASHTO manuals can be purchased at the AASHTO Bookstore website.

A very low-volume road is a road that is functionally classified as a local road and has a design ADT of 400 vehicles per day or less. The AASHTO Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400) is intended for application in the design of new construction or improvements to existing very low-volume roads. These guidelines apply in both urban and rural areas. The design guidelines enable designers to apply design criteria that are generally less restrictive than those used on higher volume roadways. The risk assessment upon which these guidelines are based shows that these less restrictive design criteria can be applied on very low-volume roads without compromising safety.

G. DEVIATIONS/DESIGN EXCEPTION PROCESS

Deviations from the standards require approval of a Local Agency Design Exception Request from ODOT. To obtain ODOT approval the LPA must submit a completed Local Agency Design Exception Request Form to ODOT's Regional Local Agency Liaison for processing.

LPAs are authorized to design projects to the standards referenced in this chapter, following the warrants and qualifying statements given. In the event any minimum design requirement cannot be incorporated into the design, the LPA shall submit the deviation for review and approval.

A LPA shall document on the Local Agency Design Exception Request Form their reasons for deviation from standards. The deviation should include a description of the problem, its proposed solution and any other information which may be helpful as a future reference. This shall be documented prior to the LPA's completion of PS&E documents and as early in the process as possible. Approval of any design exception is a prerequisite for PS&E approval.

H. PROJECT MILESTONES

It is ODOT policy to record certain milestones for the purpose of internal auditing of project deadlines, costs, and schedule. It is advised that LPAs record specific milestone dates within the project lifecycle. These dates will help the LPA and ODOT better evaluate projects. The three new milestone dates include:

1. Design Acceptance

Design Acceptance is the critical milestone before right-of-way, permitting, and construction plans activities proceed. It is also the earliest point in project development that lends itself to the creation of an established footprint for the design parameters based on purpose and need. It should also reduce the need for design changes and project delays.
consistent measurement across all projects. The purpose of identifying the completion of design acceptance is to record when a project is ready to move forward to preparation of the PS&E package.

2. PS&E Acceptance Date

On-time performance by regions is measured by the date the PS&E package is accepted by the Office of Pre-Letting. The "13 month lock-in" is based upon the projected date of PS&E submittal to the Office of Pre-Letting, with an additional 10 business days for review and acceptance by the Office of Pre-Letting

Bid-let dates will continue to be projected at the "13 month lock-in". The bid-let date is needed to provide contractors with the Six-Month Schedule of Contract Lettings.

3. Notice to Proceed (NTP) Date

Contracting performance is ODOT's ability to get bid-able projects into the hands of contractors. NTP is the best objective measure of the successful conclusion of the contracting phase. Performance for the combined design and contracting phases will be measured by adding 57 calendar days to the projected bid-let date and comparing that date to the actual NTP date.