

CFLHD SUPPLEMENT 9.1.3.4-1

9.1.3.4 Documenting Design Exceptions

Add the following:

This Supplement provides guidance on using the [Highway Design Standards form](#).

9.1.3.4 Highway Design Standards Form

The purpose of the Highway Design Standards (HDS) form is to document the engineering judgment used in the decisions involving design standards and practices for each project.

9.1.3.4.1 Projects Requiring the HDS Form

The HDS Form is required on all projects, except for the following project types:

- Preventative maintenance projects that extend the roadway surfacing life without degrading any existing geometric aspects of the roadway. Refer to the PDDM [Section 4.7.1.3](#), the FHWA Pavement Preservation memorandum of September 12, 2005, and the [Federal-Aid Policy Guide NS CFR 23 625](#) for more information. Typically, the preventative maintenance work items include pavement repair, such as crack sealing, or minor resurfacing, such as chip sealing.
- Spot Improvement Projects approximately 500 feet or shorter and contains no geometric or typical section changes.
- ERFO projects that restore federal roads and bridge to pre-disaster conditions.
- For these three types of projects, use the [HDS Memo](#) for design standard documentation.

9.1.3.4.2 Preparing the HDS Form

The HDS form is formatted as an Adobe Acrobat form.

This section provides a summary of items to address, as applicable, in the Highway Design Standards form.

Project Design Controls

1. Provide project identification information, including project number and name.
2. Briefly describe the location of the project.
3. Select the type of project (i.e. new construction, reconstruction, or 3R). The 'Other' option includes bridge replacement or spot improvement projects.
4. Select the appropriate type of terrain. Refer to the PDDM [Section 9.3.1.3](#).
5. Briefly describe the work included in the project. This description should be similar to what is shown on the project Title Sheet.

6. Determine and select the appropriate box if the project is on the National Highway System and the functional classification of the roadway. Refer to the PDDM [Section 9.3.1.2](#)
7. List the owner of the roadway.
8. Provide traffic information. Refer to the PDDM [Section 9.3.1.5](#) and [Section 8.6.1](#) for information on calculating the traffic data.
9. Select the design standards used on the project. Refer to the PDDM [Section 4.4](#).

Geometric and Bridge Criteria

1. Using the appropriate design standard, list the design criteria that apply to the project in the 'Standard' column. If a criterion does not apply to the project (e.g. bridge criteria on a project without a bridge), insert N/A.
2. List the design criteria used in the project in the 'As Designed' column. For projects where the existing geometry is incorporated into the final design without any changes, such as some 3R projects, document the known information as much as possible. When the existing information is not known, indicate that the project geometry matched the existing conditions.
3. Select the checkbox in the last column to indicate an exception or variance to the design criteria.

Exceptions:

Justification

Provide a narrative describing any design exceptions and reasons why a design exception is needed. Give reasons why the design standard should not be met in the proposed design and provide support to justify the proposed design criteria. Considerations which may warrant an exception to the design standard include:

- Social, economic, and environmental impacts
- Steep terrain
- Compatibility with adjacent sections on a route
- Excessive construction cost
- Right-of-way constraints
- Impacts during construction, including traffic control operations, detours and private property access
- Visual impact
- Geotechnical infeasibility
- Relationship to future improvements

If needed to support the justification, document the estimated costs to achieve the design standard and the estimated cost of the proposed design exception.

Risk Analysis and Mitigation

Provide a narrative describing risks associated with the design exception and any design features included in the project to mitigate the design exception.

Briefly describe crash data and summarize the safety analysis. If no crash data is available, describe any anecdotal evidence or field observations of safety issues. Consider using IHSDM (e.g. crash prediction module and design consistency module) to evaluate the effect of any design exceptions on predicted safety performance.

Consider the following when evaluating design exception risks:

- The effect of the design exception on the safety and operation of the facility and its compatibility with adjacent sections of roadway;
- The functional classification, the amount and character of the traffic, the type of project, and the accident history of the road;
- The anticipated improvement in safety performance of the roadway
- The degree to which a design criteria is being reduced and how the exception affects other guidelines; and
- The effect of the design exception on all users and stakeholders, including motorists, bicyclists, pedestrians, road owning or managing agency, and CFL.

Generally, lower risk is associated with low traffic volumes, low design speeds, or locations with little or no history of crashes.

In addition to safety risks, consider the other types of risks, including capacity, durability, operational, life cycle cost, and maintenance.

Evaluate the risks for each design exception individually. If multiple design exceptions are proposed, evaluate the risks in combination as well as individually.

Refer to the FHWA [Mitigation Strategies for Design Exceptions](#), FHWA-SA-07-011 (2007). For RRR projects, the Transportation Research Board [Special Report 214](#) may be used to help assess the risk and mitigation for design exceptions.

Use the information in Figure A as a guide in assessing risk for individual design criteria.

Figure B details some options that may be used on a project to mitigate design exceptions. Consider all potential mitigation options.

Variances:

Provide a narrative describing any design variances and reasons why a design exception is needed.

Figure A
Risk Assessment for Specific Design Criteria

Geometric and Bridge Criteria	Risk Assessment References
(1) Design Speed	<ul style="list-style-type: none"> • AASHTO <i>Guide for Achieving Flexibility in Highway Design</i> Section 1.5.1 • Interactive Highway Safety Design Model (IHSDM)
(2) Bridge Loading	<ul style="list-style-type: none"> • AASHTO <i>Guide for Achieving Flexibility in Highway Design</i> Section 3.7
(3) Lane Width	<ul style="list-style-type: none"> • PDDM Section 9.3.8.5 • AASHTO <i>Guide for Achieving Flexibility in Highway Design</i> Section 3.6.1 • FHWA-RD-99-207 Prediction of the Expected Safety Performance of Rural Two-Lane Highways Chapter 5 Table 7. • IHSDM • <i>Highway Capacity Manual</i> Chapter 20
(4) Shoulder Width	<ul style="list-style-type: none"> • PDDM Section 9.3.8.5 • FHWA-RD-99-207 Prediction of the Expected Safety Performance of Rural Two-Lane Highways Chapter 5 Table 8. • IHSDM • <i>Highway Capacity Manual</i> Chapter 20
(5) Horizontal Curve Radius	<ul style="list-style-type: none"> • PDDM Section 9.3.5.3 • AASHTO <i>Guide for Achieving Flexibility in Highway Design</i> Section 3.2.2 • FHWA-RD-99-207 Prediction of the Expected Safety Performance of Rural Two-Lane Highways Chapter 5 Table 9. • IHSDM
(6) Superelevation Rate	<ul style="list-style-type: none"> • FHWA-RD-99-207 Prediction of the Expected Safety Performance of Rural Two-Lane Highways Chapter 5 Table 10.
(7) Stopping Sight Distance	<ul style="list-style-type: none"> • PDDM Section 9.3.6.10 and Section 9.3.7.7 • AASHTO <i>Guide for Achieving Flexibility in Highway Design</i> Section 3.5.1.2

Geometric and Bridge Criteria	Risk Assessment References
(8) Maximum Grade	<ul style="list-style-type: none"> • PDDM Section 9.3.6.10 • AASHTO <i>Guide for Achieving Flexibility in Highway Design</i> Section 3.3 • FHWA-RD-99-207 Prediction of the Expected Safety Performance of Rural Two-Lane Highways Chapter 5 Table 11. • IHSDM • <i>Highway Capacity Manual</i> Chapter 20
(9) Cross Slope (Crown)	<ul style="list-style-type: none"> • AASHTO <i>Green Book</i> Chapter 4 § Pavement Cross Slope
(10) Vertical Clearance to Structure	<ul style="list-style-type: none"> • AASHTO Guide for Achieving Flexibility in Highway Design Section 3.7

Figure B
Controlling Criteria Design Exception Mitigation Options

Geometric and Bridge Criteria	Potential Mitigation Options
(1) Design Speed	<ul style="list-style-type: none"> • Limit the difference in operating speed between curves to a maximum of 15 mph (preferably less than 10 mph). • Post warning signs. • Post speed advisory. • Install chevrons. • Install raised or recessed pavement markers. • Improve sight distance.
(2) Bridge Loading	<ul style="list-style-type: none"> • Post warning signs. • Post load limit signs. • Restrict vehicle size. • Identify and post alternate route.
(3) Lane Width	<ul style="list-style-type: none"> • Improve pavement edge lines (e.g. wider stripe). • Install raised or recessed pavement markers. • Post delineators. • Provide consistency with adjacent roadway segments. • Restrict vehicle size. • Improve stopping sight distance. • Widen the roadway and clear zone as much as possible, including the shoulder.
(4) Shoulder Width	<ul style="list-style-type: none"> • Flatten roadside slopes. • Improve roadside slopes by adding shouldering material. • Construct paved ditches on a recoverable slope to replace graded ditches on steep or erodible slopes. • Provide occasional pullouts or turnouts. • Improve delineation. • Install shoulder rumble strips. • Post warning signs. • Provide consistency with adjacent roadway segments. • Provide curve widening. • Remove or relocate fixed objects. • Widen the roadway as much as possible. • Identify and post alternate bicycle route.
(5) Horizontal Curve Radius	<ul style="list-style-type: none"> • Post warning signs. • Post speed advisory. • Install chevrons. • Add curve widening. • Improve sight distance. • Flatten roadside slopes. • Improve clear zone area. • Improve superelevation. • Install lighting. • Install guardrail. • Widen shoulders. • Apply pavement antiskid treatment. • Relocate driveway to a location with better sight distance.

Geometric and Bridge Criteria	Potential Mitigation Options
(6) Superelevation Rate	<ul style="list-style-type: none"> • Post warning signs. • Post advisory speed. • Install pavement antiskid treatment.
(7) Stopping Sight Distance	<ul style="list-style-type: none"> • Remove obstructions. • Post advisory speed. • Post warning signs. • Install lighting. • Relocate intersection. • Improve horizontal sight lines. • Install advance flashing warnings. • Widen shoulders. • Flatten roadside slopes.
(8) Maximum Grade	<ul style="list-style-type: none"> • Post warning signs. • Consider truck climbing or passing lane. • Consider slow-moving vehicle turnout. • Use flatter radius horizontal curves at the bottom of steep downgrade.
(9) Cross Slope	<ul style="list-style-type: none"> • Improve the surface friction with an open-graded surface course. • Improve crown/superelevation as much as possible. • Improve drainage.
(10) Vertical Clearance to Structure	<ul style="list-style-type: none"> • Post warning signs. • Restrict vehicle size. • Mill pavement under structure. • Identify and sign alternate route. • Install clearance checking devices in advance.

9.1.3.4.3 Review, Approval, and Distribution

Submit a draft HDS form at each preliminary design project milestone.

Present the completed form for signature at the 70% project milestone. Obtain signatures from the Lead Designer, Highway Design Manager (internal projects), Design Manager or Project Manager (A/E projects), CFLHD Project Manager, Project Development Engineer, and partner agencies at the 70% project milestone.

If any design changes occur after 70% that would be reflected in the HDS form (including design criteria, justification, or mitigation), revise the form and obtain signatures on the updated form. Attach the original form to the revised form to maintain documentation of design decisions.

Distribute the signed version of the HDS form to the Chief of Engineering, Project Management Engineer, Project Development Engineer, Highway Design Manager, Safety Engineer, Project Manager, Quality Assurance Engineer, and Senior Highway Design Engineer. Keep a copy of the HDS form with the project design records.