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## Project Development Design Project Geometric Design Requirements

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*Our Nation's roads are constructed to specific geometric design requirements*



Each day, Americans depend on the more than 4 million miles of Federal, State and local road systems that make up our Nation's highway network. We drive these roads to get to work, move goods and freight, and to appreciate the vastness and wide array of parks, forests, cities, museums, beaches and cultures the United States has to offer.



The National Highway System, or NHS, makes up just a fraction of the Nation's total road miles, yet it carries a significant percentage of all traffic. The NHS is a road system classification consisting of the Interstate system and other roadways of particular importance to the Nation's economy, defense and mobility. The State and local road systems make up the vast majority of remaining public streets and highways, which are also vital to our Nation.

Agencies at all levels of government are responsible for providing motorists a nearly uniform level of consistency by building and maintaining our Nation's roads to a common set of geometric design features.

These design features establish the physical aspects of our roadways like the sharpness of a curve or width of a lane.

You, as a local public agency, or LPA, are responsible for developing your Federal-aid project consistent with the applicable geometric design features for the type of highway system and type of project. Applying the appropriate geometric design features help to ensure the safe accommodation of traffic and freight while serving our Nation's strategic and economic priorities.



Geometric design requirements for roadways making up the NHS have been established by the Federal Highway Administration, or FHWA, to preserve a high level of mobility and safety. It is important for you to understand that the design requirements for projects affecting the NHS apply regardless of funding source.



Federal-aid projects on State or local roads must adhere to the geometric design requirements established by your State.

The four primary geometric design requirements that may apply to your highway project are:

- AASHTO's *A Policy on Geometric Design of Highways and Streets*, commonly referred to as the "Green Book." The Green Book is maintained by an organization of State government transportation officials known as the American Association of State Highway and Transportation Officials, or AASHTO.
- AASHTO's *A Policy on Design Standards- Interstate System*
- Your State's approved 3R geometric design standards
- Other State approved design standards



To determine which design requirements apply to your highway project, you first should consider the type of project and where it's located. Project types generally fall into one of three categories, based on the scope of work: (1) new construction or reconstruction projects, (2) resurfacing, restoration or rehabilitation projects, more commonly referred to as 3R projects, and (3) preventive maintenance projects. Geometric Design requirements apply

to projects on one of the following four categories of roads:

- Interstate,
- NHS freeway,
- Non-freeway NHS route
- Non-NHS road.

All new construction and reconstruction projects on the NHS, as well as any 3R projects on an NHS freeway, must be designed to meet the FHWA approved edition of the AASHTO Green Book. The FHWA has also approved the use of State design manuals in lieu of the AASHTO Green Book in some states. Since the 2001 publication of the Green Book, which serves as the current requirement, a 2004 and 2011 edition have been published, and FHWA, may soon adopt the latest version as the new requirement.

AASHTO's *A Policy on Design Standards – Interstate System* contains the design requirements for all new construction, reconstruction or 3R-type projects on the Interstate system.

A 3R-type project located on the NHS but not on the Interstate or an NHS freeway may be required to be designed according to your State's approved 3R design requirements. If your State does not have approved 3R design requirements, then either the AASHTO Green Book or your State's approved design manual requirements apply to your project.

Any preventive maintenance-type project located on the NHS must comply with your State's design requirements established for preventive maintenance-type projects. You are responsible for determining your State's preventive maintenance design requirements as they vary in each State.

		Type of Project		
		New Construction/ Reconstruction	3R Projects	Preventive Maintenance
Location of Project	Interstate			
	NHS Freeway			
	NHS Non-Freeway			
	Non-NHS Road			

If you are responsible for any type of project located off the NHS that uses Federal-aid funds, you must adhere to applicable laws and design requirements required by your State.



The design criteria found in the AASHTO Green Book provides substantial flexibility to address specific conditions encountered on projects. Among the thousands of design features listed in the AASHTO Green Book, FHWA recognizes the following 13 criteria having considerable importance to the operational and safety performance of any highway:

- Design Speed
- Lane Width
- Shoulder Width
- Bridge Width
- Horizontal Alignment
- Vertical Alignment
- Grades
- Stopping Sight Distance
- Cross Slope
- Super-elevation
- Lateral Offset to Obstruction
- Vertical Clearance
- Structural Capacity

The FHWA calls these critical elements the “thirteen controlling criteria,” and these cannot be deviated from without first coordinating approval through your State DOT.

If you determine that conditions warrant an exception to the applicable design requirement, then follow your State’s procedures for requesting a design exception.



Design exception requests must consider all project conditions, including compatibility with adjacent sections of road, and the expected length of time before reconstruction of the section. Your written request should detail the considerations and engineering judgment used to analyze and justify the design exception. Include details of how you considered the costs and impacts of meeting the design criteria, the risks involved of not meeting the criteria, and any other relevant factors, such as traffic volumes or speeds or the extent to which the design criteria cannot be met.



If you are considering a design exception, it is important to emphasize the mitigation strategies you have considered to offset the risks of not meeting the design criteria. For example, what mitigation strategies could you consider to address a sharp, substandard curve ahead? In this situation, your goal is to consider features proven to help vehicles stay on the road to mitigate the risk of building a substandard curve. In this example, you could address this situation by including mitigation techniques such as the installation of warning signs or speed plaques, widening the roadway or shoulders, installing rumble stripes, adding super-elevation or incorporating a skid resistant high-friction pavement surface.





Your completed design exception request should be forwarded to your State department of transportation, or State DOT, which is responsible for facilitating the review and approval process for design exceptions. Check your State DOT's procedures for design exceptions for projects located off the NHS.

When a design exception is necessary, the key issue is to allow adequate time in your project planning to get the design exception approved so that your construction is not delayed.

Finally, remember that you are required to meet these geometric design requirements on all Federal-aid projects. Doing so will help you avoid any unnecessary delay in receiving construction authorization for your Federal-aid project.

### Additional Resources

- Information on highway design topics  
<http://www.fhwa.dot.gov/design/>
- Federal regulations on design standards for highways  
<http://www.ecfr.gov/cgi/t/text/text-idx?c=ecfr&sid=34ef730f21ebfc5a205093db12962891&rgn=div5&view=text&node=23:1.0.1.7.18&idno=23>
- Information on how to mitigate challenging design situations  
[http://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/fhwa\\_sa\\_07011.pdf](http://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/fhwa_sa_07011.pdf)
- Information on designing safe, efficient roads that incorporate community values  
<http://www.fhwa.dot.gov/environment/publications/flexibility/>
- Information on the applicability of design standards  
<http://www.fhwa.dot.gov/programadmin/standards.cfm>

The content of this document is not a substitute for information obtained from State departments of transportation, appropriate FHWA Division Offices, and applicable laws. Scenarios have been simplified for emphasis and do not necessarily reflect the actual range of requirements applicable to the scenario or this topic. This document was created under contract number DTFH63-12-F-00025 by the Federal Highway Administration, U.S. Department of Transportation, and is offered to the public to heighten and focus awareness of Federal-aid requirements within the local public agencies community and reinforces the importance of these necessary policies, procedures, and practices.

This companion resource is the script content for the video production of the same name.