

VIRGINIA DEPARTMENT OF TRANSPORTATION

LOCATION AND DESIGN DIVISION

INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: Design Exceptions / Waivers		NUMBER: IIM-LD-227.13 IIM-S&B-70.10
SPECIFIC SUBJECT: Design Exception Request Form LD-440 Design Waiver Request Form LD-448 Design Waiver Request Form LD-452		DATE: November 17, 2020 SUPERSEDES: IIM-LD-227.12 IIM-S&B-70.9
LOCATION AND DESIGN DIVISION APPROVAL: Susan H. Keen, PE State L&D Engineer November 17, 2020	STRUCTURE AND BRIDGE DIVISION APPROVAL: Kendal Walus, PE State S&B Engineer November 17, 2020	

Changes are shaded.

CURRENT REVISION

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- Revised to reflect 2018 AASHTO Green Book adoption and Structure and Bridge Division updates.
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EFFECTIVE DATE

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- Revisions related to Geometric Standards (GS) will be required for all projects with a Preliminary Engineering (PE) Authorization date of January 1, 2021 and later.
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OVERVIEW

- VDOT's Geometric Design Guidelines present basic practical guidelines compatible with traffic, topography, and safety; however, due to the restrictive format, all variables cannot be included. The designer should refer to AASHTO's A Policy on Geometric Design of Highways and Streets, and related chapters in the Road Design Manual, for further discussion of design considerations before selecting the proper design criteria for a project.
- The selection of the criteria provided in the Geometric Design Guidelines must be made in conjunction with sound engineering judgment to achieve a proper design. The economic,

environmental and social factors involved in highway design shall also be considered. The designer should always attempt to provide for the highest degree of safety and best level of service that is economically feasible as outlined in IIM-LD-255.

FEDERAL REQUIREMENTS

- Under Title 23, United States Code (USC) 109, the Secretary of Transportation approves design and construction standards for the National Highway System (NHS) including Interstates. The 23 CFR 625 designates those standards, specifications, policies, guides, and references that are acceptable to the Federal Highway Administration (FHWA) for use on the NHS. NHS roadways can be found in the FHWA mapping: http://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/virginia/index.cfm
- The design standards referenced in Title 23 CFR 625 are comprehensive in nature, covering a multitude of design characteristics, while allowing flexibility in application. Design Exceptions may be given on a project by project basis for designs which do not conform to the minimum criteria as set forth for National Highway System (NHS) Projects. The full list of standards can be found in 23 CFR 625.4, which includes the AASHTO (American Association of State Highway and Transportation Officials) publication "*A Policy on Geometric Design of Highways and Streets*," which is commonly called the "Green Book."
- In May of 2016, the FHWA updated its 1985 policy regarding controlling criteria for design, applicable to projects on the NHS, thus reducing the number of controlling criteria from thirteen (13) to ten (10), and applying only two (2) of these criteria to low speed roadways (design speed < 50 mph). More detailed information can be found in FHWA memo, <http://www.fhwa.dot.gov/design/standards/160505.pdf>, which summarizes the policy set forth in the Federal Register, Docket # 2015-0020 <https://www.federalregister.gov/articles/2016/05/05/2016-10299/revision-of-thirteen-controlling-criteria-for-design-and-documentation-of-design-exceptions>. This clarifies when design exceptions are needed and the level of support documentation that is required.
- Design Exception documentation is to specifically include the applicable items: specific design criteria that will not be met; existing roadway characteristics; alternatives considered; safety and operational performance of the roadway (per Traffic Operations and Safety Analysis Manual, TOSAM); other impacts such as right-of-way, community, environment, cost, and usability by all modes of transportation; proposed mitigation measures; and compatibility with adjacent sections of roadway. The level of analysis should be commensurate with the complexity of the project.
- Unless FHWA retains this approval authority on a Projects of Divisional Interest (PODI) project, Virginia DOT assumes responsibility of approving design exceptions per the most recent FHWA/VDOT Stewardship and Oversight Agreement. FHWA may also review the design exception processes and procedures through a program review.

CONTROLLING CRITERIA

- The following ten (10) controlling criteria apply to Virginia roadways, regardless of design speed, functional class or whether the roadway is NHS or non-NHS.
- A Design Exception is required whenever the following controlling criteria are not met:
 - Design speed
 - Lane width
 - Shoulder width
 - Design Loading
 - Structural Capacity
 - Horizontal Curve Radius
 - Maximum Grade
 - Stopping Sight Distance
 - Cross slope
 - Superelevation Rate
 - Vertical Clearance
- A Design Exception is required when Minimum Acceleration and Deceleration Lane Lengths for Entrance and Exit Terminals are not met. *See AASHTO Green Book, Chapter 10, Tables 10-4 and 10-6 for minimum acceleration and deceleration lengths. For additional information see Road Design Manual Appendix C.

VDOT DESIGN EXCEPTION POLICY

- Any time there is a deviation from established VDOT Controlling Criteria, the designer should clearly and thoroughly analyze and document the potential impacts and constraints. The process to evaluate and justify design exceptions must be based on an evaluation of the context of the facility (e.g., community values), needs of all the various project users, safety, mobility (i.e., traffic performance), human and environmental impacts, project costs, and other impacts. The designer shall ensure that the deviation is based on an engineering analysis and that the methods of operation chosen are sufficiently protective of persons and property.
- All design exceptions shall include an estimate of the cost to attain full standards along with a determination of the feasibility of the alternatives considered.
- If the design exception request involves any features that are safety related, then sufficient crash data and history shall be attached to the request to support the reasons for justification.
- The mitigation measures that would minimize the effects of the deviation shall be considered, including future improvements.
- The archived FHWA publication, "Mitigation Strategies for Design Exceptions" provides examples of mitigation strategies that should be considered when evaluating, preparing and submitting design exceptions. This publication is available at:
http://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/fhwa_sa_07011.pdf

- Changes to the posted speed limits of highways need to be evaluated by considering applicable design standards. Design exceptions are required whenever the change causes the existing design features of the roadway to not conform to the minimum criteria for the new speed limit. The consistency of the design speed for the facility needs be considered and isolated changes in design speed to eliminate a design exception are not allowed. Design exceptions caused by proposed changes in the posted speed that adversely affect the design features of the roadway will not be considered.
- The State Location and Design Engineer approves design exceptions for all projects that are owned and maintained by VDOT regardless of who designs the project (VDOT or LAP) or funding type (State, Federal or Local) and urban primary extensions within a municipality unless the locality has an agreement with VDOT to maintain that portion of roadway that is within their boundaries (city limits or corporate limits). For bridge-related design exceptions, approval by the State Structure and Bridge Engineer is also required, except as noted below for bicycle facilities.

GEOMETRIC DESIGN CRITERIA

- The geometric design standards approved for use are contained in AASHTO's "*A Policy on Geometric Design of Highways and Streets.*"
- For the Interstate System, the VDOT adopted editions of AASHTO's "*Policy on Design Standards—Interstate System*" and the LRFD Bridge Design Specifications shall be used as design standards where they do not conflict with AASHTO's "*A Policy on Geometric Design of Highways and Streets.*"
- Ramp Design Criteria
 - VDOT's ramp design speed selection shall be based on a minimum 50% of the mainline accordance with AASHTO Green Book Chapter 10. Design speed for loops shall be a minimum of 25 mph. Lowering of the ramp selected design speed to below 50% to accommodate existing geometric design elements is prohibited.
 - **All geometric design element criteria shall be based on the selected design speed for the ramp or loop.** The selected design speed applies to the controlling ramp curve with the smallest radius when multiple curves are located on the ramp or loop. The curve immediately adjacent to the mainline (including when designing for loops) whether exiting from or entering onto the mainline shall have an equal to or greater radius based on the selected mainline design speed as shown above, to help with acceleration/deceleration.
 - If any of the 10 controlling criteria, or if either the acceleration or deceleration lengths at the terminals do not meet the minimum for the selected design speed, then a design exception is required for each individual element. Shown below is how to establish the design criteria for ramps:
 - The selected minimum ramp width (travelway + paved shoulders) shall be based on Case II, Traffic Condition C located in the 2018 AASHTO Green Book Table 3-27 for applicable

radius. Modifications to the width shall be incorporated in accordance with Table 3-28. In no case shall the total ramp width be less than 22 ft.: 12 ft. lane width + 10 ft. combined shoulder width (see below). Vehicle sweep path analysis software shall also be utilized to confirm that the proposed ramp width can accommodate the design vehicle for the ramp. If the path analysis shows conflict and movements CANNOT be accommodated, then a Design Exception is required.

- Ramp paved shoulder widths shall be a total minimum of 10 ft. Generally, a 6 ft. paved shoulder should be provided on the right with a 4 ft. paved shoulder on the left. However a minimum 2 ft. paved shoulder is allowed as long as the combined width of the paved shoulders is 10 ft. This flexibility allows for the adjustment of the right and left paved shoulder widths to maximize sight distance.
 - Minimum radius, Superelevation, Ramp grade, and Minimum Stopping Sight Distance shall be based on the design speed selected for the ramp, which is reflected in the GS-R standard.
 - Cross slope shall be 1.5% to 2% for tangent alignments.
 - Minimum acceleration and deceleration lane lengths shall be in accordance with 2018 AASHTO Green Book, Chapter 10, Tables 10-4 and 10-6.
- VDOT's Geometric Design Standards in Appendix A of the Road Design Manual are based on established design criteria and are generally consistent with AASHTO. Allowances, however, have been provided but are not limited to some design features such as guardrail. (For RRR projects, see Section A-4 of the Road Design Manual).
 - VDOT Design criteria is also provided in the following sources:
 - VDOT's Road and Bridge Standards
 - VDOT's Manual of the Structure and Bridge Division and
 - VDOT's Structure and Bridge Division Instructional and Informational Memoranda

TIMING OF DESIGN EXCEPTION REQUESTS

- Project Managers or Design Engineers should discuss potential design criteria that may require the need for an exception with the appropriate Assistant State Location and Design Engineer and FHWA (if applicable) prior to detailed development of the exception or providing a design exception request to the District L & D Engineer (or equivalent Structure and Bridge positions for bridge-related items).
- Design Exceptions should be identified at the Preliminary Field Inspection of the Project Development Schedule and requested shortly thereafter. Plans at the Public Hearing Development Stage and the Structure and Bridge Preliminary Plan Development Stage should reflect approved design exceptions for those key design elements or features. Design approval following the Location and Design / Design Public Hearing may be

delayed if known or discovered design exceptions or design waivers have not been approved.

- Design exceptions for roadway geometrics approved by the State Location and Design Engineer do not necessarily indicate that the bridge geometrics are automatically approved by the State Structure and Bridge Engineer since present and future costs for bridge widening, etc. may have to be considered. Normally, the roadway designer's and bridge designer's request will be transmitted separately. Location and Design Division exceptions directly impacting a structure and/or bridge shall be coordinated with the District Structure and Bridge Engineer. The Structure and Bridge Designer will determine the impact and provide guidance and recommendations to the Location and Design Project Designer and coordinate the necessary approval from the State Structure and Bridge Engineer for all resulting Structure and Bridge Design Exceptions.

DESIGN EXCEPTION REQUEST FORM LD-440

- All requests for design exceptions shall document all supplemental information necessary and appropriate for the comprehensive review of the engineering details of the exception request. The request shall be submitted via Form LD-440 to the District Location & Design Engineer and/or the District Structure and Bridge Engineer for review and recommendation for submission to the Central Office.
- The Responsible Person preparing the design exception request shall electronically seal and digitally sign the request in the seal and sign block provided above "Prepared By:"
- Location & Design Division maintains Form LD-440 at the following website:
<http://vdotforms.vdot.virginia.gov/>
- Supporting documentation for all design exceptions is to be submitted to the State Location and Design Engineer and/or the State Structure and Bridge Engineer for filing with a copy kept by the Project Manager in the project file.

DOCUMENTING DESIGN EXCEPTIONS ON PROJECT TITLE SHEET

- All design exceptions shall be shown on the project title sheet.
 - Whenever a project design element(s) does not meet AASHTO minimum design criteria (for example, shoulder width, horizontal curve radius) the location(s) and criteria are to be noted on the project title sheet. In order to alert everyone concerned, it will be necessary to identify these locations from the earliest stages of plan development. If changes are made during plan development that would alter the situation, then the title sheet must be corrected to reflect the new design. The following methods will be used to show design exceptions:

Plans with Functional Classification block:

EXAMPLE:

DESIGN EXCEPTIONS			
Sta. To Sta.	Design Speed (mph)	Exception for:	Approval Date
102+75 to 104+75		Shoulder Width	October 28, 2010
621+00 to 624+50	60	Horizontal Curve Radius	October 28, 2010

The data as indicated in the previous example is to be shown directly below the Functional Classification block.

Plans without Functional Classification block: Exceptions should be noted inside the title sheet borderlines immediately following the design speed classification as follows:

EXAMPLE:

V = 60 mph Exceptions: 102 + 75 - 104 + 75 Shoulder Width (Approval Date) 621 + 00 - 624 + 00 (35 mph) Horizontal Curve Radius (Approval Date)
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- For information on the placement of approved design exceptions on the Structure & Bridge title sheet, see Manual of Structure and Bridge Division, Part 2.

EXAMPLES OF WHEN A DESIGN EXCEPTION / DESIGN WAIVER IS **NOT** REQUIRED

- A design exception is not required on State funded rural projects where design constraints require that the overall design speed selected for the project is less than the design speed which would normally be selected based on terrain, if the speed falls within the-range of design speeds for that class of roadway shown in the AASHTO Green Book.
- A design exception is not required for Design Speed within the functional area of a Roundabout in accordance with the FHWA Roundabout Informational Guide (NCHRP 672) Chapter 6, available at:
http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_672.pdf
- For stop control intersections: A design exception is not required for horizontal curve radius, maximum grade, cross slope, superelevation or stopping sight distance within the calculated physical deceleration length regardless of whether there is a turn lane. When approaching a stop control intersection, the physical deceleration length to the intersection should be calculated based on the entering taper length (L2) the deceleration length (L3) and the storage length (L4) found in the 2018 AASHTO Green Book, , Section 9.7.2 Deceleration Lanes.
- Design exceptions are not required on standalone pavement rehabilitation, mill and overlay, or paving schedule projects where no geometric related safety issues have been identified in the safety study as long as the project is in accordance with the Code of

Federal Regulations Title 23 CFR 625 and the [2015 FHWA/VDOT Agreement for Federal - Aid Maintenance Projects](#).

- A design exception is not required for the installation of rumble strips or rumble stripes.
- Design exceptions / design waivers are generally not required for pavement transitions within VDOT defined “transition areas” of a project. The transition length (L) shall be in accordance with RDM, Appendix A (Lane/Pavement Transitions). However, the Designer shall contact the responsible District Traffic Engineer when reviewing the crash history for the past three (3) years as locations showing accident rates higher than the statewide average for that roadway classification attributable to the substandard design criteria may require a design exception.
- The intent of establishing project termini for the majority of projects scoped as “Bridge Only” is to tie into the existing approach alignment as quickly as possible and in accordance with, and defined and described in, the Manual of the Structure and Bridge Division, Part 2 (See “Bridge Only” projects).
- Unless there are specific crash clusters at the project site attributable to any substandard geometric feature, then substandard approach roadway geometrics associated with these “Bridge Only” projects do not require corrections and do not require design exceptions or design waivers unless the existing conditions are made worse.
- A design exception / design waiver is not required for safety and operational projects such as HSIP and ITS projects on **NHS** roadways in accordance with the Agreement for Safety and Operational Projects Not Requiring Formal Design Exceptions and Design Waivers dated August 28, 2013: <http://www.virginiadot.org/business/trafficeng-productlists.asp>. However this exception is not applicable to Preventative Maintenance, 3R Projects and projects that add capacity to the roadway. Additional projects may be eligible on a case by case basis if approved by the Office of the State Traffic Engineer in coordination with the Federal Highway Administration as appropriate.
 - VDOT has adopted the FHWA memorandum for projects on non-NHS roadways as well. However, VDOT has eliminated the stipulation of HSIP only funding for Vertical curve adjustment and Horizontal curve adjustment.

DESIGN EXCEPTION POLICY (APPLICABLE TO VDOT STRUCTURES & BRIDGES)

- In addition to the ten (10) controlling criteria, the State Structure and Bridge Engineer has identified the following items as requiring a design exception:
 - Modifications to VDOT parapet/rail standards except as indicated in VDOT’s Manual of the Structure and Bridge Division, Part 2, Chapter 5 or **Notes to Designer for the Standard in Part 3**.
 - Proposed new crash-tested parapets / rails (other than VDOT)

- Design exceptions shall be requested for all structures or bridges on the Interstate, Primary and Secondary System that do **not** meet AASHTO minimum design standards. For structures or bridges not owned and maintained by the department, design exceptions are the responsibility of and shall be submitted to the owner (city, locality, etc.) of the structure.
- For additional information on design exceptions with regard to structures and/or bridges, see Manual of Structure and Bridge Division, Part 1 at: <http://www.virginiadot.org/business/bridge-manuals.asp>.
- Design exceptions for design loading structural capacity, vertical clearance (on or under) and shoulder width (where the roadway shoulders meet AASHTO minimums, but the bridge shoulder(s) do not) are typically prepared by the bridge designer and submitted to the State Structure and Bridge Engineer through the District Structure and Bridge Engineer.

DESIGN WAIVER POLICY FOR ROADWAY DESIGN (APPLICABLE TO VDOT OWNED AND MAINTAINED ROADWAYS **ONLY**)

- Design waivers are required when deviations from VDOT's design criteria occur on VDOT owned and maintained roadways and urban primary extensions within a municipality unless the locality has an agreement with VDOT to maintain that portion of roadway that is within their boundaries (city limits or corporate limits) only. When design criteria meet or exceed AASHTO and Americans with Disabilities Act Accessibility Guidelines (ADAAG) minimum design standards, but fall short of VDOT's minimum design standards, a design waiver shall be required. Design waivers will be applicable to all projects regardless of functional classification and funding and shall be documented and approved in accordance with the Design Waiver Request Form LD-448.
- Items requiring a design waiver include, but are not limited to, the following:
 - Paved Shoulder Width
 - Curb and Gutter
 - Minimum Radius
 - Shared Use Path Width
 - Sidewalk Width
 - Ditch Width
 - Lane Shifts / Tapers
 - Buffer Strip Width
 - Superelevation
 - Intersection Sight Distance
 - Total Shoulder Width
- Designers are expected to adhere to the typical sections and requirements for roadways and structures with bicycle and/or pedestrian facilities found in VDOT's Road Design Manual and VDOT's Manual of the Structure and Bridge Division, Part 2. When it is determined to use bicycle and/or pedestrian facility geometrics that do not meet the design criteria in the above-mentioned manuals, a design waiver is required only from the District Location and Design Engineer.

DESIGN WAIVER POLICY FOR HYDRAULIC DESIGN (APPLICABLE TO VDOT OWNED AND MAINTAINED ROADWAYS **ONLY**)

- Design waivers are required when deviations from VDOT's hydraulic design criteria occur on VDOT owned and maintained roadways only, regardless of functional classification and funding. When design criteria fall short of VDOT's minimum design standards, a design waiver shall be requested by the District Hydraulics Engineer. Design Waivers shall be documented and approved in accordance with the Design Waiver Request Form LD-448.

DESIGN WAIVER POLICY (APPLICABLE TO VDOT STRUCTURES & BRIDGES)

- Design waivers are required when deviations from VDOT's design criteria occur for VDOT owned and maintained structures only.
- For additional information on design waivers, see Manual of Structure and Bridge Division, Part 1 at: <http://www.virginiadot.org/business/bridge-manuals.asp>.

DESIGN WAIVER POLICY (APPLICABLE TO LAND DEVELOPMENT REVIEW)

- For additional information on design waivers applicable to Land Development Review (Office of Land Use), see IIM-LU-500 at: <https://insidevdot.cov.virginia.gov/Docs/Documents/IIM-LU-500Approved.pdf>

DESIGN WAIVER PROCESS

- L&D design waiver requests shall utilize Design Waiver Request Form LD-448 <http://vdotforms.vdot.virginia.gov/> and document all supplemental information necessary and appropriate for the comprehensive review of the engineering details of the waiver request.
- Any time there is a deviation from published and accepted VDOT standards (not AASHTO), the designer should clearly document that the deviation is to be made on the basis of an engineering analysis and that the methods of operation chosen are sufficiently protective of persons and property. The approach must incorporate reasons for the decision and approved documentation based on sound engineering judgment.
- Requests for a Design Waiver (Form LD-448) must contain the following:
 - Established design criteria versus proposed and existing criteria.

- Reason the appropriate design criteria cannot be met.
 - Justification for the proposed criteria.
 - Any background information which documents, supports or justifies the request.
 - Any mitigation that will be provided to further support or justify the request.
 - Cost to meet design criteria.
- Submittal Process
 - Design waiver requests shall be prepared by the Project Designer and submitted to the District Location and Design Engineer.
 - For roadway projects designed by localities that are VDOT owned and maintained, requests for design waivers shall be submitted to the VDOT Project Manager/Coordinator under the criteria and format described in this IIM.
 - The Responsible Person preparing the design waiver request shall electronically seal and digitally sign the request in the seal and sign block provided above “Prepared By:”
 - Approval Authority
 - Location and Design Division Waivers shall be reviewed and approved by the appropriate District Location and Design Engineer.
 - Approval authority shall not be delegated to a lower position without the approval of the State Location and Design Engineer.
 - Complete documentation should be retained by the Project Manager in the project file and a copy of the approved waiver sent to the appropriate Assistant State Location and Design Engineer and the State Geometric Engineer for means of compliancy and oversight purposes.
 - Location and Design Division Waivers directly impacting a structure and/or bridge shall be coordinated with the District Structure and Bridge Engineer. The structure and bridge designer will determine the impact and provide guidance and recommendations to the Location and Design Project Designer and coordinate the necessary approval from the State Structure and Bridge Engineer for all resulting Structure and Bridge Design Waivers.
 - Project Title Sheet
 - Design waivers are **not** to be shown on the Project Title Sheet.

DESIGN WAIVER POLICY FOR MULTIMODAL DESIGN STANDARDS FOR MIXED-USE URBAN CENTERS (APPLICABLE TO BOTH VDOT OWNED AND MAINTAINED ROADWAYS AND LOCALITY OWNED AND MAINTAINED ROADWAYS)

- When “**optimal**” values cannot be met for the modal emphasis primary element(s) mentioned on the Design Waiver Request Form for Mixed-Use Urban Centers, the Design Waiver Form LD-452 shall be submitted in accordance with this IIM.
- Mixed-use Urban Centers Waivers shall be reviewed and approved by the appropriate District Location and Design Engineer.

DESIGN WAIVER REQUEST FORM LD-452 FOR MULTIMODAL DESIGN STANDARDS FOR MIXED-USE URBAN CENTERS

- Design Waiver Request Form LD-452 shall be completed and all supplemental information necessary and appropriate for the comprehensive review of the engineering details of the waiver request shall be included in the submission.
- Location and Design Division maintains Form LD-452 at the following website:
<http://vdotforms.vdot.virginia.gov/>
- REQUESTS, SUBMITTALS and APPROVALS for this Design Waiver (Form LD-452) shall follow the current Design Waiver (Form LD-448) process as mentioned in this IIM.

ACCESS MANAGEMENT WAIVER REQUEST AM-E, AM-W

- Access Management waivers shall be completed following the requirements set forth in Appendix F of VDOT’s Road Design Manual and the Access Management Regulations found in the Virginia Administrative Code 24 VAC 30-72 and 24 VAC 30-73.