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Design Exception Process

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What is the Design Exception Process?

- It is the procedure followed to document the physical, social, environmental or economic constraints that prevent the application of a specific highway design criteria or standard.
- The process is intended to acknowledge and document concurrence that fulfillment of a particular design standard requires an unreasonable impact or expense.



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From the Design Exception Guidelines:

Why is a Design Exception necessary?

- NCDOT policy states all projects shall meet the minimum AASHTO or Sub-Regional Tier standards.
- Failure to meet the minimum standards requires a Design Exception.
- It formally documents the “why’s” of selecting design criteria that do not meet accepted standards.
- Note: An exception is not applicable when unmet criteria are only at locations where a project ties to existing conditions.



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Bullet 1: FHWA guidance says all NHS projects. NCDOT extends that to ALL STIP projects.

Bullet 3: Could be used for legal defense should legal actions arise. Shows that thought and judgement went into the decision.

Bullet 4: If the only exception is to facilitate a tie to existing, it does not have to be documented. The project has to end somewhere.

What do we check for in a Design Exception?

13 Design Criteria

- Design Speed
- Lane Width
- Shoulder Width
- Bridge Width
- Structural Capacity
- Maximum Grade
- Horizontal Alignment
(Min. Radius)
- Vertical Alignment
(Crest & Sag K Factors)
- Horizontal SSD
- Vertical SSD
- Cross Slope
- Superelevation
- Horizontal and Vertical Clearance



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Comments on Specific Design Criteria:

- **Structural Capacity must be determined by the Structural Engineer not the Roadway Engineer.**
- **Vertical SSD is usually determined mathematically using the formula in AASHTO.**
- **Horizontal SSD is usually determined graphically.**
- **Horizontal and Vertical Clearances over a roadway or railroad. (Some get this horizontal clearance confused with the horizontal offset on the bridge used to determine bridge width.)**

Transition: Changes for Design Exceptions:

- **FHWA involvement – Oversight Agreement**
- **Reduction in required elements.**

New FHWA guidance for NHS ≥ 50 mph

10 Design Criteria

- Design Speed
- Lane Width
- Shoulder Width
- Maximum Grade
- Minimum Horizontal Curve Radius
- Stopping Sight Distance (Horizontal and Crest Vertical)
- Cross Slope
- Superelevation
- Vertical Clearance
- Structural Capacity



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Design elements no longer requiring Design Exceptions include:

- **Bridge Width**
- **Vertical Alignment**
- **Stopping Sight Distance for sag vertical curves**
- **Horizontal Clearance**

New FHWA guidance for NHS < 50 mph

2 Design Criteria

- Design Speed
- Structural Capacity



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Note that Design Speed plays into many of the other design criteria so this is not allowing a free for all.

When is a Design Speed Exception needed?

- If several of a project's design elements are in violation of standards.
- If a single design element is in violation of the standard for the majority of the length of a project.
- If the design speed of the element(s) in question are significantly below the standard.



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This plays directly into the Design Speed discussion from the previous slide.

Documentation of the Process



Design Exception Checklist



Design Exception Letter



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Next we will look at the two parts of the Design Exception documentation process.

Design Exception Checklist

Rev. 3/2016

DESIGN EXCEPTION PROCESS CHECKLIST

Date: February 9, 2016 Project Engineer: Jason Moore, PE
 TIP No: 1-5000 Functional Classification: Principal Arterial / Intermediate
 Posted Speed: 60 mph (0-65) Terrain: Rolling

(2) Items requiring formal approval

	Prop Design	AASHTO Std ⁽¹⁾	Exception Req'd
Design Speed ⁽²⁾	60mph	60mph	No
Lane Width	12'	12'	No
Shoulder Width	14'	12'	No
Bridge Width	N/A	N/A	N/A
Structural Capacity ⁽³⁾	N/A	N/A	N/A
Maximum Grade	2.30%	4%	No
Min. Horizontal Curve Radius	1910'	1330'	No
Sag Vertical Curve K	N/A	N/A	N/A
Crest Vertical Curve K	216	151	No
Horizontal SSD	470' ⁽⁴⁾	570'	No
Vertical SSD	663'	570'	No
Pavement Cross Slope	2%	2%	No
Superelevation	6%	6%	No
Vertical Clearance	15'-7"	16'-0"	Yes
Horizontal Clearance	10'-0"	6'-0"	No

Listed below are the known non-complying items not requiring an approved design exception:

(1) The AASHTO STD, as it relates to the design speed should be equal to the higher of either the posted speed or the minimum "Greenbook" value for design speeds.
 (2) If design speed is less than the posted or statutory speed, a design exception is required.
 (3) Structure Design's responsibility - be sure they have checked for need of design exception.
 (4) 470' horizontal stopping sight distance measured from the center of the existing route lane, closest to the existing raised median barrier. This is an existing condition and not a part of the proposed design.



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Standard AASHTO Checklist:

Three columns:

Proposed design values

AASHTO standard values

Is an exception required?

This example project required a design exception for Vertical Clearance.

Design Speed Design Exception Checklist

DESIGN EXCEPTION PROCESS			DESIGN EXCEPTION PROCESS CHECKLIST		
Date: February 9, 2016	Project ID:		Date:	Project Engineer:	
TIP No: 1-0000	Functional Class:		TIP No:	Functional Classification:	
Posted Speed: 60 mph (0.85)			Posted Speed:	Terrain:	
Items requiring formal approval Design Speed ⁽¹⁾ 60mph Lane Width 12' Shoulder Width 14' Bridge Width N/A Structural Capacity ⁽²⁾ N/A Maximum Grade 2.30% Min. Horizontal Curve Radius 1932' Sag Vertical Curve K N/A Crest Vertical Curve K 235' Horizontal SSD 430' ⁽³⁾ Vertical SSD 600' Pavement Cross Slope 2% Superlevation 5% Vertical Clearance 12'-2" Horizontal Clearance 12'-2"			Items requiring formal approval Design Speed ⁽¹⁾ AASHTO Std For Proposed Design Speed Lane Width Shoulder Width Bridge Width Structural Capacity ⁽²⁾ Maximum Grade Min. Horizontal Curve Radius Sag Vertical Curve K Crest Vertical Curve K Horizontal SSD Vertical SSD Pavement Cross Slope Superlevation Vertical Clearance Horizontal Clearance		
Listed below are the items not complying items not requiring approval (1) The AASHTO SSD as it relates to the design speed should be equal to the posted speed or the minimum "Clearance" value for design speed. (2) If design speed is less than the posted or statutory speed, a design exception is required. (3) Structural Design's responsibility - he sure they have checked for 430' horizontal stopping sight distance measured from the center of the existing posted median barrier. This is an existing condition of design.			Listed below are the items not complying items not requiring an approved design exception. (1) The AASHTO SSD as it relates to the design speed should be equal to the higher of either the posted speed or the minimum "Clearance" value for design speed. (2) If design speed is less than the posted or statutory speed, a design exception is required. (3) Structural Design's responsibility - he sure they have checked for need of design exception.		





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A column is added to show the AASHTO Standards for the new design speed that is requested.

Like the Sub Regional Tier Checklist there will be two sets of YES/NO responses for each element.

Design Exception Letter

 <p>MEMO TO: <u>Rodger D. Rochelle, PE</u> Technical Services Division Administrator</p> <p>FROM: <u>Glenn W. Mansfield, PE</u> State Roadway Design Engineer</p> <p>DATE: <u>February 9, 2016</u></p> <p>SUBJECT: <u>Project: 4113.1.1 (S-500) Gaston County</u> <u>P.A. Project: DM-40-1113107</u> <u>I-85/US 321 Geometric Safety Improvements</u></p> <p>Request for Design Exception</p> <p>This is a request for a design exception for the vertical clearance of Ramp D under the existing Marietta Street V-2 bridge. No. 14.</p> <p>If you have any questions, please contact Jason Moore, PE, RA 707.4286.</p> <p>Roadway Project Design Engineer: <u>Jason Moore, PE</u> Asset: <u>State Rd</u></p> <p>Roadway Project Engineer: <u>Stan Rowley</u></p> <p>GWM:mk</p> <p>Attachment</p> <p>cc: <u>Jason Moore, PE</u></p> <p>APPROVED: _____</p> <p>DATE: _____</p> <p>cc: <u>Glenn Mansfield, PE</u> <u>Jason Moore, PE</u> <u>Janey Hancock, PE</u></p> <p style="text-align: right;">cc: <u>Nothing Compares...</u></p> <p style="text-align: right; font-size: small;">State of North Carolina - Department of Transportation 1000 South Tryon Street, Suite 1000 Raleigh, NC 27601-1000 919.737.4000 1.800.332.4000</p>	<p style="text-align: center;">NC DOT DESIGN EXCEPTION</p> <p>F.A. Project No: <u>DM-40-1113107</u> State Project No: <u>4</u></p> <p>TIP No: <u>14000</u> County: <u>Gaston</u></p> <p>Design Exception Requested for: <u>Minimum vertical clearance</u></p> <p>Location of Design Feature in Question: <u>4. Sta. 66+27.6</u> <u>auxiliary lane under existing Marietta Street (V-2) bridge</u></p> <p style="text-align: center;">PROJECT DATA</p> <p>Current ADT (2017): <u>60,500</u> Design ADT: _____</p> <p>% Trucks: <u>12%</u> Design Speed: <u>70 mph (3-4)</u></p> <p>Functional Classification: <u>Principal Arterial / Intersect</u></p> <p>Minimum AASHTO Dimensions: <u>16'-4"</u> Date: _____</p> <p>Total Estimated Cost of Project: <u>\$13,800,000</u></p> <p>Additional Cost to Meet Minimum AASHTO Requirements: <u>Exception Item 4)</u></p> <p style="text-align: center;">BASIS FOR EXCEPTION</p> <p>1. Describe how the accident history relates to the proposed project. This project adds new ramps and additional drainage interchange. There were a total of 36 accidents during the year 2015. The majority of the accidents were minor. There were no fatalities and none of the accidents were related to the project.</p> <p>2. Describe any future plans for upgrading the roadway project. I-85 through this area is scheduled to be widened into four lanes in 2024. The widening of I-85 will eliminate the need for the bridge.</p>	<p>3. Describe the cross section, geometrics, access control, etc. of the existing roadway outside the project limits.</p> <p>I-85 is an existing elevated roadway with three 12-foot lanes in each direction divided by a double-lined median barrier. In the area of this project I-85 has full control of access and is currently posted at 65 mph.</p> <p>Ramp D introduces a new traffic movement, replacing the existing Loop C movement, which takes US 321 traffic to northbound I-85. Ramp D consists of two 12-foot lanes and narrows to a single lane before it joins the outside of a horizontal curve on I-85 with an approximate 1,000-foot radius measured from the centerline of the median. Traffic continues in a parallel auxiliary lane an additional 1000 feet before merging onto I-85. The existing vertical alignment on I-85 has a grade of a little over +1%, existing approximately 550 feet beyond the Ramp D tie-in point.</p> <p>The existing horizontal clearance under the Marietta Street bridge is sufficient to allow the 12-foot auxiliary lane and a 10-foot paved shoulder with a single faced barrier protecting the Marietta Street bridge piers. The ramp travel speed will be approximately 40-50 mph as indicated past under the existing bridge.</p> <p>4. Explain why it is not reasonable or feasible to meet (engineering, environmental and/or ROW constraints) minimum AASHTO requirements.</p> <p>The existing Marietta Street bridge is in very good condition with many years of service life remaining.</p> <p>The upcoming I-85 widening project, I-85/US 321, currently scheduled for Right of Way in 2022 and for Let in 2024, will require this bridge to be replaced to allow more width for additional travel lanes. The exact typical section under this bridge has not been determined for this future project. The existing Marietta Street bridge should remain in place until the next requirements for the I-85 widening project have been determined and subsequently replaced as a part of the future project.</p> <p>5. Describe any measures proposed to mitigate the design element that is below standards.</p> <p>The existing I-85 bridge over US 321 has a minimum of 15'-0" vertical clearance. Currently the existing southbound US 321 traffic must go under the existing I-85 bridge to access Loop C. Since the proposed Ramp D replaces the existing Loop C traffic movement, the Ramp D clearance under the Marietta Street bridge is equivalent to the clearance of the current traffic pattern.</p> <p>With the substantial vertical clearance matching the existing conditions, and with the bridge's imminent replacement with the upcoming I-85 widening project, no mitigation measures are proposed at this time.</p>
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Three Components of Design Exception Letter:

Cover Letter

Basic Project Information including:

Elements Requiring Exception

Traffic

Classification


Costs

Basis for Exception

Five Key Questions

Basis of Exception

1. Describe how the accident history relates to the proposed design exception. See current 3-year accident history, attached (number, type, rates, severity, cause, comparison to statewide average, etc.).		<small>Currently posted at 60 mph. Ramp D introduces a new traffic movement, replacing the existing Loop C movement, which takes US 321 traffic to northbound I-95. Ramp D consists of two 12-foot lanes and narrows to a single lane before it ties to the outside of a horizontal curve on I-95 with an approximate</small>
<small>F.A. Project No: IMP-85-1(13)17 State Project No: 41163.1.1 TIP No: 1-0000 County: Gaston</small>		
2. Describe any future plans for upgrading this roadway either at or in the vicinity of this project.		<small>4. Explain why it is not reasonable or feasible to meet (engineering, environmental and/or ROW constraints) minimum AASHTO requirements. The existing Marietta Street bridge is in very poor condition with many years of service life.</small>
<small>Current ADT (2017): 60,500 Design ADT (2037): 60,100 % Trucks: 12% Design Speed: 70 mph (0-86) Posted Speed: 60 mph (0-86) Functional Classification: Principal Arterial / Interstate</small>		
3. Describe the cross section, geometrics, access control, etc. of the existing roadway outside the project limits.		<small>5. Describe any measures proposed to mitigate the design element that is below standards. The existing I-95 bridge over US 321 has a minimum of 15'-7" vertical clearance. Currently the existing southbound US 321 traffic must go under the existing I-95 bridge to access the project. The widening of I-95 will require the replacement of the Marietta Street (V2) bridge therefore eliminating the basis of this design exception.</small>
4. Explain why it is not reasonable or feasible to meet (engineering, environmental and/or ROW constraints) minimum AASHTO requirements.		
5. Describe any measures proposed to mitigate the design element that is below standards.		



Discuss the 5 Questions in More Depth

- 1) Accident History: **A 3 year Accident History must be requested from Traffic Safety.**
- 2) Future Upgrades: **Not limited to TIP project improvements**
- 3) Existing Roadway Outside Project: **Immediately adjacent to the project. Sets context for the project in relation to the surrounding area.**
- 4) Explanation of justification for exception: **Significant extension to project limits (usually bridge projects), excessive impacts to natural resources, significant right of way costs, inconsistent with the surrounding area.**
- 5) Mitigation: **Could be as simple as evaluating the conditions once new facility is in operation.**

Important Points To Remember

- A Design Exception Checklist should be completed for every project.
- Not every situation requires a formal Design Exception letter.
- Discuss the need for an exception early in project development.
- The basis for the exception must clearly show why the design standards cannot be met.



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Bullet 1: Keep in Project File

Bullet 2: Things such as guardrail length of need reduction - document with note to file.

Bullet 4: Description of justification for the exception needs to be documented in detail.



Questions?



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