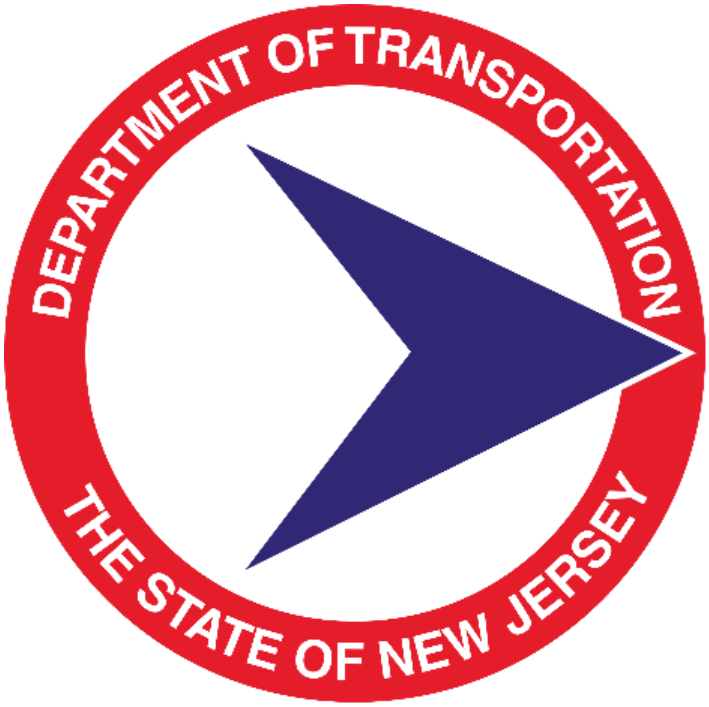
DESIGN EXCEPTION MANUAL



2019

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1.0 General

When conditions warrant, a design exception may be granted for a project design that proposes one or more controlling substandard design elements (CSDEs). A design exception may be approved when it can be documented that a lesser design value is the best practical alternative. The factors to be considered when determining if a lesser design value should be selected shall include social, economic and environmental impacts together with safe and efficient traffic operations.

On projects requiring a Preliminary Engineering Report (PER), the approved Design Exception Report, if required, shall be included with the PER package. Although the Design Exception Report will be completed during the Preliminary Engineering Phase, to ensure that safety standards/concerns are thoroughly and consistently considered and to aid in the scope development process, a "Geometric Review" (in lieu of the previous "Reasonable Assurance") is required by the Geometric Solutions Unit. The "Geometric Review" will be completed during the alternatives analysis within the Concept Development Phase. See Section 8.0 for details.

A design exception is only required for CSDEs within the proposed construction areas of a project. For example, if a project contains spot and/or multiple construction locations (Stop Construction / Resume Construction) within a project's overall limits (Begin Project / End Project), design exceptions are only required for CSDEs within the proposed construction areas. A design exception is not required for a CSDE that is within the transition from the proposed improvement to the existing condition, provided that the existing condition is not being worsened or a new CSDE is not being created. Nor is a design exception required for a temporary CSDE that may be present during the construction stage of a project.

When a project contains multiple CSDEs that occur at the same location or when the same CSDE occurs at multiple locations, each CSDE will be addressed independently.

Design exceptions will require FHWA approval on Projects of Division Interest (PODI) and Interstate projects regardless of the funding source.

For further information, please refer to the Federal Registry Exceptions – Revision of Thirteen Controlling Criteria for Design: https://www.federalregister.gov/documents/2016/05/05/2016-10299/revision-of-thirteen-controlling-criteria-for-design-and-documentation-of-design-exceptions.

2.0 Controlling Design Elements

2.1 Design Exception Type 1 (Design Speeds ≥ 50 mph)

The following ten controlling design elements apply to Interstates, Freeways & Expressways, along with other roadways on the National Highway System with Design Speeds ≥ 50 mph, regardless of the funding source. **(See Notes #1 and #2 below**). Also, for the map showing NJ NHS roadways, see the following site: https://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/new_jersey/index.cfm

2.1.1 Roadway Elements

- Stopping Sight Distance (crest vertical curves and horizontal curves)
- Superelevation Rate (for mainline and ramps ≥50mph)
- Horizontal Curve Radius (for mainline and ramps)
- Cross Slope (Minimum & Maximum)
- Lane Width (Through and Auxiliary)
- Shoulder Width
- Maximum Grades
- Design Speed (See Note #1 below, under Section 2.2)

2.1.2 Structural Elements

- Vertical Clearance (Including under clearance and over clearance - in the case of a truss)
- Design Loading Structural Capacity (See Note #1 below, under Section 2.2)

2.2 Design Exception Type 2 (Design Speeds < 50 mph)

The following two controlling design elements apply to roadways on the National Highway System with Design Speeds < 50 mph, regardless of the funding source.

Interstates, Freeways & Expressways will follow Design Exception Type 1, regardless of Design Speeds. **(See also Notes #1 and #2 below)**

2.2.1 Roadway Elements

- Design Speed (See Note #1 below)

2.2.2 Structural Elements

- Design Loading Structural Capacity (See Note #1 below)

NOTE #1: NJDOT will not approve a design exception for Design Speed or Design Loading Structural Capacity. The rare exception is where FHWA/NJDOT deem it appropriate to utilize a lower design speed for an entire corridor (or a substantial segment of a corridor) due to topographic or environmental constraints. In addition, exceptions to Design Loading Structural Capacity are also extremely rare. If deemed appropriate, these exceptions will be considered on a case by case basis.

NOTE #2: Projects with various design speeds, the speed transition areas (changing from ≥ 50 mph to < 50 mph) must be in accordance with Design Exception Type 1.

2.3 Design Exception Type 3 Major Access/Developer Projects (All Design Speeds)

Major Access projects do not follow NJDOT's Capital Project Delivery process. Therefore, to ensure that safety standards/concerns are considered and to maintain design consistency between the Capital Projects and Major Access projects, the following list of design elements will be considered **controlling design elements** for all Major Access Projects (for all design speeds and all roadways on NHS and Non-NHS) and will require formal Design Exception Reports.

2.3.1 Roadway Elements

- Stopping Sight Distance (crest vertical curves, horizontal curves, and non-signalized intersections)
- Superelevation Rate (for mainline and ramps)
- Horizontal Curve Radius (for mainline and ramps)
- Cross Slope (Minimum and Maximum)
- Lane Width (Through and Auxiliary)
- Shoulder Width
- Minimum and Maximum Grades
- Through lane drop Transition Length
- Acceleration and Deceleration Length
- Design Speed (a design exception for a reduction in the design speed will not be approved)

2.3.2 Structural Elements

- Vertical Clearance (Including under clearance and over clearance - in the case of a truss)
- Design Loading Structural Capacity

In addition, NJDOT reserves the right to require the Developer's designer to perform a Highway Safety Manual Analysis comparing the Developers planned improvements vs NJDOT standards or other requested improvements.

2.4 Vertical Clearance - Department of Defense (Bridges over Interstate Highways)

Concurrence must be obtained from the Department of Defense (DOD) for projects which contain substandard vertical clearances (VC) on an Interstate. The NJDOT Project Manager (PM) shall coordinate with the responsible Area Engineer from the NJ Division Office of the FHWA in order to obtain the appropriate forms and begin coordination with the DOD. This approval shall be obtained prior to design exception review/approval. The completed forms shall be submitted as part of the Design Exception Report. The NJDOT PM and the designer must account for the additional time required for this coordination to occur between the FHWA and the DOD.

For Limited Scope *Resurfacing* projects on Interstate Highways, The Department of Defense form shall be completed as follows:

- Item Numbers 1 – 4 and 7 - 9 shall be completed.
- Item # 5 - Description of Work required to achieve the 16' clearance: must state, *"Outside the scope of work. No change in vertical clearance. The existing substandard vertical clearance to be maintained on this pavement preservation project."*
  The estimated additional cost to obtain 16' clearance: should state, *"Not Applicable".*
- Item # 6 – Reason why 16' vertical clearance cannot be attained: must state, *"Outside the scope of work for this pavement preservation project. No change in vertical clearance."*

NOTE: If the vertical clearance is reduced, even by < 1", worsening an existing substandard VC (or creating a new substandard VC), a design exception for vertical clearance will be required and the Department of Defense form must be completed in its entirety for the subject bridge.

For more information regarding the DOD, including the "Form for Coordination" (MS Word doc.), see the *"Attachments Link*" within the following site: https://www.fhwa.dot.gov/design/090415.cfm

2.5 Vertical Clearance – Railroad Bridges

For Substandard vertical clearance at a railroad structure (roadway bridges over railroads): the railroad authority shall be contacted (as soon as possible during Concept Development) requesting comments and the required clearances (relative to the train car traffic along the line) for any work within the vicinity of a railroad facility. The Design Exception Report must include the written concurrence from the railroad authority.

3.0 Design Standards and Relative Resources

The standard design values for the controlling design elements mentioned above are contained in the following documents:

- NJDOT Design Manual – Roadway
  http://www.state.nj.us/transportation/eng/documents/RDM/
- NJDOT Design Manual - Bridges and Structures
  http://www.state.nj.us/transportation/eng/documents/BSDM/
- AASHTO publication, A Policy on Design Standards Interstate System
- AASHTO publication, A Policy on Geometric Design of Highways and Streets
- AASHTO publication, Guidelines for Geometric Design of Low Volume Roads
- Mitigation Strategies for Design Exceptions
  http://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/fhwa_sa_07011.pdf

4.0 Project Types Requiring a Design Exception

As denoted in 23 CFR 625.3: design exceptions are required for the following types of projects on the NHS where controlling criteria are not met. For the map of NJ's NHS, see the following site: https://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/new_jersey/index.cfm

- New highway construction.
- Existing highway reconstruction (lane addition including auxiliary, acceleration and deceleration lanes, pavement structure replacement - except shoulders, use of an existing shoulder as a through lane, and a change in the horizontal and/or vertical alignment.
- Major Pavement Rehabilitation projects (non-Limited Scope Resurfacing projects)
- Total Bridge Replacement.
- Bridge Superstructure Replacements and/or Widening.
- Bridge Deck Replacements (excluding vertical clearance for non- Interstates, Freeways & Expressways). The vertical clearance must be determined and documented within the Geometric Review during the Concept Development Phase.

5.0 Projects EXEMPT FROM THE DESIGN EXCEPTION PROCEDURE

(NOTE: This Section does not apply to Major Access Developer projects.)

Design exceptions are only required for projects that are on the National Highway System (NHS). However, a "Geometric Review" will be required for all NHS and Non-NHS projects – see Section 8 of this document.

The following project types, regardless of NHS status and the funding source, are exempt from design exceptions Types 1 and 2:

5.1 Preventive Maintenance Projects

Preventive maintenance includes rehabilitation or restoration of specific elements of a highway facility when it can be demonstrated that such activities are a cost effective means of extending the pavement or bridge life and shall not degrade any existing or geometric aspects of the facility. The majority of the work to be accomplished on these projects will be between existing curb lines or outer edges of existing shoulders. Projects that address deficiencies in the pavement structure or increase the structural capacity of bridges, are not considered preventive maintenance, and will require a design exception for CSDEs. Preventive maintenance projects will be clearly defined as part of the initial screening process and will be classified as such when presented to the Capital Programming Committee (CPC) Screening Committee for approval. **See also** (on the Project Management Office website) the NJDOT Limited Scope Project Delivery Guidelines (Pavement Preservation Treatments).

A general list of preventive maintenance work items is listed below:

5.1.1 Roadway Activities

- Pavement resurfacing (a maximum increase in profile of up to one inch at any pavement location is permissible when improving pavement cross slopes or maintaining existing minimum values. However, if the project is on the NHS and the Design Speed ≥ 50 mph, a design exception will be required for vertical clearance - if an existing substandard vertical clearance is reduced (even by < 1") or if an existing standard vertical clearance is reduced to below standards.)
- Asphalt crack sealing
- Chip sealing
- Slurry or micro-surfacing
- Thin and ultra-thin hot-mix asphalt overlay
- Concrete joint sealing
- Diamond grinding
- Dowel-bar retrofit
- Isolated partial and/or full-depth concrete repairs (to restore functionality of the slab; e.g. edge spalls, or corner breaks)

5.1.2 Bridge Activities

- Bridge hot-mix asphalt resurfacing (equal depth milling and paving)
- Bridge deck patching
- Joint replacement or repair
- Rehabilitation of existing structures
  - Deck rehabilitation
  - Rehabilitation of superstructure/substructure (exclusive of replacement)
  - Seismic retrofit
  - Scour Countermeasures
- Bridge deck restoration and component patching

5.2 Improvement Projects

In addition to preventative maintenance projects that are intended to extend the pavement or bridge life, there are also other highway improvement projects that do not require a design exception for a CSDE that falls within the limits of the project. These projects are typically beyond the existing edge of pavement and are intended to improve safety and aesthetics, and mitigate noise. In addition, improvements within the roadway that are for the purpose of improving safety and do not degrade the existing highway geometrics will be addressed through the CPC Screening Committee.

A CSDE contained within the following project types or work items or both would not require a design exception:

- Replacement of curb or sidewalk or both
- Roadside safety enhancements
  - Repair/replacement of beam guide rail
  - New beam guide rail
  - Resetting beam guide rail
  - Repair or replacement of existing impact attenuators
  - New impact attenuators
  - Removal of obstructions
  - Rumble strips/stripes
- Drainage improvements
- Addition of channelizing islands (provided that existing lane or shoulder widths are not reduced below standards)
- Signing (bendaway supports)
- Striping (no additional lanes or reduction in existing lane width)
- New or replacement of raised pavement markers
- Access revisions
- Upgrading existing lighting systems
- Modifying sidewalk to comply with ADA requirements
- New signals
- New sign structures (sign bridge, cantilever and bridge mount provided they meet clearance requirements)
- Type II noise barriers (provided existing stopping sight distance is not degraded)
- Minor lane or shoulder widening exclusive of a full lane addition and no right-of-way required
- Intersection improvements (no reduction in existing lane or shoulder width)
- Fencing (provided existing stopping sight distance is not degraded)
- Glare Screens (provided existing stopping sight distance is not degraded)
- ITS (fiber optic cable, message signs, cameras, emergency call boxes, etc.)
- Upgrading existing signals
- Large ground mount signs
- New under deck, highmast, offset, or conventional lighting systems

- Replacement of existing median barriers
- New curb or sidewalk
- Rock fall mitigation (slope cutbacks, wire mesh, catchment zones, fences, etc.)
- Regrading existing berm section
- Jacking of concrete slabs
- Landscape improvements
- Traffic calming features (speed tables, chicane, midblock median islands, choker, narrowed lane, etc. Consult with FHWA on NHS Routes)

5.3 County or Municipal Construction Projects Facilitated by Local Aid and Economic Development District Offices

The design exception process is NOT required for 100% State Aid or Federally funded projects on non-NHS facilities. However, written justification is required. (See Section 8 for guidance.) The justification must be prepared by the designer, approved by the facility owner and submitted to the Division of Local Aid and Economic Development District Office. The justification should indicate the substandard design feature, the proposed construction (intent of the project), and the reasons for not satisfying the standard. A review of current crash data shall be made to ensure the design feature(s) in question is not a contributing factor to known crashes.

The design exception process (Type 1 or Type 2) is required if the project is on the NHS – regardless of the funding source. Design exceptions (applicable to the facility) must be prepared by the designer, approved by the facility owner and submitted to the Division of Local Aid and Economic Development District Office.

NOTE: If the project involves a road under state or federal jurisdiction, the NJ State Transportation Engineer must approve applicable design exceptions.

5.4 Orphan Bridges (Abandoned Overhead Railroad Bridges)

Orphan Bridge rehabilitation and replacement projects are often located on county and municipal roads, however substandard design elements (controlling or otherwise) will be reviewed and approved by NJDOT in accordance with this Manual.

6.0 Design Exception Report Format

The Design Exception Report (DER) is comprised of a list of the CSDE's within the project, listed by location number and station/milepost. The list is followed by individual table(s) containing a description of the CSDE, including the standard design value, the proposed safety measures, crash analysis, and the impacts associated with correcting the CSDE.

Standard forms are provided as Attachments and should be used for all design exceptions. Attachments 1, 2 (or 3 or 4) and 5 are to be completed for all design exceptions. The DER shall be included with the Preliminary Engineering Report (PER).

When the design exception requires FHWA approval, the cover letter (Attachment1) shall include a line for FHWA approval.

Also, the designer shall include with the Design Exception Report, any applicable plan sheets/sketches that may facilitate the review of the request. This may include, but not be limited to, construction plans, profiles, grading plans, typical sections, etc. Any plan sheets submitted should be half-scale if available. In addition, if the design exception is for substandard vertical clearance over a railroad, the designer shall include documented concurrence from the railroad authority.

The designer shall submit one copy of the DER package to the Geometric Solutions Unit (within Capital Program Support) for initial review. For those design exceptions requiring FHWA approval (PODI and Interstate projects), Project Management staff will coordinate the initial review with the FHWA and Geometric Solutions. Once the initial review has been completed and all comments have been addressed, the designer shall submit two copies of the final Design Exception Report (three copies for PODI and Interstate projects) plus a CD of the electronic files

in PDF format to Geometric Solutions. The final Design Exception Report will then be sent to the State Transportation Engineer (and FHWA for PODI and Interstate projects) for formal approval.

There are instances when contract plans must be revised during the construction of the project. If a change of plan degrades or creates additional locations of any of the CSDEs covered by an approved design exception, or creates any new CSDEs, a new or amended design exception will be required. The new or amended design exception shall follow the same procedure outlined above and will require approval of the State Transportation Engineer (as well as FHWA approval on PODI and interstate projects).

Below is a Checklist showing the minimum requirements. Additional information that will facilitate the review and approval of the DER should also be included. (This checklist is not required as part of the DER submittal):

Design Exception Report Checklist	
Attachment 1 – Cover Letter (*If FHWA approval is needed, add line for FHWA signature approval*)	
Department of Defense Interstate Substandard Vertical Clearance Form (Bridges over Interstates)	
Vertical Clearance Concurrence letter from Rail road Authority (Roadway Bridges over railroads)	
Posted speeds have been verified via NJDOT Traffic Regulations website	
Project Fact Sheet (See Appendix D)	
Attachment 2 – For Design Exception Type 1 (Design Speed ≥ 50 mph)	
Attachment 3 – For Design Exception Type 2 (Design Speed < 50 mph)	
Attachment 4 – For Design Exception Type 3 Major Access / Developer Projects	
Attachment 5 – Tables (with corresponding Proposed Safety Measures; Crash Analysis & Impacts)	
Crash Analysis Letter with detailed crash reports from Bureau of Safety, Bicycle, and Pedestrian Programs	
Plan Sheets as needed (*Typical Sections, Construction, Signing & Striping, Profiles, Grading Plans, etc.*)	

7.0 Crash Analysis

The Design Exception Report shall use the design exception crash analysis provided by the Bureau of Safety, Bicycle, and Pedestrian Programs. This will include an analysis of each substandard element for the most recent 3 year period. The Design Exception Report shall also include the crash detail report printout. The designer is to thoroughly consider the crash data while recommending whether to allow the existing substandard condition to remain or provide a safety improvement. Refer to the design exception *Crash Analysis* when discussing a CSDE that has indicator crashes that exceed the statewide average (see the crash analysis requirements following the Tables in Attachment **5**).

In the case of CSDE's located on ramps, the designer must review the available crash data and, if warranted, recommend improvements.

Note that crash analyses are sometimes not needed for features that do not exist. A new ramp is an example. However, if a substandard length deceleration lane is proposed and one does not exist, a crash analysis may help support the conclusion that a substandard deceleration lane would be an improvement.

In order to receive the required information needed for proper consideration of the design exception, designers must select the following items from the Bureau of Safety, Bicycle, and Pedestrian Programs Crash Data/Analysis Request Form, and provide the corresponding information requested on the form:

- Crash Detail Printouts
- Design Exception Crash Analysis

8.0 Geometric Review (Concept Development Phase)

A Geometric Review is required, regardless of the funding source, NHS and Non-NHS, the Design Speed, or further design exception requirements. The "Geometric Review" must be submitted by the designer and approved by the *Geometric Solutions Unit, within the Bureau of Design Standards.* (Structural elements shall be approved by the *Structural Engineering Unit*.) The geometric review must be conducted and approved during (or immediately following) the selection of the Preliminary Preferred Alternative (PPA) during Concept Development for the following types of projects:

- Limited Scope Deck/Superstructure Replacements and other applicable Limited Scope projects that may alter roadway geometric features.
- Full Scope Capital Program Projects
- Local Government Aid projects - involving State roads and Interstates
- Projects facilitated by other Agencies involving State roads and Interstates

The following list of substandard geometric and structural design elements are to be considered:

- Lane Width (through and auxiliary)
- Shoulder Width
- Cross Slope (Minimum and Maximum)
- Stopping Sight Distance (crest vertical curves, horizontal curves, and non-signalized intersections)
- Superelevation Rate (for mainline and ramps)
- Horizontal Curve Radius (for mainline and ramps)
- Minimum and Maximum Grades
- Through lane drop Transition Length
- Acceleration and Deceleration Length
- Vertical Clearance (Including under clearance and over clearance - in the case of a truss)
- Design Loading Structural Capacity

In addition, the following information must be submitted for review:

1. Memorandum (hard copy) listing the anticipated substandard design elements for the alternatives being developed. These elements should have been previously determined in activity 2125.

   This memo should include (if available):

   - Purpose and need of project.
   - Typical Section.
   - Location of anticipated substandard elements.
   - Posted (and Design) Speeds. Posted speeds must be verified via NJDOT Traffic Regulations website.
   - Existing/proposed/standard for each anticipated substandard element (a range of values is sufficient if exact dimensions are not known yet).
   - Order of Magnitude of what it would take to obtain the standard for each anticipated substandard element. This Order of Magnitude estimate would be a general idea of the issues (ROW, utilities, environmental, etc.) without getting into specific impacts (detailed costs, number of ROW parcels, permits, etc.) which would normally be obtained during further advancement of the project (preliminary engineering).
   - **The project's Crash Diagram.** Depending on the Crash Diagram, an Indicator Crash analysis (at specific locations) may be warranted.

2. Plans (hard copy) that provide enough information/detail to adequately allow for a review of the locations of the substandard elements.

Attachment 1 – Cover Letter

New Jersey Department of Transportation

Memorandum

To: ***(Name)***

State Transportation Engineer

From: ***(Name)***

Title

Date: **Phone:**

RE: **Design Exception**

Route, Section/Contract Number

Municipality
County
Milepost Limits
Project Category
NJDOT Job Number
Federal Project Number (if applicable)
UPC Number

Approval of the design exception is requested for the following controlling substandard design elements (CSDE) contained in the (list only those references that apply: *NJDOT Design Manual Roadway*; *NJDOT Design Manual Bridges and Structures*; AASHTO publication, *A Policy on Geometric Design of Highways and Streets*) based on the warranting conditions described herein:

Attached is a list by location of the impacts for each CSDE identified. **(**Note to designer: include Attachments 2 or 3 or 4 and 5)

Please refer to the attached Project Fact Sheet for the project description. A crash analysis is also included.

Based on the warranting conditions presented (the existing conditions, proposed geometry, impacts, crash analysis and safety measures), it is recommended that the above design exception be approved.

Approval By:

_____ _____

(Name) Date
State Transportation Engineer

(FHWA Signature **Only** for PODI and Interstate projects)
Approval by FHWA

_____ _____

(Name) Date

Attachment 2 – List of Controlling Substandard Design Elements for Design Exception Type 1 (Design Speed ≥ 50 Mph)

Route _____ Section/Contract No. _____

Design Exception

This project contains the following controlling substandard design element(s):

Controlling Design Elements:

____ Stopping Sight Distance (SSD) Crest Vertical Curve(s)

____ SSD Horizontal Curve(s)

____ Lane Width (Through & Aux.)

____ Shoulder Width

____ Cross Slope (Minimum & Maximum)

____ Horizontal Curve Radius

____ Design Speed

____ Design Loading Structural Capacity

____ Vertical Clearance

____ Superelevation Rate

____ Maximum Grades

Controlling substandard design elements have been identified at the following locations:

Controlling Substandard Design Elements		
Location Number	Location and Direction (Station and Milepost)	CSDE

Attachment 3 – List of Controlling Substandard Design Elements for Design Exception Type 2 (Design Speed < 50 mph)

Route _____ Section/Contract No. _____

Design Exception

This project contains the following controlling substandard design element(s):

Controlling Design Elements:

____ Design Loading Structural Capacity

____ Design Speed

Controlling substandard design elements have been identified at the following locations:

Controlling Substandard Design Elements		
Location Number	Location and Direction (Station and Milepost)	CSDE

Attachment 4 – List of Controlling Substandard Design Elements for Design Exception Type 3 (Major Access/Developer Projects; All Design Speeds)

Route _____ Section/Contract

No. _____

Design Exception

This project contains the following controlling substandard design element(s):

Controlling Design Elements:

_____ Stopping Sight Distance (SSD) Crest Vertical Curve(s)

_____ SSD Horizontal Curve(s)

_____ Lane Width (Through & Aux.)

_____ Shoulder Width

_____ Cross Slope (Minimum & Maximum)

_____ Horizontal Curve Radius

_____ Superelevation Rate

_____ Acceleration & Deceleration Lane Length

_____ Through Lane Drop Transition Length

_____ Design Speed

_____ SSD at Non-Signalized Intersections

_____ Design Loading Structural Capacity

_____ Vertical Clearance

_____ Maximum Grades & Minimum Grades

Controlling substandard design elements have been identified at the following locations:

Controlling Substandard Design Elements		
Location Number	Location and Direction (Station and Milepost)	CSDE

Attachment 5 – Tables (Design Exceptions Type 1, 2 or 3 as appropriate)

For each CSDE identified on Attachment 2, one or more of the following Tables will be required. The calculated speed for vertical curves and horizontal curves can be determined from the Department's Website. https://www.state.nj.us/transportation/eng/tools/roadway.shtml

Stopping Sight Distance on Crest Vertical Curves

Location Number	Location and Direction (Station/ Milepost)	Type of Curve	A (%) Exist./Prop.	L (feet) Exist./Prop.	S (feet) Exist./Prop.	S (feet) Stand.	V (calc.) (mph) Exist./Prop.	Posted Speed/ Design Speed (mph)

- Proposed Safety Measures
- Crash Analysis
- Impact

Stopping Sight Distance on Horizontal Curves

Location Number	Location and Direction (Station/ Milepost)	Radius (feet) Exist./Prop.	HSO (feet) Exist./Prop.	S (feet) Exist./Prop.	S (feet) Stand.	V(calc.) (mph) Exist./Prop.	Posted Speed/ Design Speed (mph)

- Proposed Safety Measures
- Crash Analysis
- Impact

Design Loading Structural Capacity

Location Number	Location and Direction (Station/Milepost)	Bridge Design Load		
		Exist.	Prop.	Standard

- Proposed Safety Measures Impact
- Impact

Cross Slope (Minimum and Maximum)

Location Number	Location and Direction (Station/Milepost)	Cross Slope (%)		Cross Slope (%)
		Exist.	Prop.	Standard.

- Proposed Safety Measures
- Crash Analysis
- Impact

Superelevation Rate (for mainline and ramps)

Location Number	Location and Direction (Station/Milepost)	Radius (feet)		eMax		eMax	V(safe) mph		V(safe) mph	Posted Speed/Design Speed (mph)
		Exist.	Prop.	Exist.	Prop.	Stnd.	Exist.	Prop.	Stnd.	

- Proposed Safety Measures
- Crash Analysis
- Impact

Horizontal Curve Radius (for mainline and ramps)

Location Number	Location and Direction (Station/Milepost)	Radius (feet)		Radius (feet)	Design speed (mph)	Safe Speed (mph)	Posted Speed/Design Speed (mph)
		Exist.	Prop.	Standard.	Prop.	Prop.	

- Proposed Safety Measures
- Crash Analysis
- Impact

Maximum Grades

(Minimum Grades included within Developer Projects and Geometric Reviews)

Location Number	Location and Direction (Station/Milepost)	Type of Grade	Grade (%)		Grade (%)
			Exist.	Prop.	Standard.

- Proposed Safety Measures
- Crash Analysis
- Impact

Lane Width (Through and Auxiliary)

Location Number	Location and Direction (Station/Milepost)	Existing Width (feet)	Proposed Width (feet)	Standard Width (feet)

- Proposed Safety Measures
- Crash Analysis
- Impact

Shoulder Width

Location Number	Location and Direction (Station/Milepost)	Type of Shoulder	Existing Width (feet)	Proposed Width (feet)	Standard Width (feet)

- Proposed Safety Measures
- Crash Analysis
- Impact

Through Lane Drop Transition Length

(Developer Projects and Geometric Reviews Only)

Location Number	Location and Direction (Station/Milepost)	Lane Length (feet)		Lane Length (feet)
		Exist.	Prop.	Standard.

- Proposed Safety Measures
- Crash Analysis
- Impact

Acceleration and Deceleration Lane Length

(Developer Projects and Geometric Reviews Only)

Location Number	Location and Direction (Station/Milepost)	Type of Lane	Lane Length (feet)		Lane Length (feet)
			Exist.	Prop.	Standard.

- Proposed Safety Measures
- Crash Analysis
- Impact

Stopping Sight Distance at Non-Signalized Intersections

(Developer Projects and Geometric Reviews Only)

Location Number	Location and Direction (Station/Milepost)	S (feet) Exist/Prop.	S (feet) Stand.	V(calc.) Exist./Prop. (mph).	Posted / Design Speed (mph)

Vertical Clearance

Location Number	Location and Direction (Station/Milepost)	Bridge Clearance (feet)		Bridge Clearance (feet)
		Exist.	Prop.	Standard

- Proposed Safety Measures
- Crash Analysis
- Impact

Proposed Safety Measures

Provide a brief discussion of the proposed safety countermeasures that are being provided to improve the CSDE(s). Appendix B provides examples of low cost safety measures related to each CSDE.

Crash Analysis

For each location where the indicator crashes for the CSDE exceed the statewide average, the designer shall provide a more detailed analysis of the crashes. The crash analysis should include the type of crash, severity, contributing circumstances, environmental conditions and time of day. A collision diagram may also be necessary for locations involving a significant number of crashes. Likewise, for locations where the indicator crashes for the CSDE **approach but do not exceed** the statewide average, a more detailed analysis of the crashes may also be warranted. Designers should use engineering judgment to determine whether it is appropriate to provide the more detailed analysis for this condition.

Impact

For each CSDE not met, provide a concise narrative qualitatively describing the impacts including construction costs, ROW, utilities and social/environmental impacts. The narrative should cite the crash analysis and the proposed safety measures, with a concluding statement saying, "Not meeting the standard design value will not result in degrading the relative safety of the roadway."

When a CSDE exists at multiple locations, the designer shall evaluate the impacts for each location individually, as opposed to grouping the impacts together as a whole for all the locations. It may very well be practical to undertake improvements at some of the locations where the CSDE exists, rather than not constructing any improvements at all of the locations cited.

Appendix A - Vertical Curve Conversion from SSD To V (Calc.) & Superelevation Safe Speed Calculation

A.1 Crest Vertical Curve Conversion From SSD To V (Calc.)

If S is greater than L, then $S = (L/2) + (1079/A)$ If S is less than L, then $S = [(2158L) / A]^{1/2}$

S = Stopping Sight Distance, Feet

A = Algebraic Difference in Tangent Grades, Percent L = Length of Vertical Curve, Feet

A formula calculator is available on the NJDOT website Solve for S, then look for V in table below

SSD	Vcalc	SSD	Vcalc	SSD	Vcalc
Feet	**mph**	**Feet**	**Mph**	**Feet**	**mph**
152	25	312	41	521	57
160	26	324	42	536	58
169	27	336	43	551	59
178	28	348	44	566	60
187	29	360	45	581	61
197	30	372	46	597	62
206	31	385	47	613	63
216	32	398	48	628	64
226	33	411	49	644	65
236	34	424	50	661	66
246	35	437	51	667	67
257	36	451	52	694	68
267	37	464	53	711	69
278	38	478	54	728	70
289	39	498	55		
301	40	507	56		

Sometimes the profile has to be checked graphically to determine if a vertical curve less than the required length meets the required design value for stopping sight distance. These cases involve adjacent crest and sag vertical curves with little or no intervening tangent.

NOTE: the SSD figures shown in this table may differ from the corresponding table shown in the AASHTO "Green Book". The figures within the Green Book are rounded.

A.2 Superelevation Safe Speed Calculation

Safe speed is an accepted limit at which riding discomfort due to centrifugal force is evident to the driver. The safe speed of a horizontal curve in miles per hour, given the radius (R) and superelevation (E), can be calculated by using the following formulas.

V ≤ 50 mph

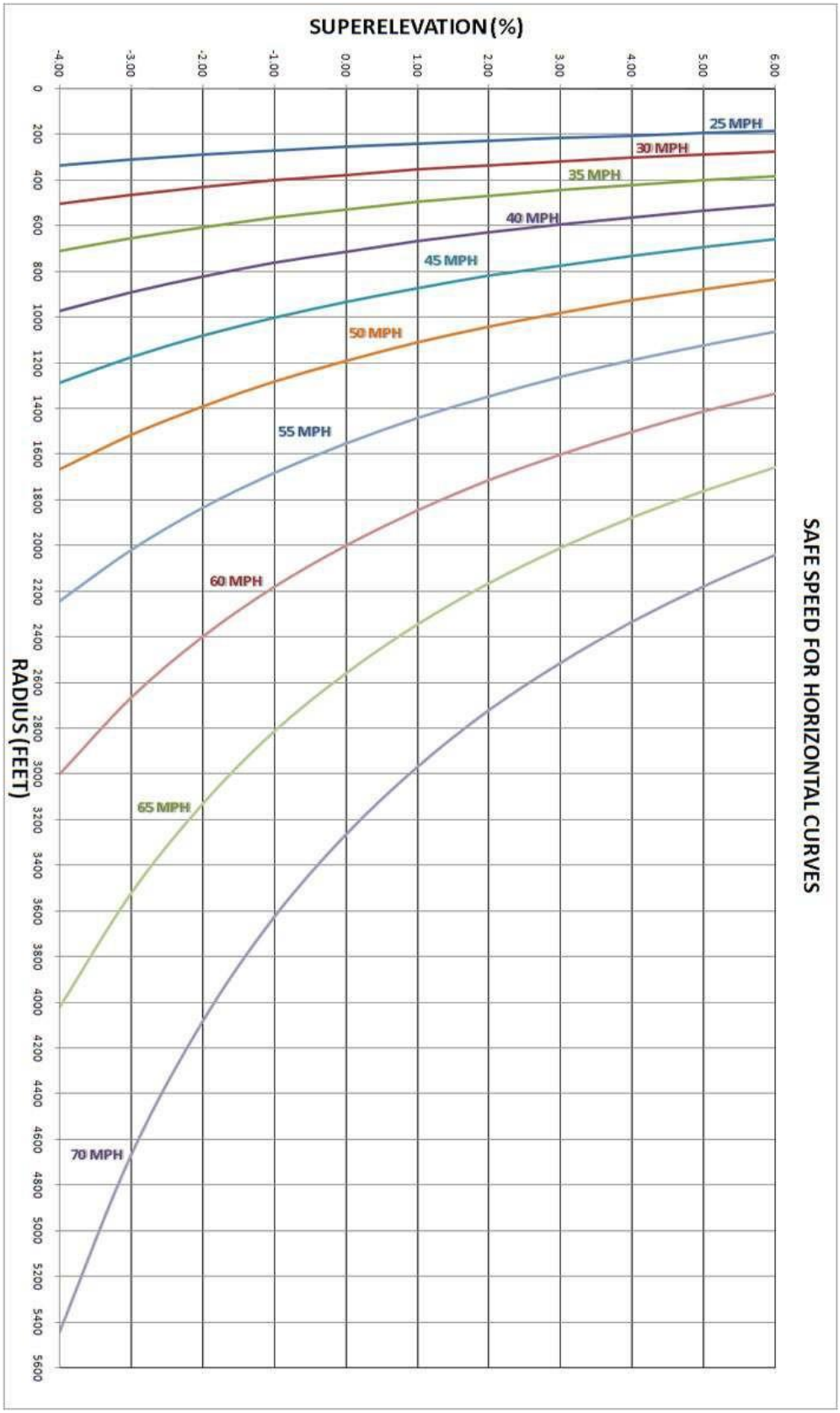
$$V = \frac{-0.015R + [(.015R)^2 + 4R(15E + 2.85)]^{1/2}}{2}$$

V > 50 mph

$$V = \frac{-0.03R + [(.03R)^2 + 4R(15E + 3.6)]^{1/2}}{2}$$

Note: Use when radius is in feet, E= superelevation expressed as a decimal (e/100).

The formula is based on a Ball Bank indicator reading of 10 degrees.


SUPERELEVATION (%)
-4.00
-3.00
-2.00
-1.00
0.00
1.00
2.00
3.00
4.00
5.00
6.00
RADIUS (FEET)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
4200
4400
4600
4800
5000
5200
5400
5600
25 MPH
30 MPH
35 MPH
40 MPH
45 MPH
50 MPH
55 MPH
60 MPH
65 MPH
70 MPH
SAFE SPEED FOR HORIZONTAL CURVES

Appendix B - Low Cost Safety Measures

See also the following links regarding Safety Countermeasures**:**

Proven Safety Countermeasures:

https://safety.fhwa.dot.gov/provencountermeasures/

Making Our Roads Safer One Countermeasure at a Time

https://safety.fhwa.dot.gov/provencountermeasures/fhwasa18029/fhwasa18029.pdf

NOTE: the countermeasures discussed within the links must be approved by the appropriate Subject Matter Expert within the NJDOT.

Controlling Substandard Design Element	**Safety Measures**
Stopping Sight Distance	• Fixed object removal • Shoulder widening • Highway lighting (sag curves) • Advisory speed signs • Reducing speed limits • Warning signs • No turn on red signs • Left turn slots • Stop and yield signs • Turning prohibitions
Superelevation Rate (mainline and interchange ramps) Horizontal Curve Radius (mainline and interchange ramps)	• Delineators • Shoulder widening • Flatten side slopes • Pavement antiskid treatment • Warning Signs • Fixed object removal • Improved drainage system • Raised pavement markers • Rumble strips
Cross Slope	• Slippery when wet signs • Transverse pavement grooving • Improved drainage system
Minimum Grades	• Regrading of the border • Provide additional drainage
Maximum Grades	• Warning signs • Advisory speed limits • Climbing lanes

Low Cost Safety Measures

Controlling Substandard Design Element	Safety Measures
Lane width (Through and Auxiliary) Shoulder width	• Pavement edge lines • Raised pavement markers Delineators • Removing fixed objects • Eliminating steep slopes • Signage (narrow lane, narrowed shoulder) • Rumble strip • Beaded / reflective pavement edge, lines
Through-lane Drop Transition Length	• Warning signs • Advisory speed limits
Acceleration and Deceleration Lane Length (for ramps)	• Additional pavement markings and signing • Delineators • High Friction Surface Course
Vertical Clearance over Roadway	• Warning Signs
Design Loading Structural Capacity	• Warning signs

Appendix C contains more detailed tables that show crash types along with probable causes, studies to be performed to determine probable cause and possible safety measures. Designers can also use this table to conduct a safety analysis in the scoping stages of a project.

Appendix C - Intersection and Link Crash Tables

1.0 Intersection Crash Types

1.1 Left Turn Head On Collision	
Probable Causes	1) Restricted sight distance due to presence of left turning traffic on the opposite approach and improper channelization and geometrics. 2) Too short amber phase. 3) Absence of special left turning phase when needed. 4) Excessive speed on approaches.
Study to be Performed	1) Review existing intersection channelization. 2) Volume count for thru traffic. 3) Perform volume count for left turning traffic. 4) Review signal phasing. 5) Review intersection clearance times. 6) Study need for special left turn phase. 7) Study capacity of the intersection approaches in question for possible multi-phase operation. 8) Perform spot speed study.
Possible Safety Measures	1) Provide adequate channelization. 2) Install traffic signal if warranted by MUTCD. 3) Provide left turn slots. 4) Install stop signs if warranted by MUTCD. 5) Increase amber phase. 6) Provide special phase for left turning traffic. 7) Widen road. 8) Prohibit left turns (study possible adverse effects on other nearby intersections). 9) Reduce speed limit on approaches if justified by spot speed study. 10) Remove left turn traffic. 11) Provide all red phase.

Intersection Crash Types

1.2 Rear End Collisions At Unsignalized Intersections	
Probable Causes	1) Improper channelization. 2) High volume of turning vehicles. 3) Slippery surface. 4) Lack of adequate gaps due to high traffic volume from the opposite direction. 5) Inadequate intersection warning signs. 6) Crossing pedestrians. 7) Excessive speed on approaches. 8) Inadequate roadway lighting.
Study to be Performed	1) Review existing channelization. 2) Review pedestrian signing and crosswalk marking. 3) Perform turning count. 4) Perform volume count for thru traffic. 5) Check skid resistance. 6) Perform spot speed study. 7) Check for adequate drainage. 8) Check roadway illumination.
Possible Safety Measures	1) Create right or left-turn lanes. 2) Increase curb radii. 3) Prohibit turns (study possible adverse effects on other nearby locations). 4) Provide "Slippery When Wet" signs (interim measure only). 5) Increase skid resistance. 6) Improve drainage. 7) Install or improve signing and marking of pedestrian crosswalks. 8) Reduce speed limit on approaches if justified by spot speed study. 9) Provide advance intersection warning signs. 10) Improve roadway lighting.

Intersection Crash Types

1.3 Rear End Collisions At Signalized Intersections	
Probable Causes	1) Improper signal timing. 2) Poor visibility of signal indicator. 3) Crossing pedestrians. 4) High volume of turning vehicles. 5) Slippery surface. 6) Excessive speed on approaches. 7) Inadequate roadway lighting. 8) Inadequate channelization.
Study to be Performed	1) Review existing channelization. 2) Review pedestrian signing and crosswalk markings. 3) Perform turning count. 4) Perform spot speed study. 5) Check skid resistance. 6) Check for adequate drainage. 7) Check visibility of traffic signals. 8) Check roadway illumination. 9) Review intersection clearance time.
Possible Safety Measures	1) Create right or left-turn lanes. 2) Increase curb radii. 3) Prohibit turns (study possible adverse effects on other nearby locations). 4) Increase skid resistance. 5) Provide adequate drainage. 6) Provide "Slippery When Wet" signs (interim measure only). 7) Install advance intersection warning signs. 8) Install or improve signing and marking of pedestrian crosswalks. 9) Provide pedestrian walk - don't walk indicators. 10) Increase amber phase. 11) Provide special phase for left turning traffic. 12) Provide proper signalized progression. 13) Reduce speed limit on approaches. 14) Install backplates, larger lens, louvers, visors, etc. on traffic signal to improve contrast and visibility. 15) Relocate signals. 16) Add additional signal heads. 17) Improve roadway lighting.

Intersection Crash Types

1.4 Pedestrian - Vehicle Collision	
Probable Causes	1) Inadequate pavement markings. 2) Inadequate channelization. 3) Improper signal phasing. 4) Restricted sight distance. 5) Inadequate pedestrian signals. 6) Inadequate roadway lighting. 7) Inadequate gaps at unsignalized intersection. 8) Excessive vehicle speed.
Study to be Performed	1) Field observation for sight obstructions. 2) Pedestrian volume count. 3) Review channelization. 4) Check roadway illumination. 5) Review pavement markings. 6) Review signal phasing. 7) Perform gap studies. 8) Perform spot speed study.
Possible Safety Measures	1) Install pedestrian crosswalks and signs. 2) Install pedestrian barriers. 3) Prohibit curb parking near crosswalks. 4) Install traffic signal if warranted by MUTCD. 5) Install pedestrian walk - don't walk signals. 6) Increase timing of pedestrian phase. 7) Improve roadway lighting. 8) Prohibit vehicle-turning movements. 9) Remove sight obstructions. 10) Reroute pedestrian paths. 11) Reduce speed limits on approaches if justified by spot speed studies. 12) Use crossing guards at school crossing areas.

Intersection Crash Types

1.5 Right Angle Collisions At Signalized Intersections	
Probable Causes	1) Restricted sight distance. 2) Inadequate roadway lighting. 3) Inadequate advance intersection warning signs. 4) Poor visibility of signal indication. 5) Excessive speed on approaches.
Study to be Performed	1) Volume counts on all approaches. 2) Field observations for sight obstructions. 3) Review signal timing. 4) Check roadway illumination. 5) Perform spot speed study.
Possible Safety Measures	1) Remove obstructions to sight distance. 2) Increase amber phase. 3) Provide all red phase. 4) Retime signals. 5) Prohibit curb parking. 6) Install advance intersection warning signs. 7) Install backplates, larger lens, louvers, visors, etc., on traffic signal to improve contrast and visibility. 8) Install additional signal heads. 9) Reduce speed limit on approaches if justified by spot speed studies. 10) Provide proper signalized progression. 11) Improve location of signal heads.

Intersection Crash Types

1.6 Right Angle Collisions At Unsignalized Intersections	
Probable Causes	1) Restricted sight distance. 2) Inadequate roadway lighting. 3) Inadequate intersection warning signs. 4) Inadequate traffic control devices. 5) Excessive speed on approaches.
Study to be Performed	1) Volume counts on all approaches. 2) Field observations for sight obstructions. 3) Check roadway illumination. 4) Perform spot speed study. 5) Review signing.
Possible Safety Measures	1) Remove obstructions to sight distance. 2) Prohibit parking near corners. 3) Improve roadway illumination. 4) Install yield or stop signs if MUTCD warrants are met. 5) Install traffic signal if MUTCD warrants are met. 6) Install advance intersection warning signs. 7) Reduce speed limits on approaches if justified by spot speed studies.

Intersection Crash Types

1.7 Sideswipe Collisions	
Probable Causes	1) Inadequate pavement markings. 2) Inadequate channelization. 3) Inadequate signing. 4) Narrow traffic lanes. 5) Improper street alignment.
Study to be Performed	1) Review pavement markings. 2) Review channelization. 3) Review sign placement. 4) Review lane width. 5) Check alignment.
Possible Safety Measures	1) Provide wider lanes. 2) Install acceleration and deceleration lanes. 3) Place direction and lane change signs to give proper advance warning. 4) Install or refurbish centerlines, lane lines and pavement edge lines. 5) Provide turning lanes. 6) Provide proper alignment.

2.0 Link Crash Types

2.1 Off-Road Crashes	
Probable Causes	1) Inadequate signing and delineators. 2) Inadequate pavement marking. 3) Inadequate roadway lighting. 4) Slippery surface. 5) Improper channelization. 6) Inadequate shoulders. 7) Inadequate pavement maintenance. 8) Inadequate superelevation. 9) Severe curve. 10) Severe grade.
Study to be Performed	1) Review signs and placement. 2) Review pavement marking. 3) Check roadway illumination. 4) Check skid resistance. 5) Review channelization. 6) Check roadside shoulders and road maintenance. 7) Check superelevation. 8) Check for adequate drainage. 9) Perform spot speed studies.
Possible Safety Measures	1) Install proper centerline, lane lines, and pavement edge markings. 2) Increase skid resistance. 3) Improve roadway lighting. 4) Install warning signs to give proper advance warning and advisory speed limit. 5) Install roadside delineators, guide rails and redirecting barriers. 6) Perform necessary road surface repairs. 7) Improve superelevation at curves. 8) Reduce speed limit if justified by spot speed studies. 9) Upgrade roadway shoulders. 10) Provide "Slippery When Wet" signs (interim measure only). 11) Provide adequate drainage. 12) Flatten curve. 13) Provide proper superelevation. 14) Rumble strips/stripes 15) Safety edge

Link Crash Types

2.2 Head-on Collisions	
Probable Causes	1) Restricted sight distance. 2) Inadequate pavement markings. 3) Inadequate signing. 4) Narrow lanes. 5) Inadequate shoulders and/or maintenance. 6) Inadequate road maintenance. 7) Excessive vehicle speed. 8) Severe curve. 9) Severe grade.
Study to be Performed	1) Review lane width. 2) Review pavement markings. 3) Review signing. 4) Check road shoulders where present. 5) Check road for proper maintenance. 6) Perform spot speed study. 7) Field check for sight obstructions.
Possible Safety Measures	1) Provide wider lanes. 2) Provide pennant signs. 3) Install no passing zones at points with restricted sight distances. 4) Install centerlines, lane lines and pavement edge markings. 5) Improve roadside shoulders. 6) Perform necessary road surface repairs. 7) Reduce speed limits if justified by spot speed studies. 8) Remove obstructions to sight distances. 9) Flatten curve. 10) Provide proper superelevation.

Link Crash Types

2.3 Pedestrian - Vehicle Collisions	
Probable Causes	1) Restricted sight distance. 2) Inadequate roadway lighting. 3) Excessive vehicle speed. 4) Pedestrian walking on roadway. 5) Inadequate signing. 6) Sidewalks too close to roadway. 7) Improper pedestrian crossing.
Study to be Performed	1) Check sight distances. 2) Check roadway illumination. 3) Review existence of sidewalks. 4) Review warning signs and placement. 5) Perform spot speed study.
Possible Safety Measures	1) Improve sight distance. 2) Prohibit curbside parking. 3) Improve roadway lighting. 4) Install sidewalks. 5) Install proper warning signs. 6) Reduce speed limit if justified by spot speed studies. 7) Install pedestrian barriers. 8) Move sidewalks further from roadway. 9) Enforcement.

Link Crash Types

2.4 Railroad Crossing Crashes	
Probable Causes	1) Inadequate signing, signals or gates. 2) Inadequate roadway lighting. 3) Restricted sight distance. 4) Inadequate pavement markings. 5) Rough crossing surfaces. 6) Improper traffic signal pre-emption timing. 7) Improper pre-emption timing of railroad signals or gates.
Study to be Performed	1) Review signing, signals and gates. 2) Check roadway illumination. 3) Review pavement markings. 4) Review sight distance.
Possible Safety Measures	1) Install advance-warning signs. 2) Install proper pavement markings. 3) Install proper roadway lighting on both sides of tracks. 4) Install automatic flashers and gates. 5) Improve sight distance. 6) Install stop signs. 7) Rebuild crossing. 8) Retime traffic signals. 9) Retime railroad signals and gates.

Link Crash Types

2.5 Parked Car Crashes	
Probable Causes	1) Improper pavement markings. 2) Improper parking clearance at driveways. 3) Angle parking. 4) Excessive vehicle speed. 5) Improper parking. 6) Illegal parking.
Study to be Performed	1) Review pavement markings. 2) Review parking clearance from curb. 3) Review angle parking if it exists. 4) Perform spot speed studies. 5) Law observance study.
Possible Safety Measures	1) Convert angle parking to parallel parking. 2) Paint parking stall limits 7 ft. (2.1 m) from curb face. 3) Post parking restrictions near driveways. 4) Prohibit parking. 5) Create off-street parking. 6) Reduce speed limit if justified by spot speed studies. 7) Widen lanes. 8) Enforcement.

Link Crash Types

2.6 Fixed Objects	
Probable Causes	1) Obstructions in or too close to roadway. 2) Inadequate channelization. 3) Inadequate roadway lighting. 4) Inadequate pavement marking. 5) Inadequate signs, delineators and guide rails. 6) Improper superelevation. 7) Slippery surface. 8) Excessive vehicle speed. 9) Severe curve. 10) Severe grade.
Study to be Performed	1) Review pavement markings, signs and delineators. 2) Review channelization. 3) Field observation to locate obstructions. 4) Check illumination. 5) Check superelevation. 6) Check for adequate drainage. 7) Perform spot speed studies.
Possible Safety Measures	1) Remove or relocate objects. 2) Improve roadway lighting. 3) Install reflectorized pavement lines. 4) Install reflectorized paint or reflectors or both on the obstruction. 5) Install crash cushioning devices. 6) Install guide rails or redirecting barriers. 7) Install appropriate warning signs and delineators. 8) Improve superelevation at curves. 9) Improve skid resistance. 10) Provide adequate drainage. 11) Provide "Slippery When Wet" signs (interim measure only). 12) Reduce speed limit if justified by spot speed studies. 13) Provide wider lanes. 14) Flatten curve. 15) Provide proper superelevation.

Link Crash Types

2.7 Sideswipe Collisions	
Probable Causes	1) Inadequate pavement markings. 2) Inadequate channelization. 3) Inadequate signing. 4) Narrow traffic lanes. 5) Improper road maintenance. 6) Inadequate roadside barriers 7) Excessive vehicle speed.
Study to be Performed	1) Review pavement markings. 2) Review channelization. 3) Review sign placement. 4) Review lane width. 5) Check roadside shoulders. 6) Check road surface for proper maintenance. 7) Perform spot speed studies.
Possible Safety Measures	1) Provide wider lanes. 2) Install acceleration and deceleration lanes. 3) Place direction and lane change signs to give proper advance warning. 4) Install or refurbish centerlines, lane lines and pavement edge lines. 5) Perform necessary road surface repairs. 6) Improve shoulders. 7) Remove constrictions such as parked vehicles. 8) Install median divider. 9) Reduce speed limit if justified by spot speed study.

Appendix D - Sample Design Exceptions

Sample 1

The following is an example of a design exception that would be included in the PER for substandard shoulder width and superelevation.

Design Exception

This project contains the following controlling substandard design elements:

Controlling Design Elements:

____	Stopping Sight Distance (SSD) Crest Vertical Curve(s)	____	Horizontal Curve Radius
____	SSD Horizontal Curve(s)	_X_	Superelevation Rate
____	Lane Width (Through & Aux.)	____	Design Loading Structural Capacity
_X_	Shoulder Width	____	Cross Slope (Minimum & Maximum)
____	Vertical Clearance	____	**Through Lane Drop Transition Length**
____	Maximum Grades** & Minimum Grades**	____	**SSD at Non-Signalized Intersections**
____	**Acceleration & Deceleration Lane Length **	____	Design Speed

****NOTE:** To be included only with Developer Projects and the Geometric Review during the Concept Development phase.

Controlling substandard design elements have been identified at the following locations:

Controlling Substandard Design Elements		
Location Number	Location and Direction (Station and Milepost)	CSDE
1	Rt. 42 NB, MP 26.88 to 27.00 Sta. 43+25 to 49+50	Substandard right shoulder
2	Rt. 42 NB, MP 14.25 to 14.28 Sta. 42+00 to 53+00	Substandard superelevation

Shoulder Width

Location Number	Location and Direction (Station/Milepost)	**Type of Shoulder**	Existing Width (feet)	Proposed Width (feet)	Standard Width (feet)
1	Rt. 42 NB & SB, MP 26.88 to 27.00 Sta. 43+25 to 49+50	**Right**	Varies 0 to 12	Varies 0 to 12	8

- Proposed Safety Measures

The proposed safety measures at Location 1 is resurfacing to improve the pavement skid resistance, installation of 4 inch wide long-life pavement edge lines, raised pavement markers and delineators mounted on the roadside guide rail.

- Crash Analysis

Fixed object crashes at Location Number 1 are over represented. Based upon the data that indicates 27 of the 29 indicator crashes occurred on a wet surface, we believe the wet surface condition is the major contributing factor to the crashes not the CSDE. A copy of the Bureau of Safety Programs crash analysis is included in the attached project fact sheet.

- Impact

Currently there are no shoulders on Route 42 under the Browning Road overpass. Providing standard width right shoulders at Location 1 would require the replacement of the Browning Road overpass. The cost to replace the existing overpass is estimated at $2,000,000. There are currently no other projects for the 5-year program for this location. Not meeting the standard shoulder width at Location 1 will not result in degrading the relative safety of the roadway.

Superelevation Rate (for mainline and ramps)

Location Number	Location and Direction (Station/Milepost)	Radius (feet)		eMax (%)		eMax 6%	V(safe) mph		V(safe) mph	Posted Speed/ Design Speed (mph)
		Exist.	Prop.	Exist.	Prop.	Stnd.	Exist.	Prop.	Stnd.	
2	Rt. 42 NB, MP 14.25 to 14.28 Sta. 42+00 to 53+00	3000	3000	1.5	1.5	4.8	71	71	77	55

Proposed Safety Measures

The primary safety improvements at Location Number 2 will be the resurfacing of the highway to improve the skid resistance, 4 inch wide long-life pavement striping, and raised pavement markers.

Crash Analysis

The crash rate at location 2 exceeds the statewide average. For the three-year period analyzed, there were 2 fixed object crashes out of a total of 7 crashes. It is our opinion, 2 crashes in 3 years is too low a frequency to be considered a result of the CSDE, as opposed to random occurrences. A copy of the Bureau of Safety Programs crash analysis is included in the attached project fact sheet.

Impact

Providing the design superelevation at Location 2 requires the replacement of the concrete median barrier in addition to the increase in quantity of Hot Mixed Asphalt. Project cost would increase by $280,000. However, only a 5 mph increase in safe speed would be accomplished. There are currently no other projects for the 5-year program for this location. Not meeting the design values at Location 2 will not result in degrading the relative safety of the roadway.

Sample 2

The following is an example of a design exception that would be included in the PER for substandard stopping sight distance on a vertical curve.

Design Exception

This project contains the following controlling substandard design element:

Controlling Design Elements:

X	Stopping Sight Distance (SSD) Crest Vertical Curve(s)	_____	Horizontal Curve Radius
_____	SSD Horizontal Curve(s)	_____	Superelevation Rate
_____	Lane Width (Through & Aux.)	_____	Design Loading Structural Capacity
_____	Shoulder Width	_____	Cross Slope (Minimum & Maximum)
_____	Vertical Clearance	_____	**Through Lane Drop Transition Length**
_____	Maximum Grades** & Minimum Grades**	_____	**SSD at Non-Signalized Intersections**
_____	**Acceleration & Deceleration Lane Length **	_____	Design Speed

****NOTE:** To be included with Developer Projects and the Geometric Review during the Concept Development phase.)

Controlling substandard design elements have been identified at the following locations:

Controlling Substandard Design Elements		
Location Number	Location and Direction (Station and Milepost)	**CSDE**
1	Rt. U.S. 206 NB & SB MP 14.00 Sta. 13+00 to 16+00	**Substandard vertical curve**

Route U.S. 206

Contract No. 00000000

Stopping Sight Distance on Vertical Curves

Location Number	Location and Direction (Milepost/Station)	Type of Curve	A (%) Exist./Prop.	L (feet) Exist./Prop.	S (feet) Exist./Prop.	S (feet) Stand.	V(calc.) (mph) Exist./Prop.	Posted Speed/Design Speed (mph)
1	Rt. U.S. 206 M.P 14.00 NB & SB Sta. 13+00 to 16+00	Crest	4.5/4.5	300/300	389/389	495	47/47	50/55

Proposed Safety Measures

Route U.S. 206 will be resurfaced within the project limits to improve pavement skid resistance. Shoulders will be provided and the guide rail updated to current standards.

Crash Analysis

There were no indicator crashes for the three years analyzed.

Impacts

To provide the standard length of vertical curve would require raising the existing road profile. Raising the roadway profile would require extending the project an additional 1400 feet and increase the project construction by $500,000. An increase in the roadway profile would impact approximately one half acre of wetland and requires slope easements from forty residential properties and one business property. The additional slope easement required from the business property would eliminate all its parking spaces and require relocation of the access driveway in order to limit the maximum driveway gradient to 8%. It is estimated that the cost to acquire the business would be approximately $500,000. There are currently no other projects for the 5-year program for this location. Not meeting the length of vertical will not result in degrading the relative safety of the roadway.

Project Fact Sheet

A. Funding Source: FHWA / NJDOT

B. Type of Project: Bridge Replacement

C. Highway Classification: Rural Arterial

D. Project Limits: Route U.S 206 extends generally south-north from Red Lion Road (County Route 641) on the south to Main Street (County Route 642) on the north. The southern terminus of the project limits on U.S. 206 is station 10+00 and the northern terminus of the project is station 20+00.

E. Project Origin: The initially preferred alternative during feasibility assessment described the structural deficiency rating of the existing bridge to be less than 50. It also identified the substandard crest vertical curve and substandard shoulders on Route U.S. 206. This problem statement was justified and assigned to Capital Program Management to develop the final design.

F. Existing Conditions

- The approach roadway section consists of 12 ft. lane and 8 ft. shoulders in each direction. The roadway section across the bridge consists of a 15 ft. lane and no shoulders in each direction.
- The roadway section is tangent with a normal crown for the length of the project.
- There is substandard stopping sight distance on a 300 feet crest vertical curve beginning at station 13+00 and ending at 16+00.
- Wire rope guide rail exists on both sides of the approaches to the structure.

G. Proposed Improvements

- The existing bridge over Conrail will be replaced. 8 ft. shoulders will be provided on the new bridge.
- Route U.S. 206 within the project limits will be resurfaced.
- New guide rail and end treatments conforming to current standard will be constructed.
  New sidewalk will be constructed on the southbound side of Route U.S.206. The new sidewalk will tie into the existing sidewalk on the south side of the bridge at Station 10+00 and extend to the existing sidewalk at station 17+00 on the north side of the bridge.

H. Roadway Section: The proposed roadway section within the project limits will consist of a 12 ft. lane and an 8 ft. shoulder in each direct direction. The cross slope in the lane and shoulder will be 1.5% and 4% respectively.

I. ADT: Existing ADT is 12000 vpd (in 2003). Expected ADT for 2023 is 18000 vpd.

J. Posted Speed: The posted speed limit on Route U.S. 206 is 50mph.

K. Design Speed: The design speed for this project is 55 mph.

L. Approximate Cost of this Project: $1million

Sample letter sent by Manager, Bureau of Safety, Bicycle, and Pedestrian Programs to the Designer.

State of New Jersey

DEPARTMENT OF TRANSPORTATION
1035 Parkway Avenue
PO Box 600
Trenton, New Jersey 08625-0614

(Name) (Date)(Title)
(Firm) (Address)
(Town, State, Zip)

Re: Design Exception Crash Analysis Route U.S. 206
Southampton Township, Burlington County Dear ***(Name)***:

As requested in your letter of January 2, 2011, crash data was collected and analyzed for the subject location. Crash data used is for years 2008 through 2010. The following is a summary of this data.

Substandard Stopping Sight Distance on Vertical Curves - The indicator crashes for this CSDE are same direction crashes. For the three-year period analyzed, there were no indictor crashes.

If you have any questions, please call ***(Name)*** of this office at (609) 530-***(Phone)***. Very truly yours,

(Name)
Manager
Bureau of Safety, Bicycle, and Pedestrian Programs