GUIDELINES FOR THE PREPARATION OF DESIGN EXCEPTIONS

New Jersey Department of Transportation
Division of Roadway Design
Bureau of Roadway Design Standards

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THE PREPARATION OF

DESIGN EXCEPTIONS

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TABLE OF CONTENTS

1-3

Tables | Page

SECTION 1
Introduction

Due to the ever growing highway needs, the Department looks for the largest return for the money spent on safety improvements on its highway system. The highway designer strives to seek safety opportunities for the geometric features specific to each project and to access the cost effectiveness of applying highway geometric design standards. The criteria used for highway geometric design in New Jersey is governed by the NJDOT Roadway Design Manual, the NJDOT Bridges and Structures Design Manual and several AASHTO publications.

Federal regulations permit the approval of "a project design that does not conform to the minimum criteria only after due consideration is given to all project conditions such as maximum service and safety benefits for the dollar invested, compatibility with adjacent sections of roadway and the probable time before reconstruction of the section due to increased traffic demands or changed conditions" (1). Also, when these criteria produce extreme social, economic and environmental impacts, lesser values may be chosen. To help ensure that the right choice has been made, a reasonable process must be followed in Planning and Design. The end result is a design exception. The design exception is prepared to document the considerations given in the evaluation of the impacts and to the safety of the motoring public.

Over the years, the development of Certification Acceptance, the Preconstruction Engineering Management System (PEMS) and increased workload have heightened a need for a guide on preparing design exceptions. This guide will reduce engineering staff preparation and review manhours while assuring a very thorough and comprehensive document.

There is no fill-in-the-blank type format to writing design exceptions. Your only tools are your engineering judgement, your writing style, and the outline and guidance provided by this document.

REFERENCES

1. "Design Standards for Highways." Federal-Aid Highway Program Manual. Volume 6, Chapter 2, Section 1, Subsection 1, (23 CFR 625.3) August 1986, Revised September 1987.

SECTION 2
DESIGN EXCEPTION CRITERIA

2-01 GENERAL

When conditions warrant, a design exception may be granted for the permanent work of a completed project, when highway geometric design standards do not conform to NJDOT and/or AASHTO minimum design standards. This design exception is required in order to obtain State and/or Federal project approval. A design exception to the minimum standards may be approved when it can be documented that a lesser design value is the best practical alternative. The warrants for the selection of a lesser design value shall give consideration to social, economic and environmental impacts in concert with safe and overall efficient traffic operations.

2-02 DESIGN EXCEPTION APPROVAL

Federal approval of a design exception is required for substandard geometric elements on Federal Aid Funded Projects and/or Interstate Projects. However, resurfacing projects, bridge rehabilitation and/or replacement projects on the Interstate system that are funded with 100% State funds for both preliminary engineering and construction will not require FHWA review and approval if the following circumstances exist (1) :

1. Substandard features are upgraded to current standards or a design exception is justified and approved in accordance with this procedure.

   Existing substandard features that are retained should receive the approval of the Assistant Commissioner Design and Right of Way. A copy of this approval should be furnished to FHWA for their information.

2. The project is to be designed in accordance with approved design procedures including Traffic Control Plans. The general upgrading of safety appurtances should either be included in the project or provision made for such upgrading no later than the next construction season.

3. The project is to be constructed in accordance with the approved <u>NJDOT Standard Specifications for Road and Bridge Construction</u> and approved supplemental specifications.

New substandard features that are created on a 100% State funded project on the Interstate system as a result of the project or existing features that are made worse should be approved by the Assistant Commissioner and the FHWA since these degraded features will change the project "as built".

Approval of a design exception by the Assistant Commissioner Design and Right of Way is required for substandard geometric elements on 100% State Funded Projects and other non-Federal Aid Projects.

2-03 DESIGN WAIVER APPROVAL

Substandard geometric elements which are verified, reviewed and approved in the process which grants access approval to State highways shall be called "design waivers". This process includes minor access permits, major access permits and developer agreements (2). A conscious effort should be made to upgrade the substandard features to current standadrs.

Minor access permit design waivers shall be verified, reviewed and approved by the Regional Maintenance Office. Major access permit and developer agreement design waivers shall be verified, reviewed and approved by the Regional Design Office.

A design waiver shall become part of either the highway access permit application or the developer agreement. Therefore, when the access permit or developer agreement is approved, the design waiver will be approved.

The contents of a design waiver shall be the same as contained in Part II "Project Description" and Part III "Each Substandard Feature" of the body of a design exception, see Figure 5-5.

2-04 GEOMETRIC ELEMENTS

A design exception may be granted for projects which do not conform to minimum design standards where conditions warrant for the following geometric elements:

Roadway Elements:

- Lane and Shoulder Widths
- Bridge Widths
- Horizontal Alignment
- Vertical Alignment
- Grades
- Stopping Sight Distance
- Cross Slopes
- Superelevation
- Horizontal Clearance

Structural Elements:

- Structural Capacity
- Vertical Clearance

It should be noted that design exceptions should not be submitted for substandard cross slopes on roadways (excluding structures) since it is economically feasible to upgrade the cross slopes to current standards, see Chapter 8.

2-05 CONTROLLING CRITERIA

The controlling criteria for the geometric elements mentioned previously are contained in the following publications:

- NJDOT Roadway Design Manual (3)
- NJDOT 3R Standards (4) (5)
- NJDOT Bridges and Structures Design Manual (6)
- AASHTO publication A Policy on Design Standards Interstate System (7)
- AASHTO publication A Policy on Geometric Design of Highways and Streets (8)

Specific criteria for each of the geometric elements, along with its reference to AASHTO and the NJDOT Design Manuals, is presented in Tables 2-1, A through J for your information and use. It should be noted that the criteria in NJDOT Design Manuals is equal to or more stringent than AASHTO.

The following paragraphs explain which publications to use for the design of different highway types and/or projects. For your convenience, Chapter 2 is summarized in Table 2-2.

2-05.1 All Highways Except the Interstate System, Off System Projects and Transportation Trust Fund Resurfacing Projects

The controlling criteria for the roadway geometric elements on new construction, reconstruction, resurfacing, restoration and rehabilitation projects for all highways except the Interstate system and Off System Projects is contained in the NJDOT Roadway Design Manual (3).

In order to provide flexibility to the designer, the NJDOT 3R Standards may be used for resurfacing, restoration and rehabilitation (3R) projects and they may be used only when it is not possible to meet the Department's design standards for new alignment projects (4)(5).

3R Standards can be used on any 3R project on a land service highway or street, provided a formal report as outlined in the Department's 3R Standards has been prepared and approved. If Federal funding is involved, the Federal Highway Administration is to be advised when preliminary engineering is being requested that the 3R Standards are applicable for that project.

The controlling criteria for the structural elements for all highways except Off System Projects is contained in the NJDOT Bridges and Structures Design Manual (6).

The controlling criteria for the structural elements for Off System projects is contained in Section 2-05.3.

2-05.2 Interstate System Projects

For new construction and reconstruction projects on the Interstate system, the controlling criteria for roadway geometric elements is contained in the AASHTO publication A Policy on Design Standards Interstate System (7). For design criteria not listed in this publication, the AASHTO publication A Policy on Geometric Design of Highways and Streets shall apply (8).

The controlling criteria for structural geometric elements is contained in the NJDOT Bridges and Structures Design Manual (6).

The controlling criteria for horizontal alignment, vertical alignment and cross sectional elements, for resurfacing, restoration and rehabilitation projects on the Interstate system is the same as above,or may be the Interstate standards that were in effect at the time of the original construction. The engineer should make every effort to update the geometrics to current standards, unless doing so will result in unacceptable social, economic or environmental consequences. The decision to use past AASHTO standards shall be made prior to Phase 1 submission and recorded on the bottom center of the project Key Map. The record shall read:

> This project falls under the category of resurfacing, restoration or rehabilitation. The AASHTO standards that were in effect at the time of the original construction will apply. This section of highway was originally built under (Route, Section) using design standards as per the (Date) AASHTO publication entitled (Name of publication).

2-05.3 Off System Projects

For off system projects (Local Aid), the roadway geometric elements need only comply with AASHTO design standards, therefore, refer only to the AASHTO publication A Policy on Geometric Design of Highways and Streets when writing these design exceptions (8). Figure 2-1 has the recommended design criteria for Local Aid projects, off system bridges.

County or municipal construction projects funded under the following State Aid Programs are not required to follow the design exception process as contained in this manual unless the design phase (Preliminary Engineering) is being funded with federal aid:

- NJTTF - Federal Aid Urban System Substitution Program: County and Municipal Aid,
- NJTTF - Municipal Aid,
- 1979 Transportation Bond Issue Program,
- 1983 NJ Bridge Rehabilitation and Improvement Fund: State Aid to Counties and Municipalities (Local Non-Federal portion),

- 1989 NJ Bridge Rehabilitation and Improvement and Railroad Right of Way Preservation Bond Act (Local Aid portion),
- and any previous State Aid to county or municipality programs with remaining balances where the Department was not responsible for the development of the plans and the advertising and bidding of the construction contract.

2-05.4 100% State Funded Resurfacing Projects

A design exception will not be required except as indicated herein for a resurfacing project funded by a 100% State dedicated funding source, such as established by a site specific capital program line item or a betterment capital program line item (9). For a resurfacing project on the Interstate system, regardless of funding, see Section 2-02.

A resurfacing project funded by a 100% State dedicated funding source has the primary purpose of achieving the greatest overall benefit from the funding available. These resurfacing projects are intended to preserve the integrity of the existing state highway infrastructure by maintaining the structural capacity of the pavement, improving the riding quality of the pavement and upgrading the skid resistance of the pavement. The majority of the work to be accomplished on these projects will be between existing curb lines or outer edges of existing shoulders.

Due to the limited scope of these resurfacing projects it will generally not be possible to design a resurfacing project that will bring a roadway into complete compliance with the current Department design standards. A resurfacing project will typically address standards for pavement material type, minimum resurfacing thickness, pavement smoothness, and in some instances, lane width, cross slope and superelevation. Therefore, a design exception will not be necessary, except for the following:

1. Cross slopes that are less than 1.5%.
2. The conversion of a shoulder to a riding lane.

A resurfacing project shall require an accident analysis of the projects limits covering the latest three year period of record to confirm a reasonable operational performance and the absence of any adverse safety concerns. Should an operational or safety concern be identified that can not be addressed in the subject resurfacing project, the Project Manager shall prepare and submit a "Transportation Problem Statement" (Form TP-1) to the Manager, Bureau of Transportation Priorities for processing under current Department Policy and Procedure No. 4.1081, entitled "Initiation and Development of NJDOT Problem Studies, Proposals, and Projects.

A resurfacing project may contain the following items of work in the project scope:

- Pavement resurfacing
- Short sections of pavement repair, joint replacement and/or repair

- Milling
- Minor drainage improvements
- Minor channelization
- Berm regrading
- Curb replacement and new curb construction (control of access)
- Handicap ramps
- Signing
- Raised pavement marker replacement
- Bridge deck repairs (patching)
- Guiderail upgrading
- Waterproof membrane on bridge deck overlays
- Barrier curb repair
- Loop detector replacement
- Minor Signal Changes

REFERENCES

1. Kessler, John J. Jr., FHWA Division Administrator. "100% State Funded Interstate Resurfacing Projects." Letter to Charles F. Takacs, Director Division of Roadway Design. Trenton, January 30, 1991.

2. Guide to Highway Access Permits. NJDOT, Trenton, October 1, 1987.

3. New Jersey Department of Transportation Roadway Design Manual. NJDOT, Trenton, March 1987.

4. Afferton, Kenneth C., Chief Engineer, Design. "New Jersey Department of Transportation 3R Standards." NJDOT Interoffice Memorandum to W. Caddell et al. Trenton, July 26, 1984.

5. Afferton, Kenneth C. "New Jersey Department of Transportation 3R Standards." NJDOT Interoffice Memorandum to Dayton et al. Trenton, July 3, 1984.

6. New Jersey Department of Transportation Bridges and Structures Design Manual. NJDOT, Trenton, September 1988.

7. A Policy on Design Standards-Interstate System. American Association of State Highway and Transportation Officials, Washington, D.C., 1988.

8. A Policy on the Geometric Design of Highways and Streets. American Association of State Highway and Transportation Officials, Washington, D.C., 1984.

9. Afferton, Kenneth C., Assistant Commissioner Design and Right of Way. "Design Exception Policy for Resurfacing Projects Funded with 100% State Funds." NJDOT Interoffice Memorandum to Kjetsaa et al. Trenton, February 22, 1991.

FIGURE 2-1

MEMO ENTITLED DESIGN CRITERIA

LOCAL AID PROJECTS OFF SYSTEM BRIDGES

NEW JERSEY DEPARTMENT OF TRANSPORTATION

MEMORANDUM

TO: Jack Dunn
Assistant Chief Engineer
Traffic & Local Road Design

FROM: Robert A. Pege
Assistant Chief Engineer
Bridges & Structures, Design

SUBJECT: Design Criteria
Local Aid Projects
Off System Bridges

DATE: 7/17/87 **PHONE NO.:** 2-3300

In response to various comments on our March 11, 1987 memorandum by County Engineers and FHWA, the following revised design criteria is recommended for Local Aid Projects, off-system bridges.

1983 AASHTO Standard Specifications for Highway Bridges (with interims) except as modified below, are required as absolute minimum design specifications for off-system bridges with projected ADTT to 500. NJDOT Design Manual Bridges and Structures will be used for the remaining off-system and on-system bridges.

1. The following sections of the NJDOT Design Manual Bridges and Structures, which modify AASHTO shall be applicable:

Section 3 - Loads

3.7.2	Classes of Loading
3.7.3	Designation of Loading
3.7.4	Minimum Live Loading
3.24	Distribution of Loads & Design of Concrete Slabs
3.25	Distribution of Wheel Loads on Timber Flooring
3.29	Moments, Shears and Reactions

Section 9 - Prestressed Concrete

9.13.1	Design Theory and General Considerations
9.15	Allowable Stresses

FIGURE 2-1 CONT.

MEMO ENTITLED DESIGN CRITERIA

LOCAL AID PROJECTS OFF SYSTEM BRIDGES

Section 10 - Structural Steel

10.6	Deflection
10.14	Camber
10.23	Welding

2. Article 10.3.2.1 of AASHTO and the changes to this article made by NJDOT Design Manual shall be modified as follows.

   The number of cycles of maximum stress range to be considered in the design shall be Case II from Table 10.3.2A for all vehicular bridges regardless of type of road.

3. Design shall be made with reference to service loads and allowable stresses provided in Service Load Design (Working Stress Design).

4. Bridge geometry shall be in accordance with AASHTO or FHWA approved 3R Standards where applicable.

5. Only Phase II and Phase III submission shall be provided, instead of current NJDOT Phase submission policy and procedure.

6. Except for the article mentioned above, the use of NJDOT Design Manual for Bridges and Structures is at the option of the local authority.

7.* 1983 NJDOT Standard Specifications for Road and Bridge Construction shall be used in conjunction with current Supplementary Specifications requirements.

Original signed R.A.P.
Robert A. Pege

* Revision to Memo: Please refer to 1989 NJDOT Standard Specifications for Road and Bridge Construction.

1-15

TABLE 2-1A GEOMETRIC ELEMENTS: LANE AND SHOULDER WIDTHS

HWY. TYPE	AASHTO POLICY on GEOMETRIC DESIGN of HWYS. & STS. (GREEN BOOK: G.B.) CHAP.	PAGE	CRITERIA DESCRIPTION	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	N.J.D.O.T. ROADWAY DESIGN MANUAL (WHITE BOOK: W.B.) SAME AS AASHTO	PAGE	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	ADDITIONAL COMMENTS
LOCAL RURAL ROADS	5	464	LANE & SHOULDER WIDTHS	MIN.	TABLE 5-8	NA				LOCAL ROADS & STREETS NEED ONLY COMPLY WITH GREEN BOOK.
LOCAL URBAN STREETS	5	474	LANE WIDTHS	MAX./MIN.	TEXT	NA				
	5	475	PARKING LANE WIDTHS	MIN.	TEXT	NA				
RURAL COLLECTOR	6	514	LANE & SHOULDER WIDTHS	MIN.	TABLE 6-4	NO	5-3 TO 5-5 & 5-12	MIN.	TEXT & FIG. 5-C	DIFFERENCE IS IN GRADED SHOULDER.
URBAN COLLECTOR	6	523	WIDTH OF ROADWAY	MIN.	TEXT	YES	5-3 TO 5-5 5-12,5-13	MIN.	TEXT & FIG.5-C,5-D	
	6	523	PARKING LANES	MAX./MIN.	TEXT	NA				
RURAL ARTERIAL	7	538 & 539	LANE & SHOULDER WIDTHS	MIN.	TEXT & TABLE 7-2	NO	5-3 TO 5-5 5-12,5-13	MAX./MIN.	TEXT & FIG.5-C,5-D	DIFFERENCE IS IN USABLE SHOULDER.
DIVIDED ARTERIAL	7	548 & 549	LANE & SHOULDER WIDTHS	MIN.	TEXT	YES	5-3 5-4,5-5 5-13,5-14	MIN.	TEXT & FIG. 5-D & 5-E	
URBAN ARTERIAL	7	569 & 570	THRU LANE WIDTHS	MAX./MIN.	TEXT	YES	5-3	MAX./MIN.	TEXT	
	7	573 & 574	SHOULDER WIDTHS	MAX./MIN.	TEXT	YES	5-4	MAX./MIN.	TEXT	G.B. TEXT REFERS TO CHAP. 4 FOR SHLDR. WIDTHS (P.365).
	7	576 & 577	PARKING LANES	MAX./MIN.	TEXT	NA				
	7	571	MEDIAN LEFT TURN LANE	MAX./MIN.	TEXT	NO	6-24	MAX./MIN.	TEXT	
FREEWAYS	8	631 & 632	LANE & SHOULDER WIDTHS	MAX./MIN.	TEXT	NO	5-15 & 5-16	MAX./MIN.	FIG. 5-F & 5-G	G.B. & W.B. DIFFER IN LEFT SHLDR. CRITERIA
	8	636 & 706	MEDIAN WIDTH	MIN.	TEXT	NO	5-15	MAX./MIN.	FIG. 5-F	
	10	994 & 995	AUXILIARY LANE WIDTH & SHOULDER TREATMENT	MAX./MIN.	TEXT	NO	5-4	MAX./MIN.	TEXT	W.B. AS A MIN. DOES NOT REQUIRE A SHOULDER NEXT TO AN AUXILIARY LANE.

1-15

TABLE 2-1B	GEOMETRIC ELEMENTS:					BRIDGE WIDTHS & STRUCTURAL CAPACITY				
	AASHTO POLICY on GEOMETRIC DESIGN of HWYS. & STS. (GREEN BOOK: G.B.)					N.J.D.O.T. ROADWAY DESIGN MANUAL (WHITE BOOK: W.B.)				
HWY. TYPE	CHAP.	PAGE	CRITERIA DESCRIPTION	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	SAME AS AASHTO	PAGE	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	ADDITIONAL COMMENTS
LOCAL RURAL ROADS & LOCAL URBAN STREETS	5	465 & 481	MIN. CLEAR RDWY. WIDTHS & DESIGN LOADINGS FOR NEW & RECONSTRUCTED BRIDGES	MIN.	TABLE 5-9 & TEXT	* NO	5-24 & 5-25	MIN.	FIG. 5-O & 5-P	FOR OFF SYSTEM BRIDGES SEE FIG. 2-1 OF THIS PROCEDURAL MANUAL
LOCAL RURAL ROADS	5	466	MIN. STRUC. CAPACITIES & MIN. RDWY. WIDTHS FOR BRIDGES TO REMAIN IN PLACE	MIN.	TABLE 5-10	* NO	5-24 & 5-25	MIN.	FIG. 5-O & 5-P	FOR OFF SYSTEM BRIDGES SEE FIG. 2-1 OF THIS PROCEDURAL MANUAL
RURAL & URBAN COLLECTORS	6	516	MINIMUM STRUCTURAL CAPACITIES AND MINIMUM ROADWAY WIDTHS FOR BRIDGES TO REMAIN IN PLACE	MIN.	TABLE 6-6	* NO	5-23 THRU 5-24	MIN.	FIG. 5-N & 5-O	* GENERAL NOTE: 1.WHITE BOOK DOES NOT INCLUDE STRUCTURAL CAPACITY, SEE NJDOT BRIDGES & STRUCTURES DESIGN MANUAL, SEC. 3. 2.FOR BRIDGE WIDTHS ALSO SEE PG. 5-11 IN WHITE BOOK.
	6	515	MIN. STRUCT. CAP. & MIN. ROADWAY WIDTHS FOR NEW AND RECONSTR. BRIDGES	MIN	TABLE 6-5	* NO	5-20 THRU 5-24	MIN.	FIG. 5-K, 5-L,5-M 5-N & 5-O	
RURAL ARTERIAL	7	537	WIDTH OF STRUCT. & STRUCT. CAPACITY	MIN.	TEXT	* NO	5-23 & 5-24	MIN.	FIG. 5-N & 5-O	GREEN BOOK ALSO REFERS TO CHAP. 10, PGS. 919-925
URBAN ARTERIAL	7	577	WIDTH OF NEW BRIDGES	MIN.	TEXT	* YES	5-23 & 5-24	MIN.	FIG. 5-N & 5-O	
FREEWAY	8	633	WIDTH OF STRUCT. & STRUCT. CAPACITY	MIN.	TEXT	* YES	5-20 & 5-21	MIN.	FIG. 5-K & 5-L	GREEN BOOK ALSO REFERS TO CHAP. 10, PGS. 919-925

Note: The minimum bridge design live load is HS20-44+10%. There will be no exceptions to this minimum live load design criteria.

1-16

TABLE 2-1C GEOMETRIC ELEMENT: * HORIZONTAL ALIGNMENT

HWY. TYPE	AASHTO POLICY on GEOMETRIC DESIGN of HWYS. & STS. (GREEN BOOK: G.B.) CHAP.	PAGE	CRITERIA DESCRIPTION	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	N.J.D.O.T. ROADWAY DESIGN MANUAL (WHITE BOOK: W.B.) SAME AS AASHTO	PAGE	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	ADDITIONAL COMMENTS
ALL	3	249	CURVE LENGTH & CENTRAL ANGLE	MIN.	TEXT	YES	4-15	MIN.	TEXT	MIN. LENGTH IN G.B. BASED ON CENTRAL ANGLE, NOT VELOCITY
ALL	3	250	TANGENT DIST. BETWEEN REVERSE CURVES	MIN.	TEXT	NO	4-16	MIN.	TABLE 4-3	DISTANCES ARE DIFFERENT SINCE METHODS OF DERIVING SUPER. TRANS. LENGTHS ARE DIFFERENT
ALL	3	250	TANGENT DIST. BETWEEN BROKEN BACK CURVES		TEXT	YES	4-16	MIN.	TABLE 4-4	W.B. & G.B. AGREE THAT BROKEN BACK CURVES SHOULD NOT BE USED.
ALL	3	220	MIN. RADII FOR INTERSECTION CURVES	MIN.	TABLE 3-16	NO	6-8,6-12, 6-15,6-17 6-18,6-19	MIN.	TEXT FIG. 6J,6L 6M, 6N, 6O	
ALL	3	224	LENGTHS OF CIRC. ARC FOR A COMPOUND INTER. CURVE WHEN FOLLOWED BY A CURVE AFTER OR PRECEDED BY A CURVE OF DOUBLE RADIUS	MIN.	TABLE 3-18	NO	7-12	MIN.	FIG. 7-G	
TURNING ROADWAYS	3	232	DESIGN WIDTHS OF PAVEMENT FOR TURNING ROADWAYS	MIN.	TABLE 3-20	NO	6-15 & 7-6	MIN.	FIG. 6-L & 7-B	TURNING ROADWAYS ARE RAMPS OR CONNECTIONS AT INTERSECTIONS.

* Note: These are general controls for horizontal alignment, therefore, when these controls are not meet, a design exception is not required.

1-17

TABLE 2-1D GEOMETRIC ELEMENT: VERTICAL ALIGNMENT

	AASHTO POLICY on GEOMETRIC DESIGN of HWYS. & STS. (GREEN BOOK: G.B.)					N.J.D.O.T. ROADWAY DESIGN MANUAL (WHITE BOOK: W.B.)				
HWY. TYPE	CHAP.	PAGE	CRITERIA DESCRIPTION	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	SAME AS AASHTO	PAGE	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	ADDITIONAL COMMENTS
ALL	3	307 OR 308	DESIGN CONTROLS FOR CREST VERT. CURVES, OPEN ROAD CONDITIONS	MIN	TABLE 3-32 OR FIG.3-39	NO	4-19	MIN	FIG. 4-I	GENERAL NOTES: 1. WHITE BOOK IS MORE CONSERVATIVE. 2. THE MIN. LENGTH OF VERT. CURVES SHOULD NOT BE LESS THAN 3V. (W.B. P.4-18, G.B. P.309) 3. ALL LOCAL ROADS AND STREETS NEED ONLY COMPLY WITH GREEN BOOK.
ALL	3	314 OR 316	DESIGN CONTROLS FOR SAG VERT. CURVES, OPEN ROAD CONDITIONS	MIN.	TABLE 3-34 OR FIG.3-40	NO	4-20	MIN.	FIG. 4-J	

1-18

1-18

TABLE 2-1E GEOMETRIC ELEMENT: GRADES

HWY. TYPE	AASHTO POLICY on GEOMETRIC DESIGN of HWYS. & STS. (GREEN BOOK: G.B.)					N.J.D.O.T. ROADWAY DESIGN MANUAL (WHITE BOOK: W.B.)				ADDITIONAL COMMENTS
	CHAP.	PAGE	CRITERIA DESCRIPTION	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	SAME AS AASHTO	PAGE	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	
LOCAL RURAL ROADS	5	461	MAXIMUM GRADES	MAX.	TABLE 5-4	NA				LOCAL ROADS AND STREETS NEED ONLY COMPLY WITH GREEN BOOK.
LOCAL URBAN STREETS	5	473	MAX. & MIN. GRADES	MAX./MIN.	TEXT	NA				
COLLECTORS	6	512	MAXIMUM GRADES	MAX.	TABLE 6-3	YES	2-10 & 2-11	MAX.	TABLE 2-2 & 2-3	WHITE BOOK GRADES ARE FOR GENERAL CONDITIONS. CONSULT GREEN BOOK FOR SPECIFIC CONDITIONS.
RURAL ARTERIALS	7	536	RELATION OF MAX. GRADES TO DESIGN SPEED	MAX.	TABLE 7-1	YES	2-11	MAX.	TABLE 2-3	
URBAN ARTERIALS	7	568	MAXIMUM GRADES FOR URBAN ARTERIALS	MAX.	TABLE 7-4	YES	2-11	MAX.	TABLE 2-3	
FREEWAYS	8	633	MAXIMUM GRADES FOR URBAN AND RURAL FREEWAYS	MAX.	TABLE 8-1	YES	2-12	MAX.	TABLE 2-4	
ALL	3	259	MINIMUM GRADES	MIN.	TEXT	NO	4-18	MIN.	TEXT	

Superseded

1-19

TABLE 2-1F			GEOMETRIC ELEMENT:							STOPPING SIGHT DISTANCE
	AASHTO POLICY on GEOMETRIC DESIGN of HWYS. & STS. (GREEN BOOK: G.B.)					N.J.D.O.T. ROADWAY DESIGN MANUAL (WHITE BOOK: W.B.)				
HWY. TYPE	CHAP.	PAGE	CRITERIA DESCRIPTION	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	SAME AS AASHTO	PAGE	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	ADDITIONAL COMMENTS
LOCAL RURAL ROAD	5	468	CORNER SIGHT DISTANCE AT RURAL INTERSECTIONS	MIN.	TABLE 5-11	NA				LOCAL ROADS AND STREETS NEED ONLY COMPLY WITH GREENBOOK.
ALL	3 OR 6	138 OR 510	MINUMUM STOPPING SIGHT DISTANCE	MIN./DES.	TABLE 3-1 OR 6-2A	NO	4-2	MIN./MAX.	TABLE 4-1	GREEN BOOK MIN. VALUES ARE LESS, FROM 60 M.P.H. DESIGN SPEED AND UP.
* ALL	3	144	EFFECT OF GRADE ON STOPPING SIGHT DIST.-WET CONDITIONS	MIN.	TABLE 3-2	NA				% INCREASE FOR DOWNGRADE % DECREASE FOR UPGRADES.
ALL	3	244	MIN. STOPPING SIGHT DISTANCE ON HORZ. CURVES	MIN.	FIG. 3-25A	NO	4-4	MIN.	FIG. 4-A	WHITE BOOK IS MORE CONSERVATIVE FROM 60 M.P.H. DESIGN SPEED & UP.

* Note: This is a desirable treatment for use for design for truck operation, therefore, when this treatment is not meet, a design exception is not required. Every effort should be made to provide stopping sight distance greater than the minimum design value when horizontal sight restrictions occur on downgrades, particularly at the ends of long downgrades.

1-20

TABLE 2-1G GEOMETRIC ELEMENT: CROSS SLOPES

	AASHTO POLICY on GEOMETRIC DESIGN of HWYS. & STS. (GREEN BOOK: G.B.)					N.J.D.O.T. ROADWAY DESIGN MANUAL (WHITE BOOK: W.B.)				
HWY. TYPE	CHAP.	PAGE	CRITERIA DESCRIPTION	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	SAME AS AASHTO	PAGE	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	ADDITIONAL COMMENTS
LOCAL RURAL ROADS	5	461	CROSS SLOPES	MAX./MIN.	TABLE 5-5	NA				ALL LOCAL ROADS AND STREETS NEED ONLY COMPLY WITH GREEN BOOK.
LOCAL URBAN STREETS	4	473	PAVEMENT CROWN	MAX./MIN.	TEXT	NA				
RURAL COLLECTOR	6	511	PAVEMENT CROWN	MAX./MIN.	TEXT	YES	5-1,5-12 & 5-13	MAX./MIN.	TEXT & FIG. 5-C & 5-D	
URBAN COLLECTOR	6	521	PAVEMENT CROWN	MAX./MIN.	TEXT	YES	5-1,5-12 & 5-13	MAX./MIN.	TEXT & FIG. 5-C & 5-D	
RURAL ARTERIAL	7	537	PAVEMENT CROWN	MAX./MIN.	TEXT	YES	5-1,5-12 & 5-13	MAX./MIN.	TEXT & FIG. 5-C & 5-D	
DIVIDED ARTERIAL	7	548-549	CROSS SLOPE	MAX./MIN.	TEXT	YES	5-1,5-13 & 5-14	MAX./MIN.	TEXT & FIG. 5-D & 5-E	
URBAN ARTERIAL	7	568-569	CROSS SLOPE & PAVEMENT CROWN	MAX./MIN.	TEXT	YES	5-1,5-12 & 5-13	MAX./MIN.	TEXT & FIG. 5-C & 5-D	
FREEWAYS	8	631	PAVEMENT & SHOULDERS	MAX./MIN.	TEXT	YES	5-1,5-5, 5-15,5-16	MAX./MIN.	TEXT & FIG. 5-F & 5-G	G.B. & W.B. DIFFER IN SHOULDER CROSS SLOPE.
ALL (HIGH TYPE PAVEMENTS)	4 7 7	357 537 568	% INCR. IN CROSS SLOPE FOR ADJACENT LANES	MAX.	TEXT	YES	5-1	MAX.	TEXT	THE CROSS SLOPE IS USUALLY INCREASED BY 0.5% ON EACH SUCCESSIVE LANE BUT IT MAY BE INCR. ON EACH SUCCESSIVE PAIR OF LANES IN SOME CASES.
ALL (HIGH TYPE PAVEMENTS)	4	367 & 390	ALG. DIFF. IN PAV'T. & SHLDR. GRADES ON A SUPER. SECT. (ROLLOVER)	MAX.	TEXT & FIG. 4-3	YES	5-5	MAX.	TEXT	SEE ALL DESIGN UNIT MEMO DATED JULY 19, 1990.

1-21

1-21

TABLE 2-1H GEOMETRIC ELEMENT: SUPERELEVATION

HWY. TYPE	AASHTO POLICY on GEOMETRIC DESIGN of HWYS. & STS. (GREEN BOOK: G.B.)					N.J.D.O.T. ROADWAY DESIGN MANUAL (WHITE BOOK: W.B.)				ADDITIONAL COMMENTS
	CHAP.	PAGE	CRITERIA DESCRIPTION	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	SAME AS AASHTO	PAGE	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	
LOCAL URBAN STREETS	5	474	SUPERELEVATION RATES	MIN.	TEXT & REF. TO TABLE	NA				* ALL LOCAL ROADS AND STREETS NEED ONLY COMPLY WITH GREEN BOOK.
	5	473	MIN. RADIUS FOR CROWNED AND SUPER. SECTIONS	MIN.	TEXT	NA				
	5	463	SUPERELEVATION RUN-OFF	MIN.	TABLE 5-7	NA				
LOW-SPEED URBAN STREETS	3	214	DESIGN SUPER. RATES	MIN.	FIG. 3-18	* NO	4-7	MIN.	FIG. 4-C	W.B. USES SAME VALUES AS FOR RURAL HWYS. & HIGH-SPEED URBAN STS. THEREFORE W.B. VALUES ARE GREATER THAN G.B.
	3	215	MIN. RADIUS ON LOW-SPEED URBAN STREETS	MIN.	TABLE 3-15	* NO	4-9	MIN.	TABLE 4-2	
	3	215	LENGTH REQUIRED FOR SUPERELEVATION RUN-OFF	MAX.	TABLE 3-15	* NO	4-8	MIN.	TEXT	METHODS USED TO DERIVE TRANS LENGTH ARE DIFFERENT (W.B. IS SIMPLEST).
RURAL HWYS. & HIGH-SPEED URBAN STS.	3	188-189	DESIGN SUPER. RATES	MIN.	TABLE 3-8 & 3-9	YES	4-6 & 4-7	MIN.	FIG. 4-B & 4-C	
	3	177	MINIMUM RADIUS FOR RURAL HWYS. & HIGH-SPEED URBAN STS.	MIN.	TABLE 3-6	YES	4-9	MIN.	TABLE 4-2	W.B. ONLY SHOWS ROUNDED VALUES BASED ON 6% MAX. SUPER.
	3	188,189 200,201	LENGTH REQUIRED FOR SUPERELEVATION RUN-OFF	MIN.	TABLE 3-8, 3-9,3-14 & TEXT	NO	4-8	MIN.	TEXT	METHODS USED TO DERIVE TRANS. LENGTH ARE DIFFERENT (W.B. IS SIMPLEST).

1-23

TABLE 2-1I			GEOMETRIC ELEMENT:							HORIZONTAL CLEARANCE
	AASHTO POLICY on GEOMETRIC DESIGN of HWYS. & STS. (GREEN BOOK: G.B.)					N.J.D.O.T. ROADWAY DESIGN MANUAL (WHITE BOOK: W.B.)				
HWY. TYPE	CHAP.	PAGE	CRITERIA DESCRIPTION	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	SAME AS AASHTO	PAGE	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	ADDITIONAL COMMENTS
LOCAL RURAL ROADS	5	467	HORZ. CLEARANCE TO OBSTRUCTIONS	MIN.	TEXT	NA				LOCAL ROADS & STREETS NEED ONLY COMPLY WITH GREEN BOOK.
LOCAL URBAN STREETS	5	481	HORZ. CLEARANCE TO OBSTRUCTIONS	MIN.	TEXT	NA				
RURAL COLLECTOR	6	516	HORZ. CLEARANCE TO OBSTRUCTIONS	MIN.	TEXT	NO	•	•	•	• GENERAL NOTES: 1. FOR HORZ. CLEARANCES IN WHITE BK., SEE "CLEAR ZONE", P. 8-6 & 8-7 FIG. 8A & 8B. 2. FOR HORZ. CLEARANCE TO UTILITIES, SEE THE UTILITY ACCOMMEDATION POLICY. 3. URBAN STREETS WHICH ARE CURBED WITH NO SHOULDERS SHOULD HAVE A MINIMUM CLEARANCE OF 1.5' BEYOND THE FACE OF CURB TO OBSTRUCTION.
URBAN COLLECTOR	6	527	HORZ. CLEARANCE TO OBSTRUCTIONS	MIN.	TEXT	NO	•	•	•	
RURAL & URBAN ARTERIALS	7	539 & 577-578	HORZ. CLEARANCE TO OBSTRUCTIONS	MIN.	TEXT	YES	•	•	•	
FREEWAYS	8	634	HORZ. CLEARANCE TO OBSTRUCTIONS	MIN.	TEXT	NO	•	•	•	

1-23

TABLE 2-1J GEOMETRIC ELEMENT: VERTICAL CLEARANCE

HWY. TYPE	AASHTO POLICY on GEOMETRIC DESIGN of HWYS. & STS. (GREEN BOOK: G.B.)					N.J.D.O.T. ROADWAY DESIGN MANUAL (WHITE BOOK: W.B.)				ADDITIONAL COMMENTS
	CHAP.	PAGE	CRITERIA DESCRIPTION	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	SAME AS AASHTO	PAGE	MIN. or MAX. VALUE	TABLE, FIGURE or TEXT	
LOCAL RURAL ROADS	5	465	VERTICAL CLEARANCE	MIN.	TEXT	NA				REFER TO BRIDGE DESIGN MANUAL PGS. 1.3-2 & 1.3-3 FOR VERT. CLEARANCE AND FIG. 2-1 OF THIS PROCEDURAL MANUAL.
LOCAL URBAN STREETS	5	482	VERTICAL CLEARANCE	MIN.	TEXT	NA				
URBAN & RURAL COLLECTORS	6	516 & 526	VERTICAL CLEARANCE	MIN.	TEXT	NA				REFER TO BRIDGE DESIGN MANUAL PGS. 1.3-2 & 1.3-3 FOR VERT. CLEARANCE.
URBAN & RURAL ARTERIALS	7	537 & 569	VERTICAL CLEARANCE	MIN.	TEXT	NA				SEE ABOVE.
FREEWAYS	8	634	VERTICAL CLEARANCE	MIN.	TEXT	NA				SEE ABOVE.

TABLE 2-2
CHAPTER 2 SUMMARY

	DESIGN EXCEPTION CRITERIA	
GEOMETRIC ELEMENTS COVERED:	ROADWAY ELEMENTS: – Lane & Shoulder Widths – Bridge Widths – Horizontal Alignment – Vertical Alignment – Grades – Stopping Sight Distance – Cross Slopes – Superelevation – Horizontal Clearance STRUCTURAL ELEMENTS: – Structural Capacity – Vertical Clearance	
APPROVAL NEEDED:	FEDERAL APPROVAL	STATE APPROVAL
PROJECT TYPE:	– Fed. Aid Funded Projects – Interstate Projects	– 100% State Funded Projects – Other non–Fed. Aid Projects
CRITERIA FOR NEW CONST., RECONST., RESURF., RESTORE. & REHAB. PROJ. FOR ALL HIGHWAYS EXCEPT THE INTERSTATE SYSTEM & OFF SYSTEM PROJECTS CONTAINED IN:	ROADWAY ELEMENTS: – NJDOT Rdwy. Des. Manual – NJDOT 3R Standards	ROADWAY ELEMENTS: – NJDOT Rdwy. Des. Manual – NJDOT 3R Standards
CRITERIA FOR NEW CONST. & RECONST. PROJ. ON THE INTERSTATE SYSTEM CONTAINED IN:	ROADWAY ELEMENTS: – AASHTO Pub.: A Policy on Design Standards Interstate System – Greenbook	Not Applicable
CRITERIA FOR RESURF., RESTORE. & REHAB. PROJ. ON THE INTERSTATE SYSTEM CONTAINED IN:	– Same as above or may be the interstate standards in effect at the time of the original construction	– 100% State Funded Interstete Projects – See Section 2–02
CRITERIA FOR OFF SYSTEM PROJECTS CONTAINED IN:	ROADWAY ELEMENTS: – Greenbook STRUCTURAL ELEMENTS: – See Figure 2–1	ROADWAY ELEMENTS: – Greenbook STRUCTURAL ELEMENTS: – See Figure 2–1
CRITERIA FOR ON SYSTEM BRIDGES FOR STRUCTURAL CAPACITY & VERTICAL CLEARANCE CONTAINED IN:	– NJDOT Brdg. & Struc. Design Manual	– NJDOT Brdg. & Struc. Design Manual
CRITERIA FOR 100% STATE FUNDED RESURF. PROJ. CONTAINED IN:	Not Applicable	– See Section 2–04.4

Greenbook: AASHTO publication, A Policy on the Geometric Design of Highways & Streets.

SECTION 3
PEMS NETWORK REQUIREMENTS FOR DESIGN EXCEPTIONS

3-01 GENERAL

The design exception network requirements and the work tasks involved are shown in the Preconstruction Engineering Management System Manual, Volume IV, as Activity Numbers 3790, 3880 and 4115 (1). Network requirements define when and by whom a design exception is identified and prepared during the life of a project prior to construction.

Activity number 3790 occurs during the Planning Stage while Activity numbers 3880 and 4115 occur during the Design Stage.

3-02 PLANNING STAGE

New construction and reconstruction projects will go through the Planning Stage prior to entering the Design Stage.

In the Planning Stage, the Preliminary Engineering unit is responsible for identifying Study Plans Design Exceptions (Activity Number 3790). Major horizontal and vertical geometric criteria shall be reviewed for conformance with minimum design standards. Major geometric criteria are those features that affect the viability and feasibility of the preferred alternative. Once the preferred alternative has been selected, the Preliminary Engineering unit shall determine the feasibility of upgrading any substandard major geometric features. Any substandard major geometric features, that are included in the project scope, shall be reviewed by the Bureau of Roadway Design Standards to determine if a design exception is warranted.

During the Design Stage, the project will be reviewed for full compliance with minimum design standards. All design exceptions will be prepared in the Design Stage.

3-03 DESIGN STAGE

New construction and reconstruction projects will go through the Planning Stage prior to entering the Design Stage. Projects that are Categorical Exclusions, minor widening, resurfacing, minor bridge repair, intersection improvements or Special Projects will bypass most of the Planning Stage prior to entering the Design Stage.

The first activity in the Design Stage is Activity Number 3880, "Prepare Project Report", which is the responsibility of the Lead Design Unit. Off-system (Local Aid) projects are exempt from this activity since the project scope is done by outside agencies. Any design exception, that is identified in the Planning Stage, will be noted in the Project Report. Also, based on the geometric data available during this activity and regardless of whether the project went through a Planning Stage, any additional proposed substandard geometric elements shall be identified in the Project Report.

In Activity Number 4115, which begins after the Phase 1 plans are approved, the project will be reviewed by the Lead Design Unit for full compliance with minimum design standards. Upon completion of the review, a Design Exception Draft will then be prepared by or under the direction of the Lead Design Unit.

The Regional Design Office Project Lead, the Bridge Project Lead and the Office of Special Projects Lead shall submit the Design Exception Draft to the Bureau of Roadway Design Standards for review during Phase 2. The Traffic Engineering and Local Aid Project Lead shall submit the Design Exception Draft to the Bureau of Local Highway Design for review during Phase 2. A status report on the design exception shall be a part of the Phase 2 submission.

The Final Design Exception shall be approved prior to approval of the Phase 2 plans and the advancement of design to Phase 3.

REFERENCES

1. "Network and Activity Descriptions." Preconstruction Engineering Management System Manual. Vol. IV, New Jersey Department of Transportation, Roy Jorgensen Associates, Inc., Trenton, November 1989.

SECTION 4
DESIGN EXCEPTION ROUTING

In general, design exceptions are prepared under the direction of the Lead Design Unit for projects in the Design Stage. The Design Exception Draft is submitted to the Bureau of Roadway Design Standards or the Bureau of Local Highway Design for review. After this review, the draft is returned, with comments, to the appropriate Unit, with instructions to either submit a revised draft for their review, or revise the date on the request and submit as a Final Design Exception.

The final design exception submission shall contain a transmittal memorandum, a routing memorandum and five copies of the final design exception. Do not include transmittal memorandum and routing memorandum with the draft submission.

The transmittal memorandum shall be from the appropriate Director or Manager recommending the design exception to the Assistant Commissioner Design and Right of Way. This memorandum shall contain the following items:

- A list of the substandard features contained in the final design exception.
- The total cost of the project including the substandard features.
- The total cost involved to upgrade the substandard features to minimum design standards.
- The impact to the project schedule if the project was designed to minimum standards, that is, the ensuing advertising date and construction contract completion date.
- Address whether funds have been established or are available to upgrade the substandard features to minimum design standards.

The routing sequence and routing memorandum format for the processing of final design exceptions shall be as indicated below:

1. Federal-Aid Funded projects and/or Interstate Projects with a Design Exception from a Regional Design Office Lead or a Bridge Project Lead, the design exception shall be requested by letter to the FHWA Administrator under signature of the Assistant Commissioner Design and Right of Way. This request shall be accompanied by a separate routing memorandum from the appropriate initiating unit to confirm by signature the recommendation of the appropriate Director, review by the Manager, Bureau of Roadway Design Standards, and concurrence by the Director, Division of Roadway Design.

2. Federal-Aid Funded projects and/or Interstate projects with a Design Exception from a Local Aid Project Lead, the design exception shall be requested by letter to the FHWA Administrator under signature of the Assistant Commissioner Design and Right of Way. This request shall be accompanied by a separate routing memorandum from the Manager, Local Aid District Office to confirm by signature the recommendation of the Manager, Bureau of Local Aid District Operations, review by the Manager, Bureau of Local Highway Design, and concurrence by the Director, Division of Traffic Engineering and Local Aid.

3. 100% State and other non Federal-Aid projects with a Design Exception from a Regional Design Office Lead or a Bridge Project Lead., the design exception shall be submitted by memorandum under the signature of the appropriate initiating unit for approval by the Assistant Commissioner Design and Right of Way. The design exception request shall be accompanied by a separate routing memorandum from the appropriate initiating unit to confirm by signature the recommendation of the appropriate Director, review by the Manager, Bureau of Roadway Design Standards and concurrence by the Director, Division of Roadway Design.

4. 100% State and other non Federal-Aid projects with a Design Exception from a Traffic Engineering and Local Aid Project Lead, the design exception shall be submitted by memorandum under the signature of the Manager, Local Aid District Office for approval by the Assistant Commissioner Design and Right of Way. The design exception request shall be accompanied by a separate routing memorandum from the Manager, Local Aid District Office to confirm by signature the recommendation of the Manager, Bureau of Local Aid District Operations, review by the Manager, Bureau of Local Highway Design, and concurrence by the Director, Division of Traffic Engineering and Local Aid.

Note 1: This section shall supercede Mr. Dayton's memorandum concerning Design Exception Processing, dated 9-30-88 (1).

Note 2: For those design exceptions that will be initiated by the Office of Special Projects in the Division of Roadway Design, the Chief, Bureau of Roadway Engineering Services will provide the recommendation with concurrence by the Director, Division of Roadway Design.

Note 3: For those design exceptions that involve vertical clearance, a separate memorandum of concurrence from the Director, Division of Bridge Design will be required.

Note 4: All design exceptions for interstate projects, regardless of funding, shall follow the letter format, routing sequence and routing memorandum format for Federal Aid Funded projects.

Sample routing memorandums, for your reference and use, are shown in Figures 4-1 through 4-4. If the design exception was prepared by a consulting firm, include this statement after the first sentence of the routing memorandum: This design exception was prepared by (consulting firm's name).

When submitting the final design exceptions for signatures, five copies are required: FHWA receives the original plus one copy, and each person named on the routing memorandum receives one copy, except for the Director, Division of Roadway Design.

The final design exception submission shall not be dated. The Assistant Commissioner Design and Right of Way will date the final design exception.

Once FHWA receives the final design exception, any additional information that they require (exception: unless the design exception document is altered) shall be submitted directly to them through the Federal Aid Coordinator with a copy to the routing personnel.

The practice of the local FHWA Office pertaining to design exceptions for substandard vertical clearance for projects on the Interstate National Priority System is to forward these design exceptions to Washington D.C. for review. Allow sufficient time in the project schedule (normally an additional four weeks) for the Washington review.

REFERENCES

1. Dayton, Edwin W., Director Division of Roadway Design. "Design Exceptions Processing of Federal, State and Other Funded Projects Involving Roadway Design Standards." NJDOT Interoffice Memorandum to C. Ellis et al. Trenton, September 1988.

FIGURE 4-1

ROUTING MEMORANDUM FOR REGIONAL DESIGN OFFICE PROJECT LEAD

NEW JERSEY DEPARTMENT OF TRANSPORTATION
MEMORANDUM

TO Kenneth C. Afferton
Asst. Comr. Design and
Right-of-Way

FROM
Regional Design Engineer

SUBJECT DESIGN EXCEPTION DATE TEL. NO.
Route Section
County
Milepost Limits
DOT Job No.

Forwarded for your approval is a design exception request for the above captioned project.

Submitted: ______________________
Regional Design Engineer Date

Recommended: ______________________
Director, Division of Regional Design Date
(Chief Engineer of Regional Design)

Reviewed: ______________________
Manager, Bur. of Roadway Design Standards Date

Concurrence: ______________________
Director, Division of Roadway Design Date
(Chief Engineer of Roadway Design)

FIGURE 4-2

ROUTING MEMORANDUM FOR OFFICE OF SPECIAL PROJECTS

NEW JERSEY DEPARTMENT OF TRANSPORTATION
MEMORANDUM

TO Kenneth C. Afferton
Asst. Comr. Design and
Right-of-Way

FROM Supervising Engineer
Office of Special Projects

SUBJECT DESIGN EXCEPTION DATE______ TEL. NO.______
Route Section
County
Milepost Limits
DOT Job No.

Forwarded for your approval is a design exception request for the above captioned project.

Submitted: ______________________________
Supervising Eng.,Office of Special Projects Date

Recommended: ______________________________
Manager, Bur. of Rdwy. Engineering Services Date

Reviewed: ______________________________
Manager, Bur. of Roadway Design Standards Date

Concurrence: ______________________________
Director, Division of Roadway Design Date
(Chief Engineer of Roadway Design)

FIGURE 4-3

ROUTING MEMORANDUM FOR BRIDGE PROJECT LEAD

NEW JERSEY DEPARTMENT OF TRANSPORTATION
MEMORANDUM

TO Kenneth C. Afferton
Asst. Comr. Design and
Right-of-Way

FROM Manager, Bur. of Struc.
Design or Manager, Bur. of
Structural Project Management

SUBJECT DESIGN EXCEPTION DATE________ TEL. NO.________
Route Section
County
Milepost Limits
DOT Job No.

Forwarded for your approval is a design exception request for the above captioned project.

Submitted: ____
Manager, Bureau of Structural Design or Manager, Bur. of Struc. Project Management — Date

Recommended: ____
Director, Division of Bridge Design (Chief Engineer of Bridge Design) — Date

Reviewed: ____
Manager, Bur. of Roadway Design Standards — Date

Concurrence: ____
Director, Division of Roadway Design (Chief Engineer of Roadway Design) — Date

FIGURE 4-4

ROUTING MEMORANDUM FOR LOCAL AID PROJECT LEAD

NEW JERSEY DEPARTMENT OF TRANSPORTATION
MEMORANDUM

TO Kenneth C. Afferton
Asst. Comr. Design and
Right-of-Way

FROM Manager,
Local Aid District
Office

SUBJECT DESIGN EXCEPTION DATE________ TEL. NO.________
Route Section
County
Milepost Limits
DOT Job No.

Forwarded for your approval is a design exception request for the above captioned project.

Submitted: ________________________________
Manager, Local Aid District Office Date

Recommended: ________________________________
Manager, Bur. of Local Aid District Oper. Date

Reviewed: ________________________________
Manager, Bur. of Local Highway Design Date

Concurrence: ________________________________
Director, Div. of Traffic Eng. & Local Aid Date
(Chief Engineer of Traffic Eng. & Local Aid)

SECTION 5
DESIGN EXCEPTION WRITTEN FORMAT

5-01 GENERAL

In order to standardize the written format of design exception letters or memos; standard headings, body outline, opening paragraphs, closing paragraphs, signature line and approval line have been provided.

The letter format is used when requesting federal approval of design exceptions on Federal Aid Funded and Interstate projects (use Figures 5-2, 5-4, 5-8 and 5-10). The memorandum format is used when requesting state approval of design exceptions on 100% state funded and other Non-Federal Aid projects (use Figures 5-1, 5-3, 5-6 and 5-9).

The standard heading, NJDOT signature line and NJDOT approval line are set up for the Assistant Commissioner of Design and Right of Way.

5-02 HEADING

The heading formats for the first page and subsequent pages are provided.

The heading formats, for the first page of a memorandum and letter, are shown in Figures 5-1 and 5-2 respectively.

The heading formats for all pages, except the first page, of a memorandum and letter are shown in Figures 5-3 and 5-4 respectively

5-03 BODY

An outline for the body of a design exception is provided in Figure 5-5.

The body is comprised of four parts: opening paragraphs, project description, each substandard feature and recommendation. The outline further breaks down these four general parts into specific sections.

Opening and recommendation paragraphs are provided in the subsections that follow. A further discussion on the project description and each substandard feature is contained in Sections 6 and 7 respectively.

5-04 OPENING PARAGRAPHS

Opening paragraphs for 100% State Funded and other Non-Federal Aid projects are shown in Figure 5-6.

The opening paragraphs for 100% State Funded projects do_not apply to Stable Funding Resurfacing Projects; see Figure 5-7 for opening paragraph for the latter.

Figure 5-8 contains opening paragraphs for Federal-Aid Funded and Interstate projects.

5-05 RECOMMENDATION

The recommendation is comprised of a closing paragraph, complimentary closing, signature line and approval line.

Figure 5-9 contains the recommendation for 100% State Funded and other Non-Federal Aid projects.

The recommendation for Federal-Aid Funded and Interstate projects is shown in Figure 5-10.

Omit reference initials, enclosure notations and extra copy notations from the original letter or memo.

<u>FIGURE 5-1</u>

<u>MEMORANDUM HEADING FOR</u>

<u>100% STATE FUNDED PROJECTS</u>

<u>AND</u>

<u>OTHER NON-FEDERAL AID PROJECTS</u>

NEW JERSEY DEPARTMENT OF TRANSPORTATION
MEMORANDUM

TO <u>Kenneth C. Afferton</u> FROM <u>Name, Initiating Unit</u>

<u>Assistant Commissioner</u>

<u>Design and Right of Way</u>

SUBJECT <u>DESIGN EXCEPTION</u> DATE:________ EXT:________

Route Section
County
Milepost Limits
DOT Job No.

FIGURE 5-2

LETTER HEADING FOR

FEDERAL AID-FUNDED PROJECTS

AND/OR

INTERSTATE PROJECTS

Commissioner's Letterhead

* Date

Mr. John J. Kessler, Jr.
Division Administrator
Federal Highway Administration
25 Scotch Road
Trenton, NJ. 08628-2595

Attention Mr. (District Engineer)

Re: DESIGN EXCEPTION
Route Section
County
Milepost Limits
Federal Project No.
DOT Job No.

Dear Mr. Kessler:

* NOTE: The Assistant Commissioner Design and Right of Way will date the final design exception.

FIGURE 5-3

HEADING FORMAT FOR ALL PAGES EXCEPT FIRST PAGE OF MEMORANDUM

Mr. Kenneth C. Afferton **-(Page #)-** *** Month XX, 19XX**
Route Section

FIGURE 5-4

HEADING FORMAT FOR ALL PAGES EXCEPT FIRST PAGE OF LETTER

Mr. John J. Kessler Jr. **-(Page #)-** *** Month XX, 19XX**
Route Section

* NOTE: The Assistant Commissioner Design and Right of Way will date the final design exception.

FIGURE 5-5

OUTLINE FOR BODY OF DESIGN EXCEPTION

I. Standard Opening Paragraphs: which include a list of substandard features.

II. Project Description
   A. Funding Source: Developer, H.E.S., Stable Funding Resurfacing, etc.

   B. Urban or Rural Highway.

   C. Highway Classification
      1. Principal Arterial, Minor Arterial, Collector or Local.
      2. Interstate, Freeway, Expressway or Land Service Highway.

   D. Project Limits - both by physical landmarks and by milepost (attach straight line diagram).

   E. Project Scope and Purpose.

   F. Existing and Proposed Typical Section Description.
      1. Lane, shoulder & border widths. Include median type, if any.
      2. Cross slopes and superelevation.

   G. Posted, Proposed and Design Speed Limit.

   H. Approximate Cost of Project.
      1. Roadway
      2. Structures

III. Each Substandard Feature
   A. Location and description of existing, proposed and NJDOT and/or AASHTO minimum criteria (Provide a table if needed).

   B. Impacts caused by proposed scheme and NJDOT minimum criteria.

   C. Cost Estimate
      1. Minimum criteria cost versus proposed scheme cost.
      2. Percent increase in project cost due to min. criteria.

   D. Accident Analysis
      1. State what types of accidents are feature related.
      2. Analyze feature related accidents.
      3. State proposed countermeasures that would reduce feature related accidents.

IV. Recommendation
   A. Positive statement in favor of the substandard design features.
   B. Standard Closing Paragraph.

FIGURE 5-6

OPENING PARAGRAPHS FOR 100% STATE FUNDED PROJECTS

AND

OTHER NON-FEDERAL AID PROJECTS

Approval of the design exception is requested to the following minimum design standards, contained in the (List only those references that apply: NJDOT Roadway Design Manual; NJDOT Bridges and Structures Design Manual; NJDOT 3R Standards; AASHTO publication, A Policy on Geometric Design of Highways and Streets) based on the warranting conditions described herein:

1.
2. (List standards with milepost limits)
3.
etc.

FIGURE 5-7

OPENING PARAGRAPHS FOR 100% STATE FUNDED RESURFACING PROJECTS

Approval of the design exception is requested to the following criteria (based on the design exception policy for resurfacing projects funded with 100% State funds, recommended by Charles F. Takacs, Director, Division of Roadway Design and Clifford A. Ellis, Director, Division of Regional Design, and approved by Kenneth C. Afferton, Assistant Commissioner, Design and Right of Way, dated March 12, 1991) based on the warranting conditions described herein:

1.
2. (List criteria with milepost limits)
3.
etc.

Note: Use Memorandum Heading, Figure 5-1 and Heading Format, Figure 5-3.

FIGURE 5-8

OPENING PARAGRAPHS FOR

FEDERAL AID FUNDED PROJECTS

AND/OR

INTERSTATE PROJECTS

The Federal-Aid Highway Program Manual, Transmittal 398, Volume 6, Chapter 2, Section 1, Subsection 1, paragraph 4f, indicates that a design exception may be granted for projects which do not conform to minimum design standards where conditions warrant.

Approval of the design exception is requested to the following minimum design standards, contained in the (List only those references that apply: NJDOT Roadway Design Manual; NJDOT Bridges and Structures Design Manual; NJDOT 3R Standards; AASHTO publication, A Policy on Geometric Design of Highways and Streets; AASHTO publication, A Policy on Design Standards Interstate System) based on the warranting conditions described herein:

1.
2. (List standards with milepost limits)
3.
etc.

FIGURE 5-9

RECOMMENDATION FOR

100& STATE FUNDED PROJECTS

AND

OTHER NON-FEDERAL AID PROJECTS

Recommendation

(Insert a positive statement in favor of substandard design features.)

Based on the warranting conditions presented, (the existing and proposed geometry and surface conditions, additional costs, accident analysis and safety related countermeasures), it is recommended that the design exception be approved for (List the minimum design standards that are not met). Approval of this design exception is requested.

Signature
Name
Title
Initiating Unit

NJDOT Approval By:

______________________ ______________

Kenneth C. Afferton
Assistant Commissioner
Design and Right of Way

Date

FIGURE 5-10

RECOMMENDATION FOR

FEDERAL-AID FUNDED PROJECTS

AND/OR

INTERSTATE PROJECTS

Recommendation

(Insert a positive statement in favor of substandard design features.)

Based on the warranting conditions presented (the existing and proposed geometry and surface conditions, additional costs, accident analysis and safety related countermeasures), It is recommended that the design exception be approved for (List the minimum design standards that are not met). Approval of this exception for these controlling standards is requested.

Very truly yours,
Signature
Kenneth C. Afferton
Assistant Commissioner
Design and Right of Way

FHWA Approval By:

________________________ ____________
John J. Kessler, Jr. Date
Division Administrator

SECTION 6
PROJECT DESCRIPTION

6-01 GENERAL

The information to be included under Project Description is shown in outline form in Figure 5-5. Most of the outline items are self-explanatory. Further clarification is provided below for the items: Project Limits and Project Purpose.

6-02 PROJECT LIMITS

When describing the project limits, be sure to make reference to the attached straight line diagram along with its publication date. The straight line diagram shall be a copy of the latest N.J. State Highway Straight Line Diagrams (1). Label and show the project limits along with the location of each design exception on the straight line diagram. Also, show all proposed interchanges, intersections, ramps, streets, etc. Make sure that the straight line diagram shows all the physical landmarks mentioned in the body of the design exception.

When a straight line diagram does not exist, such as the case with new construction, a realignment or an off system project; a key map shall be substituted.

6-03 PROJECT PURPOSE

The Accident Rate, Skid Test Inventory, Final Pavement Index, Structural Sufficiency Ratings, and/or Volume/Capacity ratios for the project may be mentioned here and attached to the design exception. This information should confirm the purpose of the project. Concurrently, also explain the meaning of this information.

When the Accident Rate (safety improvement) is used, please include the Route, the location of the Accident Rate by milepost, the accident rate, the roadway cross section, the Average Accident Rate for that cross section and the year this information is based on (2).

If the Skid Test Inventory (pavement or safety improvement) is used, please include the range of SN40 values, the recommended minimum value for the posted speed limit, the date of the skid test inventory, the location of the skid test by milepost, and the route (3).

When the Final Pavement Index (pavement improvement) is used, please include the Pavement Management Priority List Date, Priority Number (ex: 67^{th} out of 87), Route, direction, location by milepost, pavement type, Traffic Factor Index, Road Roughness Index, Surface Distress Index and Final Pavement Index (4).

If the Structural Sufficiency Rating (structural improvement) is used, please include the inspection date that the rating is based on, the route, the structure name, structure number, mile post location, Sufficiency Rating and Deck Rating.

When the Volume/Capacity Ratio (capacity improvement) is used, please include the route, direction, milepost location, V/C Ratio and the equivalent Level of Service.

REFERENCE

1. New Jersey State Highway Straight Line Diagrams. New Jersey Department of Transportation, Division of Transportation Systems Planning, Bureau of Transportation Data Development, Trenton.

2. Summary of Accident Rates on State Highways in Route and Milepost Order. New Jersey Department of Transportation, Bureau of Traffic Engineering and Safety Programs, Trenton.

3. Pavement Management Skid Resistance Inventory Report. New Jersey Department of Transportation, Division of Construction and Maintenance, Bureau of Maintenance Support, Trenton.

4. Pavement Management Priority List. New Jersey Department of Transportation, Division of Construction and Maintenance, Bureau of Maintenance Support, Trenton.

SECTION 7
EACH SUBSTANDARD FEATURE

7-01 GENERAL

The third part of the body of a design exception, entitled Each Substandard Feature, is the most important part because it contains the justification behind the design exception request. The justification shall include: existing, proposed and NJDOT minimum criteria; impacts; cost estimate; and accident analysis with proposed safety countermeasures. A standard outline of "Each Substandard Feature" is provided in Figure 5-5. A further discussion on the outline is contained in the subsections that follow.

7-02 EXISTING, PROPOSED AND NJDOT AND/OR AASHTO MINIMUM CRITERIA

A table may be required to show these criteria when the substandard feature occurs at more than one location. To get an idea of what is expected, a table for two common substandard features is presented below. It should be noted that when a minimum standard cannot be met, then the highest practical geometric criteria should be selected.

Table 7-1 below, is an example of the criteria required for superelevation. The following table lists the curve locations; radii; standard, existing and proposed superelevation rates (e); and safe speeds (V). Use separate columns when the existing and proposed radius, or the existing and proposed superelevation are not the same. The safe speeds are explained in Chapter 8, "Common Substandard Features: Superelevation", p. 8-1. In this example the standard "e" is based on an "e" maximum of 6% at a design speed of 70 mph, and the standard "V(safe)" is based on the standard "e".

It is very important, when listing the criteria in table form, to give a brief description of the material presented.

TABLE 7-1

SAMPLE SUPERELEVATION TABLE

Location	Radius (Exist & Prop)	e max (Exist & Prop)	e (Stand)	V(safe) (Exist & Prop)	V(safe) (Stand)	Posted Speed
MP 71.45 to 70.77 NB (Sta. 138+14 to 174+23)	7,600	2.0	2.6	93	94	55
MP 70.62 to 70.25 NB (Sta. 182+21 to 201+35)	6,000	2.0	3.2	88	91	55
MP 70.12 to 69.89 NB (Sta. 208+27 to 220+44)	6.400	2.0	3.0	89	92	55
MP 67.90 to 66.99 SB (Sta. 322+32 to 369+42)	4,325	2.0	4.2	80	85	55

An example of the criteria required for sight distance on vertical curves is shown in Table 7-2 below. The following table lists the crest vertical curve locations; the minimum horizontal distance required to effect a 1% change in slope on the vertical curve (K min.); the existing, proposed and minimum standard length of vertical curve (L); the safe speed; and the posted speed. The design speed for this example is 45 mph.

TABLE 7-2

SAMPLE SIGHT DISTANCE ON VERTICAL CURVE TABLE

Location	K min Crest	A Exist & Prop	L Exist	L Prop	L min Stand	Safe Speed	Posted Speed
MP 10.0 to 10.04 (Sta. 525+00 to 527+00)	80	3.5	200	200	280	36	35
MP 10.04 to 10.08 (Sta. 527+20 to 529+10)	80	3.0	180	190	240	37	35
MP 10.08 to 10.12 (Sta. 529+40 to 531+30)	80	3.5	176	190	280	35	35

To compute the safe speed on a vertical curve use Figures 4-I and 4-J, of the NJDOT Roadway Design Manual, for crest vertical curves and sag vertical curves respectively (1). Use the "desirable length of vertical curve" graph as shown in these figures. Compute "K" knowing the proposed "L" and "A" (K = L/A). From "K", interpolate for "V" which will give you the safe speed.

7-03 IMPACTS

Impacts are to be shown for each substandard feature location. In the design exception, make a comparison of all impacts caused by constructing to minimum standards as opposed to constructing to the proposed scheme. The key word here is all, in other words, be specific. Do not use vague terms such as "extensive", "considerably" or "adversely". If vague terms are used, further elaboration will be necessary in the sentences that follow. An example of elaborating on vague terms is shown below:

> Providing minimum design criteria for vertical geometry would require extensive grading. Due to the short tangent sections between vertical curves, the grades on the immediate bridge approaches would have to be changed from 7.0% to 5.0% to provide for the lengthening of these curves. As a result, the limits of grading and height of fill would increase considerably. Placing the amount of necessary fill would then require construction of retaining walls in front of five (5) residences to avoid full taking and the effective elimination of seven (7) driveways because of prohibitively steep grades. Also, approximately ten feet in fill would be placed at the intersection with Clawson Avenue requiring additional roadway grading.

As can be seen by the previous example, its author paints a picture on impacts.

Tables or charts can also be used to summarize the impacts presented in the body of the design exception.

Table 7-3 is a comparison between the proposed design and the design necessary to meet minimum criteria for vertical geometry.

TABLE 7-3

SAMPLE TABLE ON IMPACTS

	PROPOSED	TOTAL TO MEET MINIMUM DESIGN CRITERIA	ADDITIONAL TO MEET MINIMUM DESIGN CRITERIA
Length of roadway Reconstruction			
South Branch Rd	1,200 LF	1,900 LF	700 LF
Clawson Ave.	150 LF	400 LF	250 LF
Maximum Height of Fill	10 FT	18 FT	8 FT
Total Amount of Fill	14,000 CY	57,000 CY	43,000 CY
Total Cost Estimate	$1,500,000	$3,100,000	$1,600,000

7-04 COST ESTIMATE

Cost goes hand in hand with impacts because cost brings into perspective the feasibility of the design exception based on the impacts.

Costs are to be shown at each location that the substandard feature occurs. At each location, make a comparison of all costs incurred by constructing to minimum standards versus constructing to the proposed scheme. The costs incurred should be separated into construction, right-of-way and utility costs. Please state if maintenance of traffic was included in the estimate.

If the improvement of one substandard feature location affects other locations, explain why and provide a cost estimate breakdown at the first location. Make reference back to the first location from the affected locations.

A percent increase in total project cost (Construction, ROW & Utilities), due to constructing to minimum criteria, should be included with the cost estimate.

7-05 ACCIDENT ANALYSIS

The accident analysis contained in the design exception body shall consist of three parts: 1. a statement on what type of accidents are related to each substandard feature, 2. an analysis on the substandard feature-related accidents, and 3. a statement on proposed safety countermeasures that would reduce feature-related accidents.

In order to provide as uniform and comprehensive an analysis of accident data as possible, Department staff shall use the accident analysis performed by the Bureau of Traffic Engineering and Safety Programs in the preparation of all design exceptions (2). The Bureau's analysis will supply information for the first two parts of the Design Exception Accident Analysis.

All requests for an accident analysis must be submitted in writing by the Lead Design Manager or the Preliminary Engineering/Project Location Manager to Manager, Bureau of Traffic Engineering and Safety Programs, Attn.: Mr. Steve Warren. As shown in Figure 7-1, each request must include a brief description of the proposed project, project limits by milepost, a list of the substandard geometric feature(s) for which a design exception is being developed, and the limits of each substandard feature by milepost.

For local roads that are not mileposted, the milepost information required in items 1B, 1C & 1D of Figure 7-1 should be replaced by appropriate distance measurements from a cross street. For this reason, the detailed large scale map requested in 2B of Figure 7-1 should indicate all cross roads including local names and/or route numbers and the approximate distances between. Any other logical landmark should also be identified with approximate distance locations (i.e., RR crossing, overpass, bridges, county line, etc.). A line diagram could be substituted if the map is not feasible. In addition, any other information including District Office interpretation of the accident data based on field trips, knowledge of the area or route, input from Local Governments, etc. should be included with the transmittal to assist the Bureau of Traffic Engineering in their analysis.

A typical accident analysis, performed by the above mentioned Bureau, first describes the type of accidents (indicators) that are related to the substandard feature. Second, the analysis will show the number of accidents that occurred during a 3 year period for each indicator, along with the percentage of total accidents that the indicator represents. Third, this indicator percentage is then compared to the statewide average.

FIGURE 7-1

MEMO ON DESIGN EXCEPTION ACCIDENT ANALYSIS

NEW JERSEY DEPARTMENT OF TRANSPORTATION

MEMORANDUM

TO: Mr. Clifford A. Ellis
Director
Division of Regional Design

FROM: P. Norman Deitch
Manager, Bur. of Traffic Engr.
and Safety Programs

SUBJECT: Design Exceptions
Accident Analyses

DATE 1/21/90 TELEPHONE NO. 5-2627

To aid us in providing timely responses to requests for Design Exception Analyses, certain important information should be included when requests are forwarded to this office. Recently, numerous requests have been submitted with less than complete descriptions of conditions or locations. So that any future submissions can be completed without excessive interoffice communications or delays, the following should be included with all memoranda:

1. State and Interstate Highway Projects -

   A. Route and milepost limits of the project section (not station numbers).

   B. Group all below standard conditions requiring accident analysis together by type and milepost limits. Example: Lack of Superelevation Route () - M.P. 22.5 - 22.70, M.P. 23.1 - 23.30, etc.

   C. If analysis involves Lack of Superelevation, Below Standard Horizontal Curve Radius or Non-Standard Tangent Length between curves, include the direction of the curve in the mileposted direction as well as PC and PT mileposts. Example: Lack of Superelevation Route () - M.P. 22,50 - 22.70 (Right curve, NB).

   D. When analysis involves Crest Vertical Curvature, include the milepost of the PVI as well as PVC and PVT.

   E. If the project involves a proposed nonstandard condition where none previously existed (Example - adding a 6' shoulder where none existed) or change from a standard to a nonstandard condition (Example - reduction from a 10' shoulder to a 4' shoulder), no analysis can be provided. No valid predictions can be made concerning accident experience for scenarios such as this.

FIGURE 7-1 CONT.

MEMO ON DESIGN EXCEPTION ACCIDENT ANALYSIS

Mr. Clifford A. Ellis -2- January 21, 1990

F. If a request is made to review and comment on an accident analysis performed by another agency, include all information used by that agency to arrive at the conclusions presented. (This applies to all roadway systems - Interstate, State, County and Municipal.)

2. County or Municipal Roadway Projects -

A. All information requested above except for the description of limits by milepost.

B. Include a large scale, detailed map of the project location.

C. Request copies of the accident reports (not detail printouts) that apply to the roadway section to be analyzed. These can be obtained from the Bureau of Accident Records or the local police. Obtain the three (3) most recent years of complete data (partial years cannot be used in our analyses).

Thank you for your cooperation in this regard and if you have any questions feel free to contact Mr. Steve Warren at 5-3879 directly.

Original signed P.N.D.
P. Norman Deitch

The following is an example of a Bureau of Traffic Engineering and Safety Programs design exception accident analysis:

> Non-Standard Superelevation-Curve #1 (M.P. 6.35 to 6.71) - Fixed object, struck parked vehicle and overturned accidents are the indicators used for this type of condition. For the three year period, 24 fixed object (median) accidents occurred westbound while 8 fixed object (other than median) accidents, overturned accident and 1 struck parked vehicle accident occurred eastbound. These accidents are presented by direction because of the separation of travel directions by a barrier curb. Fixed object (median) accidents are used as indicators when the direction of force leads into the curve. All other fixed object types plus overturned and struck parked vehicle accidents are used as indicators when the direction of force leads away from the curve. The 32 fixed object accidents represent 13.1% of the total of 245 accidents on this section. This percentage is equal to the 1986 statewide average (13.1%), so is not over represented. Both overturned and struck parked vehicle are below the statewide averages (0.4% vs 0.6% and 0.4% vs 2.2%). The west surface accident percentage for total accidents (53.5%) is well above the statewide average of 25.6%.

The main question that an accident analysis is trying to answer is whether the indicators are over represented, that is, are the indicators higher than the statewide average. If they are over represented, the analysis will further determine if the accident pattern appears random, or if the weather conditions were a factor. In either case, the Bureau of Traffic Engineering and Safety Programs shall obtain a copy of the police report, for each of the over represented accidents, in order to determine if the accidents can be linked to a substandard feature. Shown below are a few of the questions that should be considered when reviewing the police report:

1. Is the milepost correct?
2. Did the accident occur on the route in question or on a side road?
3. Did the accident occur during construction of a project? Was the traffic pattern changed during construction?
4. Did the accident occur in an intersection or interchange that is now being upgraded?
5. Did the accident occur in a traffic circle that is being replaced with a signalized intersection?

Be sure to provide a summary of the Bureau's accident analysis in the design exception body along with any further information on the over represented accidents. Attach and reference the Bureau's analysis. If a collision diagram was prepared, showing the nature of the accidents at the subject location, attach the collision diagram to the design exception. Whatever conclusions that can be ascertained by the diagram should be included in the body.

At this point, the first two parts of the three part accident analysis have been fulfilled. The third part contains proposed safety countermeasures that would reduce feature-related accidents.

It is very important to provide safety countermeasures where geometric deficiencies cannot be upgraded. Geometric deficiencies, if left unattended, could become the basis of a future tort action. But according to Special Report 214, "...it is probable that geometric features account for less than one-fourth of all tort claims" (3).

Safety problems such as deficient roadside signs or pavement markings and pavement edge-drop problems, which are often the basis of tort claims, can be routinely corrected in 3R type projects. Therefore, it is very important to provide safety countermeasures where geometric deficiencies cannot be upgraded. Include these safety countermeasures in the body.

Highway design practice provides a broad range of low-cost safety countermeasures that can be used to improve the geometric deficiencies of existing highways. Examples are shown, in Table 7-4, below (3):

TABLE 7-4

LOW COST SAFETY COUNTERMEASURES

Geometric Deficiency	Low Cost Safety Countermeasure
Narrow lanes and shoulders	Pavement edge lines Raised pavement markers Post delineators
Steep sideslopes; roadside obstacles	Roadside hazard markings Round ditches Guiderail
Narrow bridge	Traffic control devices Approach guardrail Hazard and pavement markings
Sharp horizontal curve	Traffic control devices Shoulder widening Appropriate superelevation Gradual sideslipped Pavement antiskid treatment Obstacle removal or shielding
Poor sight distance at hill crest	Traffic control devices Fixed hazard removal Shoulder widening
Hazardous intersection	Traffic control devices Traffic signalization Fixed lighting Pavement antiskid treatment Speed controls Channelization

Appendix "A" contains a more detailed table which shows each accident type along with probable causes, studies to be performed to determine probable cause and possible countermeasures. Designers can also use this table to conduct a safety analysis in the early stages of a project.

Substantial controversy has surrounded the safety implications of resurfacing with highway organizations arguing that routine resurfacing (without geometric improvements) enhances safety and safety organizations arguing the opposite. Therefore, the paragraphs that follow are devoted to this subject.

The potential effect of resurfacing on safety is a result of two factors working in opposite directions. First, resurfacing reduces surface roughness and improves ride quality, generally leading to increased average speeds. Second, resurfacing often increases pavement skid resistance, which reduces stopping distance and improves vehicle controllability when the pavement surface is wet (3).

A review of available research on the safety effects of resurfacing was conducted and can be found in the TRB State-of-the-Art Report entitled "Effect of Resurfacing on Highway Safety: A Synthesis of Prior Research" (4). This review supports the following findings:

> Routine resurfacing of rural roads generally increases dry-weather accident rates by an initial amount of about 10 percent, probably because of increased speeds. Dry-weather skid resistance and stopping are unaffected by resurfacing unless the original pavement was extremely rough, so that tires did not maintain contact with the paved surface.
>
> Routine resurfacing of rural roads generally reduces wet-weather accident rates by an initial amount of about 15 percent. Apparently, this follows from improvements in wet-weather stopping distances and vehicle controllability that more than compensate for any effects of somewhat higher speeds following resurfacing.
>
> For most rural roads, the net effect of resurfacing on accident rates is small and gradually diminishes with time. Initially, the total accident rate typically increases following resurfacing, likely by an amount less than 5 percent. When averaged over the project life, the effect of resurfacing is much less.
>
> Resurfacing improves the safety performance of roads that experience an abnormally high frequency of accidents in wet weather.
>
> Resurfacing projects provide the opportunity to correct deficient pavement cross slopes at little or no extra costs. Correcting cross slopes allows better drainage of the pavement surface and improves vehicle control in wet weather. On individual resurfacing projects, careful attention to the removal of surface defects and necessary improvements to skid resistance, surface drainage, and superelevation may help offset the potentially adverse effects of increased speeds.

REFERENCES

1. New Jersey Department of Transportation Roadway Design Manual. NJDOT, Trenton, March 1987

2. Afferton, K.C. "Design Exception Accident Analysis." NJDOT Interoffice Memorandum to C. Ellis et al. Trenton, June 1989.

3. Special Report 214: Designing Safer Roads, Practices for Resurfacing, Restoration and Rehabilitation. TRB, National Research Council, Washington, D.C., 1987.

4. Cleveland, D. "Effect of Resurfacing on Highway Safety: A Synthesis of Prior Research." TRB State-of-the-Art-Report. TRB, National Research Council, Washington, D.C. (forthcoming).

SECTION 8
COMMON SUBSTANDARD FEATURES

8-01 GENERAL

This chapter provides guidance and insight for composing design exceptions for the various substandard features shown below:

Horizontal Geometry:
1. Pavement Cross Slope
2. Superelevation
3. Radius

Vertical Geometry:
4. Sight Distance on Vertical Curves
5. Grades
6. Vertical Clearance

Typical Section:
7. Lane and Shoulder Width
8. Bridge Width

Obstructions:
9. Utility Poles

8-02 PAVEMENT CROSS SLOPE

Although pavement cross slope is not a common substandard feature, this section has been provided to clarify what was stated in Chapter 2. According to Chapter 2 on page two: "...design exceptions should not be submitted for substandard cross slopes on roadways (excluding structures) since it is economically feasible to upgrade the cross slopes to current standards." Two studies reported that pavement cross slope was the most important geometric feature concerning accidents (1,2). Pavement cross slope allows water to drain from the roadway during wet weather and thus reduces the chances of accidents caused by hydroplaning.

For bridge decks, it is not always technically possible to modify existing cross slopes to meet current standards. The total thickness of Latex Modified Concrete Overlays on bridge decks is normally limited to two inches, according to Article 1.9B.2 of the NJDOT Bridges and Structures Manual (3). As the minimum overlay thickness is 1 1/4 inches, only cross slope modifications which result in an increase of less than 3/4 inches can normally be accommodated in this type of bridge deck rehabilitation contract. An increase of 3/4 inches equates to an increase in cross slope of 1/2 percent based on a 12 foot wide lane. Therefore, it may be possible to meet minimum standards, especially on two lane structures, where the existing pavement cross slope is one percent.

It is standard procedure to check existing structural members for their load carrying capacity when work including overlays on the bridge deck is required. To change the existing cross slope to meet standards, there is a possibility that existing members, such as girders, will be overloaded.

Major reconstruction or replacement of the bridge deck and/or its supports would then be required structurally to accommodate changes in cross slope. For many projects, particularly resurfacing or bridge deck rehabilitation contracts, this is prohibitively expensive and beyond the scope of the project.

The decision to upgrade bridge deck cross slopes should be made on a case by case basis and should be based on the scope of the project, the ability of the structure to accommodate additional dead load, the cost to strengthen the structure to accommodate the increase in loading and the accident analysis.

If the decision is made for the design exception, include safety countermeasures such as "Slippery When Wet" signs and transverse pavement grooving.

8-03 SUPERELEVATION

When the standard superelevation rate for a horizontal curve cannot be met, then the highest practical maximum superelevation rate should be selected for the horizontal curve design.

An NCHRP report prepared by Roy Jorgensen Associates, Inc. for rural two-lane highways concluded that reducing the minimum design standards for pavement cross slope and superelevation exhibited little or no cost savings potential, therefore, rural highway projects should always meet the minimum design standards for pavement cross slope and superelevation (4).

As for urban highways, according to AASHTO (5):

> "The rate of superelevation to be applied to a specific horizontal curve varies according to the type of highway facility and the controls which exist along the segment under consideration. In urban areas, existing land use features usually control the amount of superelevation that can be introduced. There is considerable roadside activity and traffic signals are common. Generally, as the amount of development increases adjacent to a highway in an urban area, the running speeds decrease thereby requiring lesser rates of superelevation.
>
> In some cases it may be feasible to rebuild substandard horizontal curves to larger radii and appropriate superelevation so that advisory speed signs can be eliminated. This is especially important on curves showing a high rate of accidents as well as hidden and isolated curve situations."

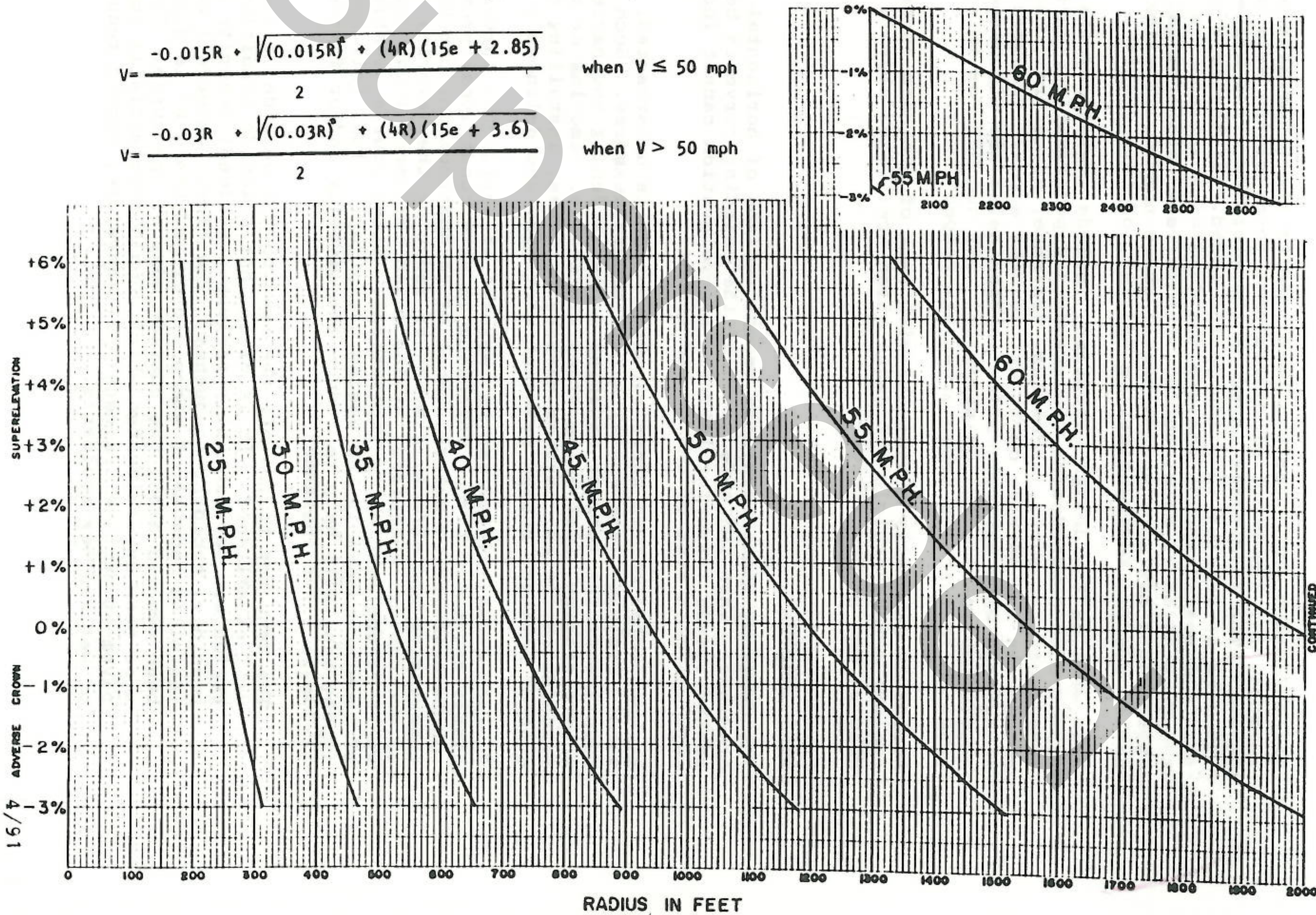
The curve data that is required in a design exception is shown in Table 7-1. Contained in the table is the safe speed (V (safe)). Safe speed is an accepted limit at which riding discomfort due to centrifugal force is evident to the driver (6). The safe speed of a curve, given the radius and cross slope, can be calculated by using the formulas or graph shown in Figure 8-1 which are based on a ball bank indicator reading of 10 degrees (5).

FIGURE 8-1

SAFE SPEED GRAPH AND FORMULAS

$$V = \frac{-0.015R + \sqrt{(0.015R)^2 + (4R)(15e + 2.85)}}{2} \quad \text{when } V \le 50 \text{ mph}$$

$$V = \frac{-0.03R + \sqrt{(0.03R)^2 + (4R)(15e + 3.6)}}{2} \quad \text{when } V > 50 \text{ mph}$$



1-60

The ball bank indicator has been used by the Department as a uniform measure, for the point of discomfort, to determine safe speeds on curves. The safe speed based on the proposed cross slope should be equal to or greater than the posted speed. If the safe speed is less than the posted speed, include the following sentence in the body: At the completion of construction, the curve(s) shall be ball banked and appropriate advisory speeds posted where needed. The lead unit shall notify Traffic Engineering, in writing, of this request.

When writing the design exception, include everything that would be impacted by constructing the standard superelevation, such as intersections, curbs, sidewalks, drainage, structures, businesses, residences and barrier curb just to name a few. Features that must be recognized when superelevation is considered are discussed in the AASHTO publication (6) on pages 144, 522 and 668 for intersections, urban collectors and urban arterials respectively.

Accidents generally associated with lack of adequate superelevation include errant vehicle accidents which are: fixed objects, overturned, head on and parked vehicle.

8-04 RADIUS

The designer should evaluate reconstruction of horizontal curves (radiuses) when the safe speed of the existing curve is below the posted speeds (assuming improved superelevation cannot increase the safe speed to that of the posted speed).

At horizontal curves where reconstruction is unwarranted, the designer should evaluate less costly safety countermeasures. Such countermeasures include widening lanes, widening and paving shoulders, superelevation, flattening steep sideslopes, removing or relocating roadside obstacles, marking no-passing zones, installing traffic control devices, raised pavement markings, and delineator posts (7).

In many cases, safety can be improved at horizontal curves without costly reconstruction. Depending on site conditions, providing safety countermeasures to curves, short of reconstruction, can be an inexpensive and effective means of reducing the severity and frequency of accidents. Therefore, evaluate and implement these countermeasures where reconstruction is impractical. State your evaluation and choice of countermeasure in the design exception. Also, tell how this improvement will help to reduce the severity and/or frequency of accidents. For instance:

> The tendency to run off the road on the outside of curves has been well established. It is clear that roadside conditions in this region can substantially influence accident severity and, quite possibly, accident frequency. Therefore, guiderail has been installed because of steep slopes and trees 6" in diameter have been removed along the outside edge of the curve. The curve has also been superelevated which should substantially improve pavement surface drainage and, therefore, should reduce the number of wet weather accidents.

One important fact in relating accidents to horizontal curves, as per Special Report 214, is that there is a strong link between degree of curve and accidents (7). That is,as degree of curvature decreases, the number of accidents at the curve also decreases, on average by about 3 fewer accidents per degree of curvature for each 100 million vehicles passing through the curve. For example, flattening a sharp curve on a road carrying 2000 vehicles per day by 5 degrees will only eliminate one accident every 8 years.

Of course, the above rule is rough in nature and does not correct for interrelated effects of other geometric features.

Roadway uniformity also has an effect on driver expectation, such as a sharp curve immediately following an extended stretch of straight highway will experience more accidents than a similar curve situated within a generally winding section (7).

8-05 SIGHT DISTANCE ON VERTICAL CURVES

An example of the location and description of existing, proposed and NJDOT minimum criteria was shown previously in Table 7-2. The criteria shown in Table 7-2 is correct when determining the sight distance requirements for vertical curves in open road conditions. There are some situations where the profile has to be checked graphically to determine if the vertical curve of less than required length actually meets the sight distance requirements. These cases involve adjacent crest and sag vertical curves with little or no tangent between.

Be sure to list all impacts caused by the proposed scheme and NJDOT minimum criteria such as: utility relocation, ROW acquisition, paving of side streets, resetting signal standards, installing new loop detectors, reconstructing curb, sidewalk, driveways, concrete island, resetting inlets and various other appurtenances, and structural work. Explain how a standard profile would affect the slope and drainage features of adjacent properties. Also, state: "Lengthening the curve to meet the appropriate design standards would require raising (or lowering) the roadway elevation a maximum of ____ inches".

For the accident analysis, state what types of accidents are feature related. Feature related accidents for sag vertical curbs are nighttime same direction accidents or wet weather same direction accidents. Feature related accidents for crest vertical curves are same direction or angle accidents.

When analyzing the feature related accidents, the location of these accidents in relation to the curve is important. For instance, a higher frequency of same direction or angle accidents would have to prevail just after the crest vertical curve for the curve to be considered a factor.

Improving the sight distance on vertical curves can sometimes be easily accomplished by milling and/or resurfacing. Other times, reconstruction is required.

Crest vertical curve improvements do little to reduce user costs; therefore, reconstruction must be justified primarily on the basis of safety. In other words, the designer should routinely examine the following (7):

1. **The nature of potential hazards hidden by a crest vertical curve, such as intersections, sharp horizontal curves, narrow bridges.**
2. **The location of the hazard in relation to the portion of the highway where sight distance falls below minimum standards.**
3. **Other options such as relocating or correcting the hazard or providing warning signs.**

The designer should evaluate the reconstruction of crest vertical curves when the crest hides from view major hazards and the safe speed of the crest is below the posted speed of the vehicles on the crest.

When reconstruction of a vertical curve, to increase sight distance, is ruled out; provide safety countermeasures.

Climbing lanes for slow moving vehicles can improve safety on crest curves with inadequate sight distance for passing. Marking no-passing zones with both pavement markings and signs also improve safety at such locations (7).

If intersections, traffic signals, interchanges, deceleration or acceleration lanes exist in the vicinity of vertical curves, state: 1. that advance signing will be or is provided, 2. what the advance signing entails, and 3. where the advance signing is located (what direction).

If lighting is provided at the sag vertical curve, spell out that lighting compensates for an insufficient headlight sight distance.

8-06 GRADES

Provide the existing grade, proposed grade and the recommended minimum grade as per A Policy on Geometric Design of Highways and Streets, Chapter 3, p. 259 (6). Do not use the NJDOT Roadway Design Manual, since the minimum grade given is for general conditions.

State if the proposed cross slopes meet the state's minimum standards in order to ensure proper drainage to the gutterline. Also, state if the drainage system and placement of inlets meet or exceed the state's standards.

Develop a profile based on the minimum grade. Explain what impacts this would cause such as R.O.W., cut and/or fill slopes, and drainage.

8-07 VERTICAL CLEARANCE

The location and description of existing, proposed and NJDOT minimum criteria shall include the structure number, physical location (ex: I-78 over Chapel Ave.), station and milepost location, existing minimum vertical clearance, proposed minimum vertical clearance and standard minimum vertical clearance.

Include a discussion of how the substandard vertical clearance structures relate to any adjacent structures, to the next logical termini, that will remain after the project is completed. A listing by route, structure and vertical underclearance can be obtained from the Bureau of Maintenance Engineering, Bridge Engineering Unit.

As for impacts, discuss the alternatives that were explored for providing the standard minimum vertical clearance, such as milling, jacking or bridge reconstruction. Also, discuss the existing and proposed roadway profile. An example discussion on alternatives is shown below:

> Methods of obtaining a 14'-6" clearance included lowering the existing Route 9 profile, reducing the required pavement superelevation under the bridge, or raising the existing bridge by jacking. Lowering the Route 9 profile was infeasible because of lack of clearance over the existing bridge footings for the new widened roadway pavement section. Reducing the superelevation rate was feasible but would not contribute significantly to increasing the clearance. Raising the existing bridge by jacking was considered the most cost effective and the least disruptive alternative.
>
> It is recommended that a 14'-6" clearance be provided. This would require raising the bridge at the west abutment approximately 1'-2" and at the adjacent pier about 2'. The southbound roadway under the bridge would be lowered and the required Route 9 superelevation obtained. The cost of this option is $70,000 and the impact to the track minimized because only the west half of the bridge would be affected and the time the bridge would have to be closed for construction would coincide with the normal yearly track closing of one month.

If a proposed overlay will reduce the existing clearance, state if the pavement section thickness is based on the 18 kip equivalency factors.

It is very important to determine if the structure is located on a defense route and to report this in the body. Substandard vertical clearance design exceptions for projects on the Interstate National Priority System are forwarded to Washington D.C. for review by the local FHWA Office.

As for an accident analysis, discuss whether the bridge has been hit by high vehicle loads. Use the accident analysis performed by the Bureau of Traffic Engineering & Safety Programs, and investigate the site for any physical evidence.

Expound on any safety features that are proposed at or on the structure such as guiderail protection at the piers, abutments or parapets. Also, evaluate the existing bridge rails on the superstructure to determine if there is a need to upgrade them.

As per Chapter 4, a separate memorandum of concurrence for the substandard vertical clearance from the Director of Bridge Design will be required. It should be noted that FHWA will not approve a Design Exception for vertical clearances below 14'- 6" on the Interstate system.

8-08 LANE AND SHOULDER WIDTH

The location and description of existing, proposed and NJDOT minimum criteria shall include the location (station, milepost and direction), existing lane or shoulder width, proposed lane or shoulder width, and the standard minimum lane or shoulder width.

Shown below are some points and impacts that may justify substandard lane widths:

1. Urbanized area
2. Interrupted flow operating conditions
3. Low speeds
4. Low volume
5. Terrain and alignment (flat and tangent)
6. Pavement reconstruction of existing shoulder to attain required lane width
7. Motoring public disruptions - maintenance of traffic
8. Commercial business and local resident disruptions - driveway access, ROW takings, drainage problems, utility problems.

According to AASHTO for urban arterials: "Under interrupted-flow operating conditions at low speeds up through 40 mph narrower lane widths are normally adequate and have some advantages. Reduced lane widths allow greater numbers of lanes in restricted right-of-way and allow better pedestrian cross movements because of reduced distance. They are also more economical to construct (6).

Shown below are some points and impacts that may justify substandard shoulder widths:

1. Rural area
2. Low truck volume
3. Mountainous terrain (high cuts or fills)
4. Motoring public disruptions - maintenance of traffic
5. Commercial business and local resident disruptions - driveway access, ROW takings, drainage problems, utility problems.

If you have to choose between widening lanes or widening shoulders, in terms of accidents eliminated per foot of added width, widening lanes has a bigger payoff than widening shoulders (7). Also, according to AASHTO, "since travel lanes are more important, adequate lane width should be obtained before considering increased shoulder width. Shoulders may be reduced in width to obtain wider pavement" (5).

If the proposed lane or shoulder width is greater than the existing lane or shoulder width, state that the capacity of this section should increase slightly. A procedure for estimating the "effects of lane and shoulder width improvements on travel time" is presented in Special Report 214, Appendix K (7). This procedure is based on methodology presented in Highway Capacity Manual and accounts for the combined effects of lane and shoulder width, and traffic volumes (8). These combined effects can be important because the effect of narrow lanes and shoulders on speed are heightened when traffic volumes are greater (7).

If the proposed shoulders on a structure are substandard in width, state if these shoulders are continuous with those on the roadway approaches.

The accidents associated with substandard lane widths are head on, parked vehicle, sideswipe and fixed object accidents.

The types of accident indicators associated with insufficient or no shoulders are:

1. Head on collisions involving a vehicle, passing a right turning vehicle, hitting a vehicle in the opposite direction.
2. Rear end accidents.
3. Struck parked vehicle.
4. Same direction accidents involving a right turning vehicle.
5. Fixed object accidents occurring on the right side of the road with respect to the direction of traffic.

Safety countermeasures for narrow lanes and shoulders include, but are not limited to, pavement edge lines, raised pavement markers, post delineators, removing fixed objects (utility poles, trees, etc.), eliminating steep slopes and providing guiderail where appropriate (7).

8-09 BRIDGE WIDTH

When the approach pavement width plus shoulders cannot be provided thru a structure, a design exception may be needed. Minimum roadway widths for new and reconstructed bridges are contained in the Policy on Geometric Design of Highways and Streets, Table VI-5 (6). In the design exception, state the existing, proposed and minimum clear bridge width, and the width of the approach lanes.

The designer should evaluate bridge replacement or widening if the bridge is 100' long and the usable width of the bridge is less than the following values (7):

Design Year Volume (ADT)	Usable Bridge Width (ft.)
0 - 750	Width of Approach Lanes
751 - 2000	Width of Approach Lanes plus 2'
2001 - 4000	Width of Approach Lanes plus 4'
over 4000	Width of Approach Lanes plus 6'

The designer should estimate the following when evaluating bridge replacement or widening (7):

1. Cost of replacing the existing bridge with a wider bridge designed to AASHTO standards for new bridges.
2. Cost of widening the existing bridge if widening is practical.
3. Number of accidents that would be eliminated by replacement or widening.

As far as point 3 is concerned, a study by Daniel S. Turner indicated that the most important variables in predicting bridge accidents were: bridge relative width (bridge width minus width of approach roadway), average daily traffic volume and approach roadway width (9). In this study, a probability table was determined to be the best way to predict accidents, as shown in Table 8-1. The table was based on data gathered from two-lane, two-way traffic carrying structures on rural roads. Knowing the approach roadway width and bridge relative width, the table yields the expected collision rate. It was assumed that the reversal of accident rates for relative widths less than -4 feet for some structures shown in the table is due to drivers instinctively using safer driving procedures once they note the obvious hazard associated with such bridges.

Facts that may aid in the accident evaluation for a two lane bridge are listed below (7):

Increasing the difference between the width of the bridge and the width of the approach lanes from 0 to 4 feet. will decrease bridge accidents by about 40 percent, with the first foot of widening accounting for nearly one-third of this reduction.

The incremental safety gains of widening bridges decrease as bridge width increases: the first foot of bridge width beyond the travel lanes has three times the effect on accident rates as the tenth foot.

Also, no evidence exists to suggest a relationship between the severity of constriction at bridges and the severity of bridge related accidents.

Factors other than bridge width, such as bridge length and type (e.g. deck versus truss), presence or absence of curb, approach alignment, pavement surface condition, premature icing in winter, and so forth, may also affect the accident rate at bridges (7).

Remember to explain how any of these factors are being improved with safety countermeasures.

There are various safety countermeasures which include but are not limited to installing guiderail at bridge approaches, new or rehabilitated bridge rails, and warning signs (7).

TABLE 8-1
PROBABILITY OF BRIDGE ACCIDENT PER MILLION VEHICULAR PASSAGES

BRIDGE RELATIVE WIDTH, IN FEET	APPROACH ROADWAY WIDTH, IN FEET							
	16.0–18.0	18.1–20.0	20.1–22.0	22.1–24.0	24.1–26.0	26.1–28.0	28.1–30.0	OVER 30.0
OVER 6.0 NARROWER	1.200	0.767	0.436	0.135	0.060	0.030	0.200	0.163
4.1–6.0 NARROWER	1.200	1.171	0.757	0.686	0.604	0.533	0.472	0.150
2.1–4.0 NORROWER	1.194	0.476	0.490	0.503	0.500	0.400	0.300	0.140
0.1–2.0 NARROWER	0.611	0.649	0.553	0.695	0.479	0.500	0.400	0.130
0.0–2.0 WIDER	0.344	0.496	0.330	0.529	0.319	0.497	0.677	0.120
2.1–4.0 WIDER	0.641	0.319	0.319	0.308	0.477	0.448	0.420	0.105
4.1–6.0 WIDER	0.217	0.200	0.193	0.256	0.224	0.176	0.128	0.080
6.1–8.0 WIDER	0.254	0.170	0.234	0.061	0.162	0.113	0.064	0.056
8.1–10.0 WIDER	0.165	0.000	0.170	0.145	0.333	0.331	0.200	0.120
10.1–14.0 WIDER	0.140	0.123	0.120	0.083	0.148	0.171	0.068	0.176
OVER 14.0 WIDER	0.113	0.110	0.066	0.090	0.098	0.102	0.299	0.248

Source: D.S. Turner. "Prediction of Bridge Accident Rates". *Journal of Transportation Engineering, Vol. 110, No. 1,* American Society of Civil Engineers. N.Y. Jan. 1984

1-68

It is vitally important to have proper guiderail attachments to structures, especially at the bridge approaches, since a 1966 study by Brown and Foster of New Zealand found the point of impact for 60 percent of all accidents occurred on the approach bridge end on the vehicle's side of the road (10). They also found that nighttime bridge accidents were eight times more likely to occur than daytime accidents, therefore, provide the necessary lighting or delineation, especially on bridges 20% narrower than the approach.

8-10 UTILITY POLES

The criteria for minimum pole offsets for rural and urban highways is contained in the New Jersey Department of Transportation Utility Accommodation Policy (11). According to this policy:

(a) When the minimum offset, as identified under "Location" (16:25-5.4), cannot be provided, a design exception can be made where:

1. The documented cost estimates to relocate the utility poles, including any additional right-of-way, in relationship to the construction project are considered excessive, and

2. An accident analysis for the preceding 3 years for the highway section involved does not reveal a significant history of accidents involving the utility poles.

(b) These exceptions shall be submitted and approved in accordance with design exception procedures.

As part of the design exception, the location and description of existing, proposed and NJDOT minimum criteria shall include the existing location and offset of each unprotected pole; the proposed location and offset of each unprotected pole; and the standard minimum pole offset as mentioned above. The location shall be identified by station and milepost. The pole offsets are measured from the edge of the traveled way.

As for impacts, discuss the alternatives that were explored for providing the standard minimum pole offset or the maximum pole offset that was practical. For example, state the maximum offset that can be attained by relocating the poles within the existing right of way (r.o.w.). Explore the possibility of reducing pole density with multiple pole use.

Discuss the impacts and cost associated with each alternative. For instance, do the vicinity of buildings or structures cause a problem? Would relocating poles require complete upgrading of pole attachments (mast arm)? Is there an existing blanket easement which allows the mast arms to encroach onto private property?

If R.O.W. has to be purchased in order to acquire the proper offset, show a separate cost for R.O.W.

For the accident analysis, analyze the feature related accidents which, of course, is fixed object-utility poles. State the location of each utility pole accident for the analysis period. Special attention has to be paid to pole accident concentrations.

Remember to state the proposed countermeasures that would reduce feature related accidents. For example, were the poles hit during wet weather or when the pavement was icy? If so, is the road being resurfaced to improve the skid resistance?

All wooden poles within the project limits whose sole purpose is to provide highway lighting should be converted to aluminum breakaway type. This is especially true in gore areas. Preferably, the pole should be relocated from the gore area if this can be done without seriously degrading illumination.

During the first design exception review, a decision will be made by the Bureau of Roadway Design Standards to have the Utility Pole Accident Countermeasures Evaluation (UPACE) Program included as part of the design exception (12). It shall be included where a high number of pole accidents warrant the use of UPACE.

REFERENCES

1. Dearinger, John A., and John W. Hutchinson. "Chapter 7-Cross Section and Pavement Surface." Traffic Control and Roadway Elements-Their Relationship to Highway Safety/Revised. 1970.

2. Dart, Olin K., Jr., and Lawrence Mann Jr. "Relationship of Rural Highway Geometry to Accident Rates in Louisiana." Highway Research Record Number 312-Relationships of Highway Geometry to Traffic Accidents. Highway Research Board, Washington, D.C., 1970.

3. New Jersey Department of Transportation Bridges and Structures Design Manual. NJDOT, Trenton, September 1988.

4. Jorgensen, Associates. NCHRP Report 197: Cost and Safety Effectiveness of Highway Design Elements. TRB, National Research Council, Washington, D.C., 1978.

5. Geometric Design Guide for Resurfacing, Restoration, and Rehabilitation of Highways and Streets. American Association of State Highway and Transportation Officials, Washington, D.C., 1977.

6. A Policy on the Geometric Design of Highways and Streets. American Association of State Highway and Transportation Officials, Washington, D.C., 1984.

7. Special Report 214: Designing Safer Roads, Practices for Resurfacing, Restoration and Rehabilitation. TRB, National Research Council, Washington, D.C., 1987.

8. Special Report 209: Highway Capacity Manual. TRB, National Research Council, Washington, D.C., 1985.

9. Turner, D.S. "Prediction of Bridge Accident Rates." *Journal of Transportation Engineering*. Vol. 110, No. 1, American Society of Civil Engineers, New York, January 1984.

10 Brown, J.V., and J. Foster. "Bridge Accidents on Rural Highways in New Zealand: Analysis and Appraisal," *Australian Road Research*, 1966.

11. Dayton, Edwin W. "Utility Accommodation Policy, February 2, 1987." NJDOT Interoffice Memorandum to Walter W. Caddell et al. Trenton, March 1987.

12. *Utility Pole Accident Countermeasures Evaluation Program and Input Processor Users Manual Report No. FHWA-IP-86-14*. National Technical Information Service, Springfield, December 1986.

SECTION 9
WRITING STYLE

All the rules of technical report writing apply when writing a design exception. This section will briefly cover only one aspect: writing style. Courses and books on technical report writing and error recognition can be found within the Department, which are an excellent help for the novice as well as a refresher for the veteran.

A professionally written Design Exception requires an efficient writing style. According to John M. Lannon, efficient writing style is neither fancy nor impressive, instead it is direct and to the point, easy to follow and understand; in other words, readable (1).

Efficient style requires much more than correct grammar, punctuation and spelling. Correctness alone is no guarantee that your style will be readable (1).

To help your audience spend less time reading, you must spend more time revising for a style that is: 1. clear, 2. concise, 3. fluent, 4. exact and 5. positive (1). Further discussion on these 5 points are shown below.

1. A clear sentence conveys its exact meaning on the very first reading. It signals relationships among its parts and it emphasizes the main idea. You should always organize your thoughts to form proper paragraphs. Randomly jumping from one thought to another is very confusing to the reader, therefore, use the "Outline for Body of Design Exception" in Figure 5-5.

2. First drafts rarely are concise. Get rid of anything that adds no meaning. A concise message conveys most information in fewest words. It is highly informative but not cluttered.

3. Fluent sentences are easy to read because of clear connections, variety and emphasis. Long and short sentences each have their purpose: long sentences show connections and clarify relationships, whereas short sentences isolate an idea for special emphasis.

4. When choosing exact words, choose words that are convincing, precise and informative. Whether intentional or not, poor word choices have only one result: inefficient writing that resists interpretation and frustrates the reader. So don't be vague, be specific. As an example, don't just say "it would be adversely affected", explain how it would be adversely affected. See "Impacts" in Chapter 7 for further discussion.

Never state "it probably will" or "it might not". State "it would" or "it would not" and also show the facts behind each statement. For instance:

> Based on the most recent bridge inspection report dated X-X-XX, the structure would not support the estimated increased load of 10 tons caused by the required superelevation.

Don't just state the name of a physical location, give the milepost too.

5. Emphasize the positive, that is, emphasize benefits rather than flaws. Do not reference or use undesirable terms or unofficial names such as "Dead Man's Curve".

   Use the active voice often, passive voice selectively. In the active voice, the agent performing the action serves as subject.

Since your readers know less than you about your project, expect them to ask questions. So, prior to sending your draft design exception for review, have someone in your office, who is totally unfamiliar with the project, check your design exception for content and meaning. If this certain someone doesn't understand it, chances are the reviewer won't either.

Also, a design exception checklist is provided in Figure 9-1 as a means of speeding up the review process, so use it to your advantage.

One last tip, when all else fails, remember that a picture is worth a thousand words; so attach a plan or sketch on legal size paper to illustrate your thoughts when needed.

REFERENCE

1. Lannon, John M. Technical Writing. 4th ed. Scott, Boston, 1988.

FIGURE 9-1

DESIGN EXCEPTION CHECKLIST

[ ] FIRST REVIEW [ ] ___ REVIEW [ ] FINAL REVIEW

Route No./Name: ________________ Section: ____________________
Milepost Limits:_______to_______ Region: ____________________

[ ] 100% State Funded [ ] Fed. Aid Funded [ ] Stable Fund. Resurf.
[ ] Developer [ ] Other __________

Substandard Features	M.P. Location

I **HEADING CHECKS**

[ ] IF 100% STATE FUNDED

A. FIRST PAGE (See Fig. 5-1):

1. NJDOT Memorandum	Y [ ]	N [ ]	I [ ]
2. Route No./Name	Y [ ]	N [ ]	I [ ]
3. Section	Y [ ]	N [ ]	I [ ]
4. County	Y [ ]	N [ ]	I [ ]
5. Milepost Limits	Y [ ]	N [ ]	I [ ]
6. DOT Job Number	Y [ ]	N [ ]	I [ ]
7. From: Name & Lead Unit	Y [ ]	N [ ]	I [ ]
8. To: Kenneth C. Afferton	Y [ ]	N [ ]	I [ ]
Asst. Comr. of Design & ROW	Y [ ]	N [ ]	I [ ]
9. Ext.: _____	Y [ ]	N [ ]	I [ ]

B. ALL SUBSEQUENT PAGES (See Fig. 5-3):

1. Mr. Kenneth C. Afferton	Y [ ]	N [ ]	I [ ]
2. Route No./Name	Y [ ]	N [ ]	I [ ]
3. Section	Y [ ]	N [ ]	I [ ]
4. Page #	Y [ ]	N [ ]	I [ ]

(Y): Included (N):Not Included (I): Incomplete or Incorrect (NA): Not Applicable

I **HEADING CHECKS CON'T.**

[ ] IF FEDERAL AID FUNDED

A. FIRST PAGE (See Fig. 5-2):

1. Commissioner's Letterhead	Y [ ]	N [ ]	I [ ]
2. Route No./Name	Y [ ]	N-[ ]	I [ ]
3. Section	Y [ ]	N [ ]	I [ ]
4. County	Y [ ]	N [ ]	I [ ]
5. Milepost Limits	Y [ ]	N [ ]	I [ ]
6. Federal Project No.	Y [ ]	N [ ]	I [ ]
7. DOT Job Number	Y [ ]	N [ ]	I [ ]
8. To: John J. Kessler, Jr. w/ address	Y [ ]	N [ ]	I [ ]
9. Attention Mr. (District Engineer)	Y [ ]	N [ ]	I [ ]
10. Dear Mr. Kessler	Y [ ]	N [ ]	I [ ]

B. ALL SUBSEQUENT PAGES (See Fig. 5-4):

1. Mr. John J. Kessler, Jr.	Y [ ]	N [ ]	I [ ]
2. Route No./Name	Y [ ]	N [ ]	I [ ]
3. Section	Y [ ]	N [ ]	I [ ]
4. Page #	Y [ ]	N [ ]	I [ ]

II **BODY CHECKS**

A. STANDARD OPENING PARAGRAPHS (See Fig. 5-6 to 5-8):

1. Standard Opening Paragraphs	Y [ ]	N [ ]	I [ ]
2. List of Standards	Y [ ]	N [ ]	I [ ]
3. Milepost Limits	Y [ ]	N [ ]	I [ ]

B. PROJECT DESCRIPTION (See Fig. 5-5 & Chapt. 6):

1. Funding Source	Y [ ]	N [ ]	I [ ]	
2. Urban or Rural Highway	Y [ ]	N [ ]	I [ ]	
3. Highway Classification	Y [ ]	N [ ]	I [ ]	
4. Project Limits by:				
a. Physical Landmarks	Y [ ]	N [ ]	I [ ]	
b. Milepost	Y [ ]	N [ ]	I [ ]	
5. Straight Line Diagram or Key Map:	Y [ ]	N [ ]	I [ ]	
a. Project Limits	Y [ ]	N [ ]	I [ ]	
b. Substandard Features	Y [ ]	N [ ]	I [ ]	
c. Proposed Work (Interchange, Intersection, etc.)	Y [ ]	N [ ]	I [ ]	NA [ ]
d. Physical Landmarks	Y [ ]	N [ ]	I [ ]	
6. Project Scope	Y [ ]	N [ ]	I [ ]	

II **BODY CHECKS CON'T.**

B. **PROJECT DESCRIPTION CON'T.:**

7. Project Purpose:	Y [ ]	N [ ]	I [ ]	
a. Skid Test Inventory	Y [ ]	N [ ]	I [ ]	NA [ ]
b. Final Pavement Index	Y [ ]	N [ ]	I [ ]	NA [ ]
c. Structural Sufficiency Rating	Y [ ]	N [ ]	I [ ]	NA [ ]
d. Volume Capacity Ratio	Y [ ]	N [ ]	I [ ]	NA [ ]
8. Existing Typical Section Description	Y [ ]	N [ ]	I [ ]	
9. Proposed Typical Section Description	Y [ ]	N [ ]	I [ ]	
10. Posted Speed Limit	Y [ ]	N [ ]	I [ ]	
11. Proposed Speed Limit	Y [ ]	N [ ]	I [ ]	
12. Design Speed Limit	Y [ ]	N [ ]	I [ ]	
13. Approximate Cost of Project:				
a. Roadway	Y [ ]	N [ ]	I [ ]	NA [ ]
b. Structures	Y [ ]	N [ ]	I [ ]	NA [ ]

C. **EACH SUBSTANDARD FEATURE** (See Fig. 5-5 & Chapt. 7):

Substandard Feature: ____________________

Milepost Location : ________ to ________

1. Criteria:				
a. Existing Criteria	Y [ ]	N [ ]	I [ ]	
b. Proposed Criteria	Y [ ]	N [ ]	I [ ]	
c. NJDOT Minimum Criteria	Y [ ]	N [ ]	I [ ]	
d. Criteria Table	Y [ ]	N [ ]	I [ ]	NA [ ]
2. Impacts:				
a. Impacts due to Min. Standards	Y [ ]	N [ ]	I [ ]	
b. Impacts due to Proposed Scheme	Y [ ]	N [ ]	I [ ]	
c. Impacts Table	Y [ ]	N [ ]	I [ ]	NA [ ]
3. Cost Estimate:				
a. Constructing to Min. Criteria	Y [ ]	N [ ]	I [ ]	
b. Constructing to Proposed Scheme	Y [ ]	N [ ]	I [ ]	
c. Separated Costs (Con.,ROW,Util.)	Y [ ]	N [ ]	I [ ]	
d. % Increase in Project Cost due to Minimum Criteria	Y [ ]	N [ ]	I [ ]	
4. Accident Analysis:				
a. Copy of Traffic Engineering and Safety Programs Acc. Analysis	Y [ ]	N [ ]	I [ ]	
i. Feature Related Accidents (Indicators) Stated	Y [ ]	N [ ]	I [ ]	
ii. Indicators Analyzed	Y [ ]	N [ ]	I [ ]	
iii. Indicators Overrepresented	Y [ ]	N [ ]	I [ ]	
iv. If the answer to "iii" is yes, were the police reports studied for each of the overrepresented accidents?	Y [ ]	N [ ]	I [ ]	
b. Summary of Bureau's Accident Analysis included in Body	Y [ ]	N [ ]	I [ ]	
c. Safety Countermeasures	Y [ ]	N [ ]	I [ ]	

(Y): Included (N):Not Included (I): Incomplete or Incorrect (NA): Not Applicable

II **BODY CHECKS CON'T.**

D. RECOMMENDATION (See Fig. 5-9 to 5-10):

1. Positive statement in favor of the substandard design features Y [ ] N [ ] I [ ]
2. Standard Closing Paragraphs Y [ ] N [ ] I [ ]

III **MISCELLANEOUS**

A. ROUTING MEMORANDUM Y [ ] N [ ] I [ ]
B. CORRECT GRAMMAR Y [ ] N [ ] I [ ]
C. CORRECT SPELLING Y [ ] N [ ] I [ ]
D. CORRECT PUNCTUATION Y [ ] N [ ] I [ ]
E. EFFICIENT AND READABLE STYLE Y [ ] N [ ] I [ ]

IV **COMMENTS**

APPENDIX A

Examples of
Various Types of Improvements
and Corresponding Accident Types

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS

AND CORRESPONDING ACCIDENT TYPES

INTERSECTION ACCIDENTS

Type of Accident - Left Turn Head On Collision

Probable Cause -
1) Restricted site 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 Countermeasures -
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.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS AND CORRESPONDING ACCIDENT TYPES

INTERSECTION ACCIDENTS

Type of Accident - 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 Countermeasures -

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.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS

AND CORRESPONDING ACCIDENT TYPES

INTERSECTION ACCIDENTS

Type of Accident - Rear End Collision at Signalized Intersections

Probable Causes -
1) Improper signal timing.
2) Poor visibility of signal indication.
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 Countermeasures -
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.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS

AND CORRESPONDING ACCIDENT TYPES

INTERSECTION ACCIDENTS

Type of Accident - Rear End Collision at Signalized Intersections

Possible Countermeasures -

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.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS AND CORRESPONDING ACCIDENT TYPES

INTERSECTION ACCIDENTS

Type of Accident - 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 Countermeasures -

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.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS AND CORRESPONDING ACCIDENT TYPES

INTERSECTION ACCIDENTS

Type of Accident - Right Angle Collisions at Signalized Intersections

Probable Causes -

1) Restricted sight distances.
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 count on all approaches.
2) Field observations for sight obstructions.
3) Review signal timing.
4) Check roadway illumination.
5) Perform spot speed study.

Possible Countermeasures -

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.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS AND CORRESPONDING ACCIDENT TYPES

INTERSECTION ACCIDENTS

Type of Accident - 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 count on all approaches.
2) Field observation for sight obstructions.
3) Check roadway illumination.
4) Perform spot speed study.
5) Review signing.

Possible Countermeasures -
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.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS

AND CORRESPONDING ACCIDENT TYPES

INTERSECTION ACCIDENTS

Type of Accident - 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 Countermeasures -
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 ways.
6) Provide proper alignment.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS AND CORRESPONDING ACCIDENT TYPES

LINK ACCIDENTS

Type of Accident - Off-Road Accidents

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 Countermeasures -

1) Install proper center line, 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, guard 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.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS AND CORRESPONDING ACCIDENT TYPES

LINK ACCIDENTS

Type of Accident - 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 studies.
7) Field check for sight obstructions.

Possible Countermeasures -

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.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS AND CORRESPONDING ACCIDENT TYPES

LINK ACCIDENTS

Type of Accident - Pedestrian - Vehicle Collisions

Probable Causes -

1) Restricted sight distance.
2) Inadequate roadway lighting.
3) Excessive vehicle speed.
4) Pedestrians 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 Countermeasures -

1) Improve sight distance.
2) Prohibit curb side 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.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS AND CORRESPONDING ACCIDENT TYPES

LINK ACCIDENTS

Type of Accident - Railroad Crossing Accidents

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 Countermeasures -
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.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS AND CORRESPONDING ACCIDENT TYPES

LINK ACCIDENTS

Type of Accident -	Parked Car Accidents
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 Countermeasures -	1) Convert angle parking to parallel parking.
	2) Paint parking stall limits 7 feet 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.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS

. AND CORRESPONDING ACCIDENT TYPES

LINK ACCIDENTS

Type of Accident - Fixed Object Collisions

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 guardrails.
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 Countermeasures -

1) Remove or relocate objects.
2) Improve roadway lighting.
3) Install reflectorized pavement lines.
4) Install reflectorized paint and/or reflectors on the obstruction.
5) Install crash cushioning devices.
6) Install guardrails 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.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.

TABLE A-1

TABLE OF VARIOUS TYPES OF IMPROVEMENTS AND CORRESPONDING ACCIDENT TYPES

LINK ACCIDENTS

Type of Accident - Sideswipe Collision

Probable Causes -

1) Inadequate pavement markings.
2) Inadequate channelization.
3) Inadequate signing.
4) Narrow traffic lanes.
5) Improper road maintenance.
6) Inadequate roadside shoulders.
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 Countermeasures -

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 center lines, 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.

Source: Datta, T.K., A Procedure for the Analysis of High-Accident Locations for Traffic Improvements, 1976.