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SYNTHESIS 316

Design Exception Practices

A Synthesis of Highway Practice

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

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CONSULTANTS

JOHN M. MASON, JR.

and

KEVIN M. MAHONEY

State College, Pennsylvania

TOPIC PANEL

THOMAS R. BANE, *Florida Department of Transportation*
DAVID B. CASTEEL, *Texas Department of Transportation*
MICHAEL M. CHRISTENSEN, *Minnesota Department of Transportation*
ARTHUR J. EISDORFER, *New Jersey Department of Transportation*
KATHLEEN KING, *Ohio Department of Transportation*
RAYMOND A. KRAMMES, *Federal Highway Administration*
JOHN L. LOUIS, *Arizona Department of Transportation*
MARK NORMAN, *Transportation Research Board*
ROBERT C. SCHLICHT, *Federal Highway Administration*

SUBJECT AREAS

Transportation Law; Soils, Geology and Foundations; Materials and Construction; Maintenance

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

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The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration of the U.S. Department of Transportation.

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Advisers to the Nation on Science, Engineering, and Medicine

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FOREWORD

By Staff
Transportation Research Board

Highway administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to highway administrators and engineers. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire highway community, the American Association of State Highway and Transportation Officials—through the mechanism of the National Cooperative Highway Research Program—authorized the Transportation Research Board to undertake a continuing study. This study, NCHRP Project 20-5, "Synthesis of Information Related to Highway Problems," searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an NCHRP report series, *Synthesis of Highway Practice*.

The synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

PREFACE

This report of the Transportation Research Board describes the range of design exception practices among state transportation agencies (STAs) and discusses the problems and suggested improvements based on the experience of state agency personnel. All STAs are required to comply with the same federal regulation pertaining to design exceptions. However, the number of design exceptions, the circumstances under which they are prepared, and the methods employed vary considerably, with many factors contributing to this wide range of practice. This synthesis characterizes (1) conditions that require a design exception, (2) data collection and analysis techniques, and (3) internal STA and external rules. The report also describes benefits and problems experienced by STAs and identifies suggestions for improving and streamlining the design exception process. In addition, the innovative practices of two states (New Jersey and Wisconsin) are identified and discussed.

The primary source of information for this report was a survey of design engineering managers and a review of agency design exception practices. A survey questionnaire was distributed to all 50 states and the District of Columbia, and 46 completed surveys were returned. The written design exception procedures of 30 state transportation agencies were obtained and reviewed. In addition, 25 agencies were contacted for clarification of survey responses and for supplemental survey information. A literature search was also conducted and a small number of relevant publications identified and summarized.

A panel of experts in the subject area guided the work of organizing and evaluating the collected data and reviewed the final synthesis report. A consultant was engaged to collect and synthesize the information and to write this report. Both the consultant and the members of the oversight panel are acknowledged on the title page. This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.

CONTENTS

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John M. Mason, Jr., Ph.D., P.E. and Kevin M. Mahoney, D. Eng., P.E., The Pennsylvania State University, State College, Pennsylvania, were responsible for collection of the data and preparation of the report. Dr. Mason currently serves as the Associate Dean for Graduate Studies, Research and Outreach, and Professor of Civil Engineering, The Pennsylvania State University. Dr. Mahoney is a Senior Research Associate at the Pennsylvania Transportation Institute, The Pennsylvania State University. Valuable assistance was provided by Eric T. Donnell, Research Assistant, Pennsylvania Transportation Institute and doctoral candidate in Civil Engineering at The Pennsylvania State University. This publication is not a product of The Pennsylvania State University.

Valuable assistance in the preparation of this synthesis was provided by the Topic Panel, consisting of Thomas R. Bane, Roadway Design Engineer, Florida Department of Transportation; David B. Casteel, District Engineer, Texas Department of Transportation; Michael M. Christensen, Metro Division Resource Engineer, Minnesota Department of Transportation; Arthur J. Eisdorfer, Manager, Bureau of Civil Engineering, New Jersey Department of Transportation; Raymond A. Krammes, Research Highway Engineer, Turner–Fairbank Highway Research Center, Federal Highway Administration; John L. Louis, Assistant State Engineer, Roadway Engineering Group, Arizona Department of Transportation; Mark Norman, Director, Technical Activities, Transportation Research Board; and Robert C. Schlicht, Highway Engineer, Federal Highway Administration.

This study was managed by Stephen F. Maher, P.E., and Jon Williams, Managers, Synthesis Studies, who worked with the consultant, the Topic Panel, and the Project 20-5 Committee in the development and review of the report. Assistance in project scope development was provided by Donna Vlasak, Senior Program Officer. Don Tippman was responsible for editing and production. Cheryl Keith assisted in meeting logistics and distribution of the questionnaire and draft reports.

Crawford F. Jencks, Manager, National Cooperative Highway Research Program, assisted the NCHRP 20-5 Committee and the Synthesis staff.

Information on current practice was provided by many highway and transportation agencies. Their cooperation and assistance are appreciated.

DESIGN EXCEPTION PRACTICES

SUMMARY

Nearly all highway and street construction and improvement projects are designed to conform to agency-adopted geometric design criteria. In some situations, achieving conformance with all design criteria is not practical or reasonable. A “design exception” is the process and associated documentation of creating or perpetuating a geometric feature that does not meet applicable criteria. Because design features that do not meet criteria may affect the safety and operational efficiency of the facility, a decision to depart from criteria should be deliberative, documented, and approved by an authorized official. All state transportation agencies (STAs) prepare design exceptions. However, the volume of design exceptions, project conditions requiring their preparation, technical processes employed, and approval roles vary substantially among states. Although cognizant of the benefits associated with preparing design exceptions, some states are concerned about the level of resources (i.e., agency personnel, funds, and time) used in the process. This report describes the range of design exception practices among STAs and the problems and suggested improvements based on the experience of state agency personnel.

The synthesis is based primarily on information derived from a survey of design engineering managers and a review of agency design exception procedures. A survey questionnaire was distributed to the transportation agencies of all 50 states and the District of Columbia. Forty-six completed surveys were returned. The written design exception procedures of 30 STAs were also obtained and reviewed. Approximately 25 agencies were contacted by telephone or e-mail for clarification of the survey responses and for supplemental survey information. A literature search on the topic was also conducted. As a result, a small number of relevant research publications were identified and are summarized.

Chapter one provides background information on the design exception process, including its connection to the federal-aid highway program and the basic requirements that pertain to all states. In chapter two, the variations in the number of design exceptions processed by STAs and the underlying reasons are explored. The number of design exceptions prepared annually by STAs ranges from one to approximately 500. Some of this variation is attributed to the basic characteristics of states and their capital construction programs. Another cause of the variance in the number of design exceptions prepared by agencies is the factors an agency uses to determine if a design exception is needed. STAs were found to have used the following project and policy factors differently:

- Project location/system,
- Project funding source,
- Project scope/type,
- Supplemental criteria (i.e., in addition to FHWA controlling criteria),
- STA criteria values higher than those of AASHTO, and
- Use of rehabilitation, restoration, or resurfacing (3R) criteria.

This chapter indicates how STAs responding to the survey use each of these factors in determining if a design exception is needed. Additionally, the controlling criteria for which design exceptions are most often prepared are reported.

Chapter three addresses how design exceptions are prepared by STAs. Most STAs weigh the same factors (e.g., right-of-way, environmental, and cost) in the design exception process. Consideration of the safety consequences is also a practice common to STAs. However, the types of information collected and the analysis tools used to conduct safety assessments are highly variable; the breadth of these practices is summarized. The most specific procedures related to safety analysis are identified and recapped. Organizational roles in the preparation, review, and approval of design exceptions are reported. Generally, the consultant or agency designer is responsible for preparing the basic design exception documentation and request. Depending on the particular STA, the request may be reviewed by higher-level functional units, administrators, or committees prior to submission to the deciding official. Most STAs approve design exceptions in their organizational headquarters; however, five have delegated this approval to their geographic-based (i.e., district, division, or regional) offices. The FHWA role in design exceptions also varies and is generally described in a written agreement between the STA and FHWA division office. In general, the design exception approval role of the FHWA is for selected projects on the National Highway System.

Chapter four summarizes the views of STA survey respondents regarding benefits, difficulties, and potential improvements. Reduction of tort liability is often mentioned as a reason to document deviations from design criteria. Published research on the relationship of tort liability and design exceptions is synthesized and the results of the STA survey on this topic are reported. STA personnel were asked in the survey to reflect and comment on their experience with design exceptions. The most frequently identified problems are lack of documentation for a requested exception and inadequate guidance on preparing documentation. The time and effort needed to prepare design exceptions and tardy submissions were also noted as problems. The area of most needed improvement is guidance for preparing documentation.

Chapter five provides conclusions on design exception volumes and decision factors; data collection and analysis procedures; organizational roles; benefits, problems and potential improvements, and unique processes; and outlines suggested research.

This synthesis report includes examples of innovative design exception practices by the Wisconsin and New Jersey Departments of Transportation. Both STAs use programmatic design exceptions.

The synthesis also contains five appendixes. Appendix A is an excerpt from the Federal-Aid Policy Guide relevant to design exceptions. The survey questionnaire is included as Appendix B and the survey results are included as Appendixes C and D. Appendix E contains design exception content and format guidance (e.g., templates, formats, and checklists) used by 12 STAs and 2 sample design exceptions from the Ohio DOT's guidance.

CHAPTER ONE

INTRODUCTION

BACKGROUND

All state transportation agencies (STAs) routinely develop designs and prepare plans for highway and street construction projects. Each STA is guided by a collection of design standards and policies, the purpose of which is to provide a safe, operationally efficient, and economical facility. For various reasons, it is not always practical or desirable that a project meets each and every design criteria and standard. For example, a design that meets all criteria may be extraordinarily expensive or impose severe community impacts. The decision to deviate from an applicable criterion is referred to as a design exception. Before making such a decision, design alternatives and their associated ramifications are evaluated through a deliberative process. The possible safety consequences of design exceptions are a concern to many designers. A study was conducted of design exceptions that were approved for projects on existing roadways in Kentucky (*1*). The analysis showed that crash rates at the project locations after construction were not higher than before construction.

In the United States, many road and street design practices have a connection to the federal-aid highway program, which is a partnership between the STAs and the FHWA. Under this program, federal funds are apportioned to each state for eligible activities (e.g., engineering and construction) subject to compliance with certain federal policies, one of which relates to design exceptions. The FHWA provides both regulatory (compulsory) and nonregulatory direction on design exceptions. This information can be found in the *Federal-Aid Policy Guide* (*2*), the relevant section of which is included as Appendix A of this synthesis. Under this regulation, a project that does not conform to applicable criteria may be approved when warranted. This is patently reasonable but very general; the nonregulatory supplement provides additional definition in several areas. The FHWA has established minimum design criteria for projects on the National Highway System (NHS), which includes the entire Interstate system. These criteria are included in *A Policy on Geometric Design of Highways and Streets* ("Green Book") (*3*). The Interstate system has several additional design criteria, which are included in *A Policy on Design Standards—Interstate System* (*4*). As noted in the next paragraph, there are certain exceptions to the applicability of these criteria. The Green Book provides criteria, guidance, and discussion on many design related topics, not all of which are equally critical. In the nonregulatory supplement of the *Federal-Aid Policy Guide* (*2*), the FHWA indicates that "[a]lthough all exceptions from accepted standards and policies should be justified and documented in some manner, the FHWA has established 13 controlling criteria requiring formal approval." Through this regulation and guidance, the FHWA has established certain requirements with respect to design policy and design exceptions; however, their scope and applicability are limited. As outlined in subsequent paragraphs, STAs hold considerable discretion on these matters as well.

Individual states may develop design standards and secure FHWA approval for nonfreeway NHS 3R (resurfacing, restoration, and rehabilitation) projects (see the Terminology section of this chapter for further information). Upon approval, these standards may be used in lieu of Green Book criteria on applicable projects. For preventive maintenance projects, the FHWA does not require design exceptions for retention of existing features that do not conform to current criteria. Design criteria for non-NHS facilities are established solely by STAs. A STA may adopt design criteria that are equal, lower, or higher than those in the Green Book for federal-aid, non-NHS projects. The decision to deviate from these non-NHS criteria is also a matter of STA discretion. States decide how to handle policy deviations that are not among the 13 controlling criteria and whether or not to develop 3R standards. STAs also set design policy and design exception procedures for non-NHS facilities.

Each STA has a unique operating environment. The prevailing conditions within individual states and the latitude that exists under the federal-aid program have led to considerable variation in the volume of design exceptions processed by states, the methods employed, and the level of detail provided in agency procedures. For example, several STAs estimated that on average they prepare one or two design exceptions annually; the California Department of Transportation (Caltrans) estimated its annual number at 500. Several states include their entire design exception guidance in 4 or 5 pages, whereas the New Jersey Department of Transportation (DOT) draft *Design Exception Procedures Manual* (*5*) is 46 pages plus 38 pages of appendices.

OBJECTIVES AND FOCUS

Design exception practices among states vary widely. Agencies differ in their approaches to determining if a design exception is needed and in how design exceptions are prepared. This synthesis

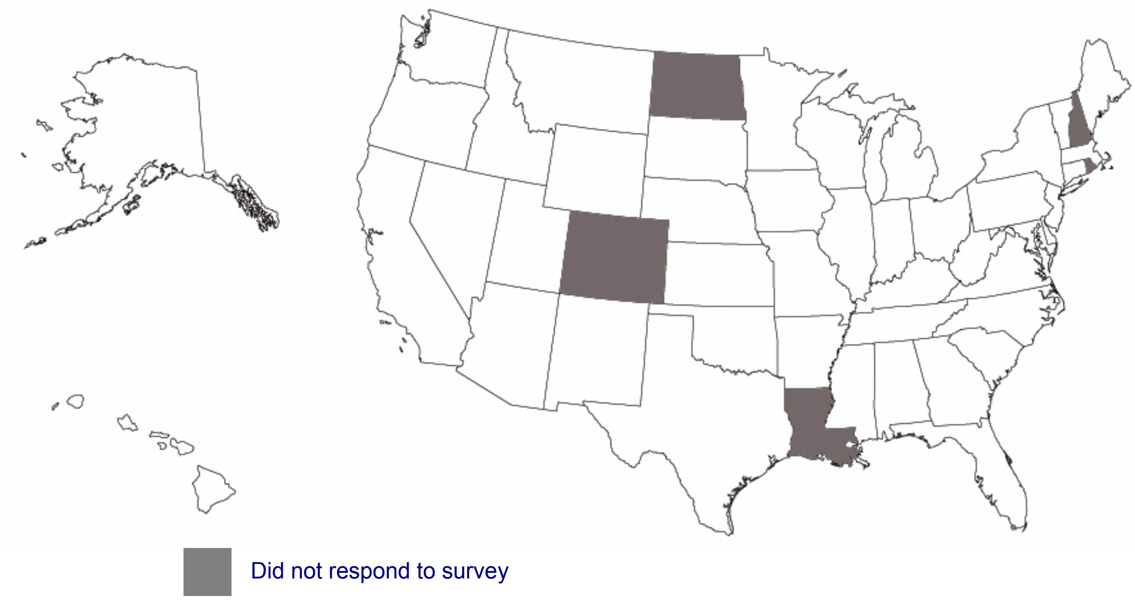

FIGURE 1 State transportation agencies responding to survey.

- Characterizes dominant and unique practices in the areas of
  - Conditions that require a design exception,
  - Data collection and analysis techniques, and
  - Internal STA and external roles;
- Reports on the benefits and problems experienced by STAs; and
- Identifies suggestions for improving and streamlining the design exception process.

Additionally, the innovative practices of two states have been identified and summarized.

REPORT BASIS, ORGANIZATION, AND SCOPE

This report is based primarily on information made available from transportation agencies. A survey was distributed to all STAs and the District of Columbia, Division of Transportation. Of the 51 surveys distributed, the transportation agencies of 45 states and the District of Columbia returned completed questionnaires. These 46 agencies will be referred to as the "responding STAs" (for purposes of this synthesis, the District of Columbia is regarded as a state) and are identified in Figure 1 (areas not shaded). The survey questionnaire is included as Appendix B. Most STAs have written procedures for processing design exceptions. Through a request in the survey and by other means (e.g., a search of STA websites) procedures from 30 states were obtained. The state procedures reviewed are listed in Table 1. Where STA design exception procedures could be located via the World Wide Web, the Universal Resource Locator (URL) is included. Approximately 25 agencies were contacted by telephone or e-mail for clarification of the survey responses and supplemental information. In addition, a search of published research on design exceptions was conducted. Although the yield from this search was limited, pertinent literature is also summarized in this report. This synthesis covers documented deviations from all geometric design criteria. Primarily, it reports on the 13 "controlling criteria" (identified subsequently in this chapter), but also includes information on supplemental criteria for which some STAs prepare documentation.

TERMINOLOGY

The general concept of a design exception has a consistent meaning across the United States. However, definitions, implementation processes, and operational guidance vary widely among STAs. In the interest of effective communication with the surveyed population, panel, and readership, key terms are defined here. These definitions for design exception and controlling criteria were also included in the survey questionnaire to ensure consistency between survey respondents and synthesis results.

Controlling criteria—The following 13 elements identified by the FHWA in the *Federal-Aid Policy Guide* as requiring formal design exceptions:

- Design speed,
- Lane width,
- Shoulder width,
- Bridge width,
- Structural capacity,
- Horizontal alignment,
- Vertical alignment,

TABLE 1
STAs PROVIDING DESIGN EXCEPTION DOCUMENTATION

State	Universal Resource Locator (URL)
Arizona	http://www.dot.state.az.us/ROADS/rdwyeng/updates/design_memos/reader/Design_Exceptions_and_Design_Variations.pdf
California	http://www.dot.ca.gov/hq/oppd/pdpm/chap_pdf/chapt21.pdf
Connecticut	http://www.dot.state.ct.us/bureau/eh/ehen/desserv/hdm/page2.htm (Section 6-6.0)
Florida	http://www11.myflorida.com/rddesign/PPM%20Manual/2003/Print%20PPM/By%20Chapter/Volume%201/V1Chap23.pdf
Georgia	http://www.dot.state.ga.us/preconstruction/consultantdesign/topps/pdp-2000.doc (See page 83)
Hawaii	No URL
Kansas	No URL
Maine	No URL
Massachusetts	http://www.state.ma.us/mhd/publications/downloads/design.pdf (Chapter 8)
Michigan	http://www.michigan.gov/documents/locagguidlin_16698_7.PDF (Section E)
Minnesota	http://www.dot.state.mn.us/tecsup/xyz/plu/desstand/highway/highway.doc
Mississippi	No URL
Missouri	No URL
Montana	No URL
Nebraska	No URL
New Jersey	No URL
New Mexico	No URL
New York	http://www.dot.state.ny.us/cmb/consult/hdmfiles/chapt_02.pdf (Sections 2.6 through 2.8)
North Carolina	No URL
North Dakota	http://www.state.nd.us/dot/docs/Chapter1.pdf (Section 06.06)
Ohio	No URL
Oklahoma	No URL
Pennsylvania	ftp://ftp.dot.state.pa.us/public/Bureaus/design/PUB10A/Appendix/Append-F.pdf
Tennessee	No URL
Texas	http://manuals.dot.state.tx.us/dynaweb/coldesig/pol/@ebt-link;pt=723?target=IDMATCH(id,bac0086);book=pol
Utah	http://www.dot.state.ut.us/esd/Manuals/DesignProcess/FormsTable.htm (See "Instructions For Completing Request For Design Exception Form," "Request For Design Exception Project Information," and "Exceptions to FHWA's 12 Critical Elements")
Vermont	No URL
Virginia	http://www.extranet.vdot.state.va.us/locdes/electronic%20pubs/iim/IIM227.pdf
West Virginia	No URL
Wisconsin	No URL

- Grade,
- Stopping sight distance,
- Cross slope,
- Superelevation,
- Vertical clearance, and
- Horizontal clearance (other than clear zone).

Design Exception—The process and resulting documentation associated with a geometric feature created or perpetuated by a highway construction project that does not conform to the minimum criteria set forth in the standards and policies. This includes what some may refer to as design exemptions.

3R—Resurfacing, restoration, and rehabilitation work, which includes placement of additional surface material and/or other work necessary to return an existing roadway, including shoulders, bridges, the roadside, and appurtenances to a condition of structural or functional adequacy (*2*).

Reconstruction—Rebuilding an existing roadway or structure in the same or approximate location.

The term "design exception," is herein assigned a more comprehensive definition than is sometimes the case. Not all design criteria are of equal criticality. Some STAs have established two or three levels of criteria and corresponding processes for documenting deviations. For example, Caltrans has established mandatory and advisory criteria. Some STAs refer to departures from noncontrolling criteria by distinct terms such as "waivers," "variances," or "exemptions." Other states use the term design exception whether or not it pertains to a controlling criterion. This synthesis reports on documented deviations from all geometric design criteria, but focuses on the 13 controlling criteria.

The terms "accident" and "crash" are both used in this report without distinction. When a particular agency's procedure or process is described, this report uses the term used by the agency.

CHAPTER TWO

CONDITIONS AFFECTING DESIGN EXCEPTION ACTIVITY LEVEL

This chapter examines the number of design exceptions prepared by STAs and the factors that influence this magnitude. The discussion focuses on the conditions used by various STAs to determine if a design exception is needed.

The operation of a STA is influenced by the budget, climate, population, and travel patterns of the state, along with organizational characteristics such as jurisdictional responsibilities and organizational structure. These factors vary widely. For example, the Texas DOT is a decentralized organization with 25 district offices. In 1999, the Texas DOT was responsible for 79,164 miles of highways and disbursed $4.5 billion. In the same year, the Rhode Island DOT had 1,229 miles of roads and $316 million in total expenditures while operating through a centralized organization (*6*). The setting of a project often influences design complexity. Nationally, 14.2% of STA-owned road mileage is within urbanized areas. However, 100% of District of Columbia roads are urban, whereas 2.1% of the mileage under North Dakota DOT jurisdiction is urban (*7*). Given the wide-ranging characteristics of states and the latitude that STAs are afforded under the federal-aid program, it is to be expected that design exception practices also vary. To attain an estimate of the quantity and range of design exception activity, STAs were asked to indicate the number of design exceptions processed in a typical year as part of the survey. Figure 2 summarizes the results.

These results provide a quantitative profile of the range in design exception activity among states and confirm the large variance. Many respondents provided a range (e.g., less than 100 or 12 to 18) or clearly stated the estimate was not based on a review of numerical data. One-half of responding STAs (23 of 46) indicated that they maintain a centralized record of all design exceptions.

For various reasons, more exceptions are made to some design criteria than others. STAs were asked to list the criteria for which design exceptions are most often prepared. Figure 3 indicates the number of STAs that identified various controlling criteria. STAs were asked about the influence of context-sensitive design. Only 20% (9 of 46) indicated that the advent of context-sensitive design has increased the number of design exceptions they prepare.

McGee et al. (*8*) conducted a survey of STAs to determine the design features for which deviations are most often sought. The results are shown in Table 2. It is noted that Figure 3 and Table 2 have numerous common geometric design elements, but also several that are not.

Each STA also develops a set of factors that influence the number of design exceptions it prepares. These decision factors are generally related to risk management, legal requirements, and interagency relationships. Consequently,

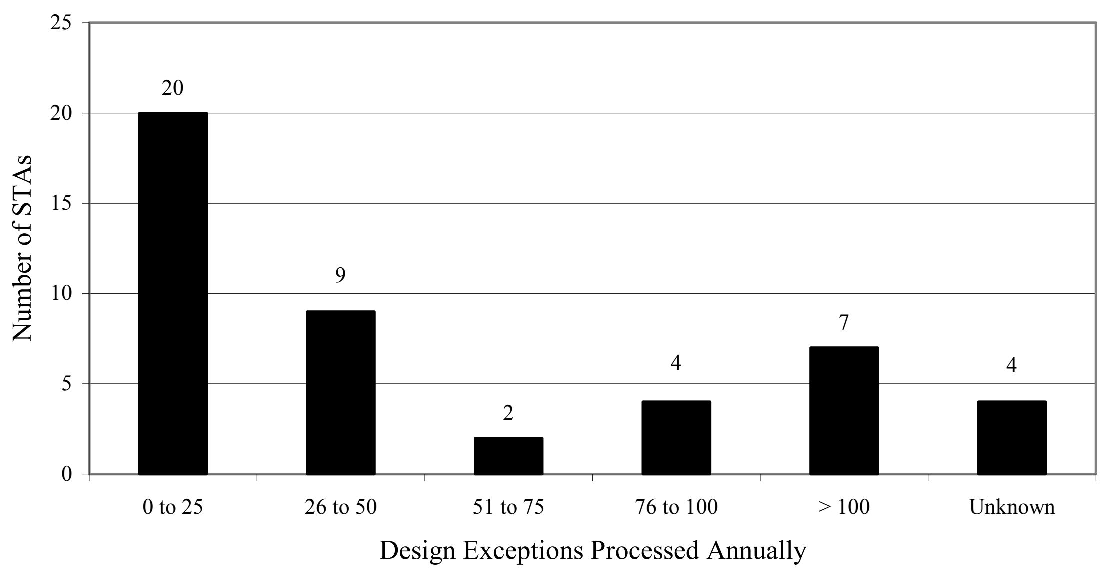

FIGURE 2 Number of STAs processing various volumes of design exceptions annually.

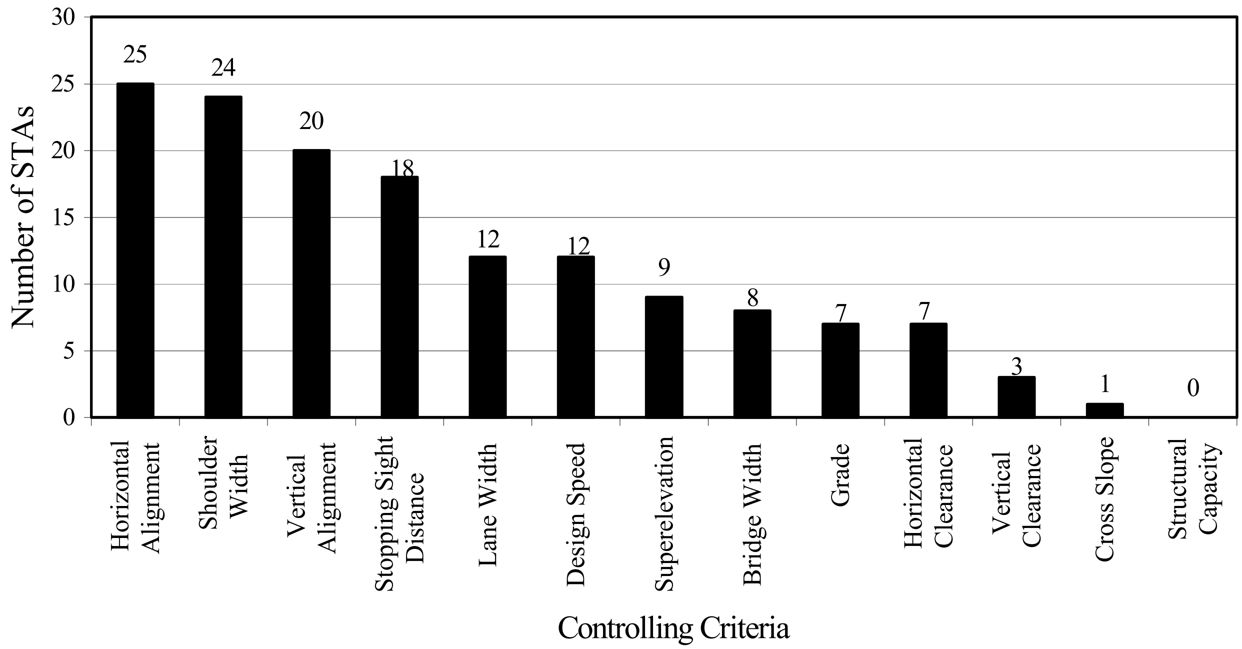

FIGURE 3 Number of responses identifying controlling criteria as a commonly occurring design exception.

TABLE 2
STA RESPONDENTS IDENTIFYING VARIOUS DESIGN ELEMENTS AS FREQUENTLY REQUIRING DESIGN EXCEPTIONS

Design Element	Responses (%)
Shoulder width	53
Vertical alignment/curvature	33
Lane width	31
Horizontal alignment/curvature	28
Stopping sight distance (alignment related)	19
Bridge width	17
Maximum grade	17
Clear zone	14
Sideslope	14
Lateral clearance	11
Superelevation	11
Reduced design speed	8

a set of design conditions may require a design exception under the procedures of one STA but not another. The survey of STAs was designed to determine the extent to which the following factors are used to determine the requirement for a design exception:

- Project location/system,
- Project funding source,
- Project scope/type,
- Supplemental criteria (i.e., in addition to FHWA controlling criteria),
- STA criteria values higher than AASHTO, and
- Use of 3R criteria.

A number of classification systems are applied to the nearly 4 million miles of public roads in the United States. Functional classification (i.e., arterial, collector, and local roads), federal-aid eligibility (Interstate Highway, NHS, and federal-aid roads), and state-owned roads are examples of classification systems. The classification system may imply a level of interest or responsibility by a particular agency. Through the survey it was determined that 72% of states (33 of 46) do not consider where a project is located (i.e., on which system) in deciding if a design exception is needed.

STAs design and review projects funded from one source, or a mix of federal, state, local government, and private (e.g., developers) sources. Nearly 87% of STAs (40 of 46) do not consider the funding source in determining the need for design exceptions.

There are a myriad of road construction project types, ranging from new construction to maintenance. Some project types are programmed to address or rectify a specific roadway element (e.g., signing, lighting, surface restoration, guardrail installation, bridge rehabilitation or replacement, and spot improvement). States differ on the use of project scope in determining the need for a design exception; 30 responding STAs consider project scope and 16 do not.

TABLE 3
SUPPLEMENTAL CRITERIA USED BY MORE THAN ONE STA

Supplemental Criterion	No. of STAs
Cut/fill slopes	4
Roadside features, including culverts	3
Median width	3
Guardrail	2
Level of service	2
Median opening spacing	2
Intersection sight distance	2
Ramp lengths	2

The *Federal-Aid Policy Guide* (*2*) identifies 13 controlling criteria, deviations from which require formal approval. However, an STA may apply the same or similar review and approval process when departing from other (i.e., noncontrolling) criteria. In this synthesis, criteria that require written documentation, if not achieved but not listed among the FHWA-designated controlling criteria, are referred to as supplemental criteria. Approximately 33% of responding STAs (15 of 46) have supplemental criteria. Some STAs refer to deviations from supplemental criteria as design exceptions and others use a distinguishing term (e.g., waivers or exemptions). Consistent with the definition noted in chapter one, all nonconforming geometric features and associated documentation are referred to as design exceptions in this synthesis. A large number of supplemental criteria were identified through the survey. Table 3 indicates those identified by more than one STA. The complete list of supplemental criteria submitted by STAs through the surveys is included in Appendix D as the response to question 5. The Missouri DOT has six supplemental criteria, the most of any responding STA.

Using its authority to establish design standards for the NHS, the FHWA has designated AASHTO Green Book values as minimums for controlling criteria. States may establish design standards higher than the AASHTO minimums. The survey results indicate that 53% of responding STAs (24 of 45 answering this question) have some design criteria that are higher than AASHTO's. Of these 24 states, 20 prepare design exceptions if a design meets AASHTO, but not the higher, state-established criteria.

As outlined in the previous chapter, states may develop their own 3R standards. Following FHWA approval, these standards may be applied to nonfreeway NHS projects in lieu of those applicable to new construction and reconstruction projects. Nearly 87% of responding STAs (40 of 46) have FHWA-approved 3R standards. These 3R standards were developed so that existing highways do not have to meet current, new construction criteria to extend their service lives. Three of the 40 STAs with 3R standards indicated they process design exceptions when the design does not meet new construction criteria. The other 37 only process design exceptions when they do not meet 3R standards.

Many STAs have adopted context-sensitive design principles in recent years. The survey was used to determine the effect of context-sensitive design on the number of design exceptions being prepared. Approximately 20% (9 of 46) of responding STAs indicated that design exceptions have increased, or are expected to increase, as a result of implementing context-sensitive design.

As noted previously, the characteristics of states served by their transportation agencies vary substantially. Additionally, STAs make different choices and interpretations in establishing conditions that trigger the requirement to document deviations from design policy. Significant differences are noted in how project characteristics (i.e., location, funding, and scope) trigger design exception requirements. The survey and review of STA procedures also indicates substantial diversity of state agency choice on supplemental (noncontrolling) criteria and the establishment of design criteria exceeding Green Book values

CHAPTER THREE

PROCESSES AND RESPONSIBILITIES FOR PREPARING DESIGN EXCEPTIONS

This chapter addresses how design exceptions are prepared. The process concludes when a decision maker, after due consideration to all project conditions, approves a project design that does not conform to the minimum criteria. Prior to that point, pertinent information and analysis are prepared and routed to reviewers within the STA. In some cases, other transportation agencies are also involved in the design exception process. The types of information collected and the roles of participants are described in this chapter.

Decisions regarding design exceptions must be justified. Restrictive rights-of-way, construction costs, and environmental impacts are frequently used as justification. Design exceptions must also assess how safety and operations will be affected by their implementation. The effect of a design exception on some factors, such as traffic operations and construction cost, are amenable to quantitative estimation using well-established techniques. Significant differences were found in how STAs evaluate and mitigate the safety effects of design exceptions. This chapter will summarize the information collection and analysis practices used by STAs, with a focus on safety-related topics.

INFORMATION AND ANALYSIS

The findings reported in this section are derived from two sources, responses to the survey and a review of STA design exception procedures. Through survey question 23 (see Appendix B), STAs were asked to estimate the frequency that various data items were collected as an initial step in processing design exceptions. The survey listed six items and invited the identification of other data elements. Table 4 summarizes the results of STA responses to the listed items.

In addition to the items included in Table 4, both the survey and review of state procedures revealed other data items that are frequently collected such as

- Statewide crash rates for similar facilities,
- Conditions on adjacent roadway sections, and
- Future (programmed) projects.

This list is based on a combination of the survey responses and written procedures. In some cases, these information sources were not in agreement. A judgment was made on whether the survey or written procedure was more reliable. For example, only one survey response indicated that statewide accident rates were collected. However, 33% (10 of 30) of the STA written procedures reviewed called for the use of a statewide crash rate or similar base (e.g., expected rate). If this data element were listed in question 23, many respondents probably would have indicated its use. In this case, the written procedures are considered more reliable.

The widespread use of collecting crash data reported in the survey was reinforced by STA design exception procedures. Of the 30 STA written procedures reviewed, 87% (26 of 30) indicated that accident data shall be included in the documentation or used in its preparation. In some cases, the written guidance is limited to a call for "crash history" (or similar words); others are more specific. For example, the North Carolina DOT specifies inclusion of a "3-year accident history (number, type, rates, severity, cause, comparison to statewide averages, etc.)."

Some of the information needed to assess a design exception can be determined and characterized easily. For example, identifying the right-of-way requirements associated with a particular design is generally straightforward.

TABLE 4
FREQUENCY THAT STAs INDICATE THEY COLLECT VARIOUS DATA

Type of Information	STAs That Routinely (or always) Gather	STAs That Occasionally Gather	STAs That Infrequently (or never) Gather
Accident history in project limits	39	6	
Accident severity information	30	10	5
Collision/condition diagrams	11	21	12
Cost to cure (construction to standards)	33	6	6
Skid number data	6	9	28
Traffic volume data	38	5	1

TABLE 5
FREQUENCY THAT STAs INDICATE THEY USE VARIOUS ANALYSIS TECHNIQUES

Type of Analysis	STAs That Routinely (or always) Use	STAs That Occasionally Use	STAs Infrequently (or never) Use
Accident modification factors (other accident prediction model)	5	13	27
Accident trends (e.g., history or occurrence indicators)	24	9	13
Before–after studies	1	16	28
Classic statistical methods (rank/rate)	10	11	23
Collision/condition diagrams	10	19	16
Cost-benefit analysis	16	18	11

Existing right-of-way limits are often directly retrievable from STA records and additional requirements (i.e., acquisition) are identified on plans. This information is developed whether or not a design exception is proposed. Environmental (i.e., community, historic, and natural resource) impacts are also routinely evaluated during project development and no special techniques are needed for projects with design exceptions. However, consideration of safety requires special attention when a design exception is involved. FHWA's Non-Regulatory Supplement (*2*) states "exceptions should not be approved if the exception would result in degrading the relative safety of the roadway." Of the 30 STA procedures reviewed, all but one call for an assessment of how the design exception may affect safety. The methods and depth of guidance on conducting an assessment vary widely among states.

The survey (question 24) asked each STA to identify the analysis tools they use to evaluate design criteria elements and the frequency of their application. Table 5 summarizes the responses of safety-related analysis methods. The listed items were those identified in the survey questionnaire. STAs were also asked to identify other analysis techniques. Although numerous items were submitted as "write ins," no single item was identified by more than one STA. The complete set of supplemental items related to analysis tools is included in Appendix C.

Written STA design exception procedures include varying degrees of information on the method(s) that should be employed in conducting a safety assessment of the exception. Some of the procedures reviewed provided no information on safety assessment methodology (these states may have guidance in a separate document that was not provided or retrieved). Many written procedures call for utilization of accident data without further guidance. For example, the Connecticut DOT's written procedure indicates that design exception documentation should include sufficient information to demonstrate the "impacts on safety (i.e., accident history)." Summaries of more detailed STA guidance on crash data analysis are included here.

California—An analysis of accident data is included to identify prevalent accident types and causes. The analyst is advised to "keep in mind that although terms like 'excessive speed,' 'inattention,' 'failure to yield right of way,' 'under the influence,' etc., are perfectly valid for CHP (California Highway Patrol), they have meaning for the highway engineer only as they relate to underlying highway characteristics." A summary is provided on how the proposed project will alleviate identified safety problems; or as a minimum, how it will not contribute to any increase. The analysis is based on evaluation of Caltrans' Accident Surveillance and Analysis System statistical data applied to both the number and severity of accidents and actual versus statewide average accident rates. This is supplemented by stating "actual" versus "expected" accident rates (*9*).

Florida—Crash locations are depicted graphically; locations, type, and severity are related to the design exception element. The impact of the proposed criteria is characterized with an annualized value of expected economic loss associated with crashes. A benefit/cost analysis is prepared to estimate the cost-effectiveness of correcting or mitigating a design feature that does not meet criteria. The benefit is the expected reduction in future accident costs using monetary cost-per-accident values from the FHWA Technical Advisory, *Motor Vehicle Accident Costs* (*10*). The process also relies on selection of a crash reduction factor, discount rate (currently 7%), construction and maintenance costs, and analysis period (*11*).

Hawaii—A 3-year accident history for the project is prepared and accident causation is evaluated using basic highway–vehicle interactions. The specific causes identified are inadequate superelevation and/or signing, high-volume turning movements without separate turning lanes, and a concentration of rear-end sideswipe accidents in a particular lane (*12*).

Nebraska—"A statement comparing the project's accident history to the statewide average for comparable routes is not sufficient analysis of the design exception's effect on project safety. 'Sufficient analysis' should include more than the accident history and/or history of the project. The project should include locating or identifying hazardous locations, accident clusters, or accident trends within the project limits" (*13*).

New Jersey—The analysis includes the accident history of the most recent 3-year period, the overall accident rate, and the statewide average accident rate for highways of similar cross sections. For each controlling criteria deviation "accident indicators" are listed. These are accident types associated with the design feature for which the design exception is being evaluated (*5*).

New Mexico—The design exception documentation identifies prevalent accident types and relates them to existing and proposed design features (*14*).

Ohio—The documentation relates the 3-year accident history to the deviation. Where accident patterns are noted, the relationship to geometric features should be studied and discussed (*15*).

Pennsylvania—A safety study is conducted based on a 3-year crash history. Collision diagrams are included when appropriate. Crash clusters within project limits are identified. Crash rates within project limits are compared to statewide averages. A narrative description is prepared on the foregoing and differences in crash remediation between the project with and without the design exception (*16*).

Wisconsin—Crash data from a 3-year period is obtained and divided into property damage, injury, and fatality types when pertinent. Crash reports are reviewed as necessary and high hazard locations identified. Overall project accident numbers and rates are found and compared with the statewide average for the type of facility. The numbers and severity (fatal, injury, and property damage) of accidents attributable to each individual substandard feature are provided (*17*). Additionally, the Wisconsin DOT has developed a programmatic design exception process for 3R projects based on crash records and their correlation to geometrics (*18*). A summary of this process is provided in chapter four.

Through the literature search, a method described as the Iowa Design Exception Process was identified (*19*). Developed by the Iowa DOT in 1985, the process is used to review requests by local public agencies for variances from current design criteria. It is not used for projects designed by the Iowa DOT. The method involves a benefit/cost analysis approach for assessing accident experience. Procedurally, the steps include the collection of accident information, the cost to bring a design element up to current guidelines, and the calculation of the benefit/cost ratio. Estimated accident or accident severity reduction is determined using modification factors for a specific design feature. The Iowa Design Exception Process has been used for reconstruction and 3R projects, with most requests for an exception for 3R projects.

Another methodological issue relates to multiple design exceptions within a single project. It is not uncommon to deviate from more than one distinct criterion (e.g., bridge width and superelevation) or to deviate from the same criterion at several locations on the same project. The survey queried STAs on their practice in these cases. When two or more *different* criteria are not met within the same project, 76% (35 of 46) of responding STAs analyze each feature separately, 20% (9 of 46) analyze the features collectively, and 4% (2 of 46) may analyze the features separately or collectively, depending on the circumstances. When the *same* criteria are not met at several different locations, 59% (27 of 46) of responding STAs reported analyzing each instance separately, 35% (16 of 46) the deviations collectively, and 7% (3 of 46) may investigate singly or collectively.

Mitigation measures counterbalance the operational and/or safety effect of deviating from design criteria. Of the 30 STA design exception procedures reviewed, 70% (21 of 30) specify that information on mitigation (or safety enhancements) be included in the design exception documentation. Although most do not, several STA design procedures provide guidance on selecting appropriate mitigation measures. In a design publication that applies only to non-NHS local agency projects, the Michigan DOT provides a list of candidate Supplemental Safety Measures that can be considered for various Geometric Concerns (e.g., narrow bridge and sharp horizontal curve) (*20*). Of the 30 STA design exception procedures reviewed, the New Jersey DOT's provide the most comprehensive treatment of mitigation (*5*). A list of candidate safety measures is provided for each controlling criterion. The Pennsylvania DOT provides a list of sample mitigation measures, but does not relate them to particular geometric deficiencies (*16*). The Wisconsin DOT indicates that low-cost mitigation features such as improved signing and marking and delineation should be included in projects. The Wisconsin DOT has also developed and published a written process for Programmatic Exception to Standards. This procedure includes a list of Geometric Deficiencies and corresponding Alternate Safety Mitigation Measures (*18*).

Mitigation measures for various design deviations were identified by means of the survey and they are tabulated in Appendix D (question 38).

Designers require certain information about site conditions. Comprehensive field surveys are conducted for some projects, whereas for others it may be feasible to acquire the necessary information through less costly methods and sources. Typically, construction on new alignment requires detailed surveys. The responses to the questionnaire indicate that for 3R projects STAs use field surveys and as-built drawings in nearly equal proportions for horizontal and vertical alignment information. Field surveys are the dominant means for collecting cross-section information and most completely meet the needs of designers for all types of field information (i.e., vertical alignment, horizontal alignment, and cross section). Other information sources and collection methods (e.g., roadway inventory and photogrammetry) are used less frequently. The complete results of the survey on this topic are included in Appendix D, response to question 10.

PREPARATION, REVIEW, AND APPROVAL ROLES

This section covers the design exception process flow, which includes the identification of a deficient feature, preparation of the request, review, and approval. Roles internal and external to STAs are described.

The potential for a design exception usually manifests itself when pertinent design criteria are applied to a project and a "problem" results. The problem may be extraordinary costs, displacements, natural resource impacts, or community disruption. Options that avoid or minimize the negative consequence(s) are evaluated. If the preferred design includes a feature that does not meet criteria, the design team will be aware of this and initiate the design exception process. However, there are other circumstances when a design criterion is inadvertently overlooked. Undetected, this will lead to the creation or perpetuation of a design deviation without the deliberative decision making of the design exception process. The frequency of this occurrence can be reduced by independent reviews (i.e., performed by someone not on the project team). It was determined that 22 responding STAs perform independent reviews to determine compliance with criteria and 24 do not.

Someone closely associated with the project (e.g., designer or project engineer) prepares the design exception documentation. For consultant-designed projects, 89% (41 of 46) of responding STAs indicated that collecting information and preparing the analysis are consultant functions. For the other five STAs, agency staffs perform these tasks. Following preparation of the request, it is passed on for review and approval.

None of the 46 STAs responding to the survey indicated that design exceptions are reviewed or approved by the same person preparing the documentation. Review roles vary widely, which is partially a result of each STA's unique structure and operating environment. Nearly 72% (33 of 46) of STAs indicated that the organizational unit approving the design exception is different than the one preparing it. A design bureau and/or some type of committee review design exceptions in more than 30 of the responding STAs. Table 6 indicates the location of its design function and design exception review and approval roles for a sample of STAs.

Nineteen of the responding STAs have decentralized design functions, meaning that projects are designed in geographic-based (i.e., district, division, or regional) offices. Of these 19, 14 approve all design exceptions at headquarters. Some of the design exceptions prepared by the Nebraska Department of Roads are reviewed by legal counsel. Nebraska was the only state reporting this practice. The responses to question 22 (Appendix B) indicate the predominant types of reviewing organizations and officials within STAs.

Other agencies may also be involved in the approval of design exceptions. The FHWA has a division office in each state and tailors its relationship to the unique characteristics of its corresponding STA. Law establishes the broad parameters of the relationship, but there is latitude on many issues and the specific interagency operating procedures are developed and committed to writing in a stewardship agreement (or exemption agreement). Because design exceptions are required under federal regulation, they are generally covered by stewardship agreements. Of the 46 STAs that returned surveys, all but one (District of Columbia) reported that approval of design exceptions is covered by their stewardship agreement. As previously noted, the FHWA role in design exceptions is subject to some discretion. The Alaska DOT (which has no Interstate highways) is the only STA of the 46 respondents indicating that the FHWA has no approval authority for their design exceptions. Based on survey results, the FHWA has approval authority for some Interstate project design exceptions in 45 of 46 responding states and for some non-Interstate NHS projects in 29 of 46 states. Approval authority on the Interstate system and NHS is not necessarily associated with federal funding of the project. The FHWA has approval authority for some non-NHS projects in four states. Follow-up contact with STA representatives in Hawaii, Massachusetts, and Virginia indicate that the FHWA has an approval role for federally funded, non-NHS projects in those states above an established cost threshold. In Alabama, the FHWA approves design exceptions for non-NHS federally funded bridge projects with an estimated cost exceeding $5 million. The Idaho Transportation Department (ITD) has a unique arrangement with the FHWA. The ITD has a design exception committee and the FHWA is a member. Therefore, the FHWA reviews all design exceptions processed by the ITD, even though the FHWA may not have design approval authority for the project.

State transportation agencies sometimes work with local public agencies (LPA) on projects through different funding and jurisdictional arrangements. An LPA-administered project is a form of partnership wherein the local government agency is responsible for administering (e.g., design or construction procurement) a project with funding from state and/or federal sources. Table 7 summarizes the responses to question 16, which asked STAs to identify the final approval authority for LPA-administered project design exceptions.

TABLE 6
EXAMPLES OF STA OFFICIALS REVIEWING DESIGN EXCEPTIONS

State DOT	Design Function	Typical Design Exception Roles (may not apply to all projects) Reviewed by	Approved by
Connecticut	Centralized	Design exception committee	Transportation engineering administrator
Georgia	Centralized	Office of Engineering Services	Chief engineer
Idaho	Decentralized	Design bureau; design exception committee (roadway design engineer, state bridge engineer, and FHWA operations engineer)	Chairman of the design exception committee (roadway design engineer)
Maryland	Centralized	Division chief/office director	Deputy administrator
Minnesota	Decentralized	State geometric design engineer	State design engineer
Mississippi	Centralized	Roadway design division engineer	Chief engineer
Montana	Centralized	Consultant design section or road design supervisor	Preconstruction engineer
Nevada	Centralized	Design unit; safety and traffic units	Assistant director, engineering
New Jersey	Centralized	Design exception unit	Director, Division of Design Services
Pennsylvania	Decentralized	Design bureau; district safety committee	Director, Bureau of Design
Texas	Decentralized	Design exception committee of design division and district personnel	Chairman of the design exception committee (deputy director, design division)
Vermont	Centralized	Design exception committee	Secretary (or designee)
Virginia	Decentralized	District location and design engineer	State location and design engineer

TABLE 7
SUMMARY OF STA RESPONSES FOR LPA-ADMINISTERED PRODUCTS

	Final Approval Authority for Design Exception			
Project Funding	Local Agency	State	FHWA	Varies (e.g., by system, cost)
State aid, local match		35		3
Federal aid, local match	1	25	6	10
State and federal aid		27	3	10

Notes: LPA = local public agencies.

Design exception approval is a decision node and on the critical path to project completion. Consequently, STAs prefer to deal with design exceptions early. Some written STA design exception procedures address timing and others do not; however, this issue may also be addressed in other design-related publications. Of the design exception procedures reviewed that address timing, all encouraged prompt disposition. In some cases, the procedure was in the form of general encouragement; others were very specific. The Florida DOT indicates that "it is required that approval be obtained no later than initial engineering phase" (*11*). The reported practice of STAs also indicates early attention to design exceptions. The responses to survey question 25 (Appendix B) indicate more than one-half of the responding STAs complete the design exception process before or at the time of environmental clearance.

The preceding discussion assumes the use of conventional project development practice, in which the design process is controlled by the owner–agency. A small but increasing number of projects are procured through other means, such as design–build. Ten states responding to the survey indicated experience with design exceptions in connection with design–build projects. Caltrans' experience in this area has been in the role of overseeing transit and toll authorities; the other nine STAs responded from the perspective of owner–agency. The majority of these STAs indicated that the design exception process used for design–build projects is similar (or the same) as that used for conventional projects. For design–build projects, every effort is made to address design exceptions prior to development of the solicitation (i.e., the design–build request for proposals). Several STAs further indicated experience in processing exceptions following award of the design–build contract. No established process for this condition was reported.

Design exceptions tell the story of why a particular criterion could not be met in a particular location. The documentation typically characterizes the project setting and circumstances that make compliance with all criteria impractical. Preparation of the documentation is normally the responsibility of the designer. If a consultant has been retained for the design, most STAs will charge the consultant with preparing the primary design exception documentation. The completed design exception provides a permanent record of the relevant factors facing the decision maker. Much of this information (e.g., right-of-way impacts and cost estimates) is of the type produced even if the project includes no design exceptions. Nearly every STA design exception process calls for a safety assessment. The types of data and analytic techniques employed in the safety analysis assessment vary among STAs. Following its preparation, the design exception request is submitted to reviewing and approving officials for action. The number and type of reviewers vary among STAs. Within a particular state, the STA may involve the FHWA in all (Idaho), none (Alaska), or some design exceptions.

CHAPTER FOUR

AGENCY EXPERIENCE AND FEEDBACK

State transportation agencies have accumulated many years of institutional experience with design exceptions. This chapter reports on the associated benefits and difficulties, based primarily on responses to the STA survey. A literature search did not reveal any published research on the broad topics of design exception benefits, costs, or effectiveness. Potential improvements and innovative practices identified through the survey of STAs are also summarized.

REPORTED BENEFITS

Although none of the 46 responding STAs indicated that it ever conducted a study assessing the benefits of design exceptions, many respondents shared their observations and insights.

Nearly every survey respondent believes that preparing design exceptions is a worthwhile activity, not simply a matter of regulatory compliance. Nearly 94% (43 of 46) indicated that they would prepare design exceptions even if not required to do so by the FHWA. The reasons cited for preparing design exceptions are shown in Figure 4.

Of the 46 STAs responding to the questionnaire, 11% (5 of 46) have experience with design exception documentation being used in a tort suit. All indicated that design exception documentation was beneficial. One STA was more specific, indicating that the documentation was supportive of the defensive legal doctrine (i.e., immunity for discretionary actions). The Washington State DOT noted that although design exceptions increase tort exposure, adequate documentation decreases the risk.

Several publications were identified that address tort liability in highway design. Liability implications of design exceptions were part of a survey completed by Jones (*21*) in August 1996. The report addressed risk management for transportation programs employing written guidelines as design and performance standards. Examples were sought where the respondents indicated the implications of written justification for design exceptions and its resulting influence on a STA's liability. Deviations from policies, standards, and guidelines may be argued as some evidence of negligence, but as noted by Jones, nonconformance to a standard is not negligence per se.

Jones specifically addressed the effect of written justification (or lack thereof) on liability. It was reported that the failure to provide written justification for design exceptions was noted by 11 states as "influencing or may have influenced liability." His conclusions indicate that supporting written documentation should provide a brief and clear rationale justifying the exception. Additionally, written guidelines as design and performance standards should use

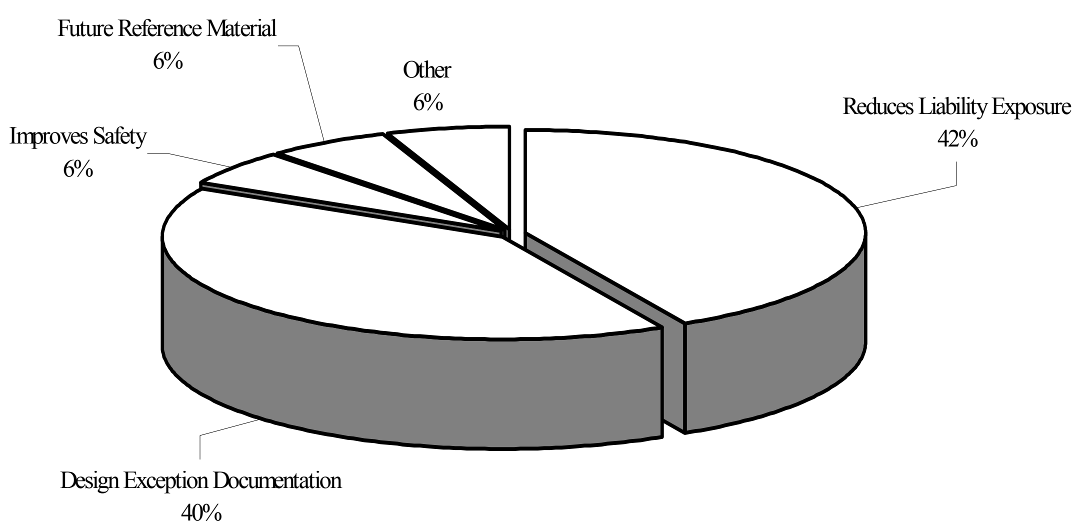

FIGURE 4 Distribution of design exception benefits identified by STAs.

permissive language to benefit from a defense of discretionary function. Ranges of alternative actions are preferable, and decisions and actions should be in writing and retained in a permanent file. Awareness of the potential liability associated with design exceptions requires that documentation be persuasive and demonstrate the exercise of reasonable care. Martin (*22*) recommends that other documentation reflect not only that the exception was justified after considering engineering aspects, but also that the resulting design is safe. The findings indicate that the number of lawsuits in which a design defect is alleged to be the proximate cause of an accident is not greater than the number of claims resulting from signing or maintenance issues. Regarding suits alleging design exceptions, the number of claims appears even smaller. Martin supports the Jones recommendations that engineering justification reports, although succinct, should completely describe the physical and environmental factors that make the exception necessary. Economic analysis as a principal argument is not advised; sound engineering judgment that assesses the resulting safety aspects will assist in defending potential tort suits.

REPORTED DIFFICULTIES

Although the design exception process is broadly supported, all 46 of the responding STAs identified one or more specific problems. The following are the most frequently reported difficulties:

- Lack of support for request—Twelve STAs reported problems with the adequacy of information and analysis. Specific concerns include improperly prepared estimates of the cost to cure, subjective analysis, and illogical conclusions.
- Resource requirements—Six states reported that developing and approving design exceptions is time- and cost-intensive. The Ohio DOT indicated that the process is cumbersome and provides little benefit for resurfacing projects.
- Inadequate guidance—Five respondents commented on policy and process documentation. Four STAs indicated submission requirements are not sufficiently clear. Two respondents noted a lack of clarity with respect to the FHWA controlling criteria. The Florida DOT commented on how the interpretation of “structural capacity” and “horizontal clearance” criteria has affected its design exception workload. Two respondents stated that submissions often do not comply with their written guidance.
- Timing—Five states indicated that requests made late in the design process are troublesome. One respondent characterized the presentation of tardy submissions as creating “hostage situations.” Another pointed out the risk of nonapproval and redesign.

Two responding STAs indicated that archiving of design exceptions is a problem. A number of additional areas of concern were identified through the survey. A complete listing of the responses to question 35 is included in Appendix D.

As noted previously, several STAs indicated that design exception checklists and templates would be helpful. To address this interest, content and format guidance has been excerpted from the written procedures of the California, Florida, Georgia, Kansas, Minnesota, Missouri, North Carolina, Pennsylvania, Tennessee, Utah, Virginia, and West Virginia transportation agencies and included as Appendix E. This appendix also includes design exception examples that are included in the Ohio DOT guidance.

POTENTIAL IMPROVEMENTS AND INNOVATIVE PRACTICES

The survey of STAs solicited suggestions on streamlining and process improvement, and 18 agencies submitted a total of 29 recommendations. Additionally, the written procedures of 30 STAs were reviewed for unique practices.

Approximately one-half of the 29 improvements suggested by STAs in survey responses relate to guidance on the design exception process. Five comments called for the FHWA to clarify controlling criteria and provide better guidelines. Several respondents indicated that checklists, documentation templates, training, and on-line resources would improve the process. Two STAs recommended a centralized record of design exceptions. The Michigan DOT suggested incorporating design exceptions into the scoping process. The following policy changes were also suggested by individual STAs:

- Eliminate design speed as a controlling criterion,
- Revise process for resurfacing, and
- Do not require design exceptions for existing features that do not meet current policy.

The review of STA procedures revealed that the New Jersey and Wisconsin DOTs use programmatic design exceptions when specific conditions are met.

The New Jersey DOT’s draft *Design Exception Procedures Manual* (*5*) includes three categories of programmatic design exceptions (PDEs). If the project comports with the qualifying parameters of the PDEs, the PDE applies and an individual design exception is not required. An “acceptable individual accident analysis” is a universal PDE prerequisite, a brief summary and PDE categories and additional applicability factors follow:

- Non-Interstate 3R projects—The PDE applies to the following substandard design features if the universal and specific conditions are met:
  - Through lanes, auxiliary lanes, or shoulder widths that are equal to or greater than a specified value based on design year volume, truck traffic level, and posted speed are eligible for the PDE.
  - Stopping sight distances on vertical curves that are equal to or greater than a tabulated value based on design speed qualify for the PDE.
  - Superelevation and stopping sight distance on horizontal curves with safe speeds equal to or greater than the posted speed qualify for the PDE.
  - Minimum and maximum grades that do not meet standards may rely on the PDE if the standard for cross slope is met.
  - Vertical clearances of 14 ft or more and written concurrence by the department's structures manager.
  - Resurfacing and restoration of structures.
- 100% state-funded resurfacing—At the project initiation stage, a Wet Accident Safety Index for each 0.2-mi segment within the project is obtained and reviewed. The index is based on wet weather accident rates relative to statewide average, rut depth, and skid number. The index values are 1, 2, and 3; with 1 being the worst. Segments with an index value of 1 are analyzed. The causative factors are to be corrected or a design exception processed. After the Wet Accident Safety Index review, the PDE will apply if the type of work is consistent with the purpose of the resurfacing program. A list of 16 specific work items (e.g., pavement repair and drainage system upgrades) is included.
- Substandard left shoulder widths—A PDE for substandard width left shoulders can be applied in the following circumstances if appropriate tapers are provided and there is an acceptable individual accident analysis:
  - Located at overhead sign structures, bridge piers, surveillance cameras, or similar features.
  - Less than 100 ft in length, excluding tapers.

The Wisconsin DOT *Facilities Development Manual* (*18*) provides detailed procedures for individual design exceptions and the Programmatic Exception to Standards (PES). The PES is integrated into the Wisconsin DOT's accelerated design process for 3R projects. A central element of the process is a three-step safety screening, performed during the programming phase, using a combination of

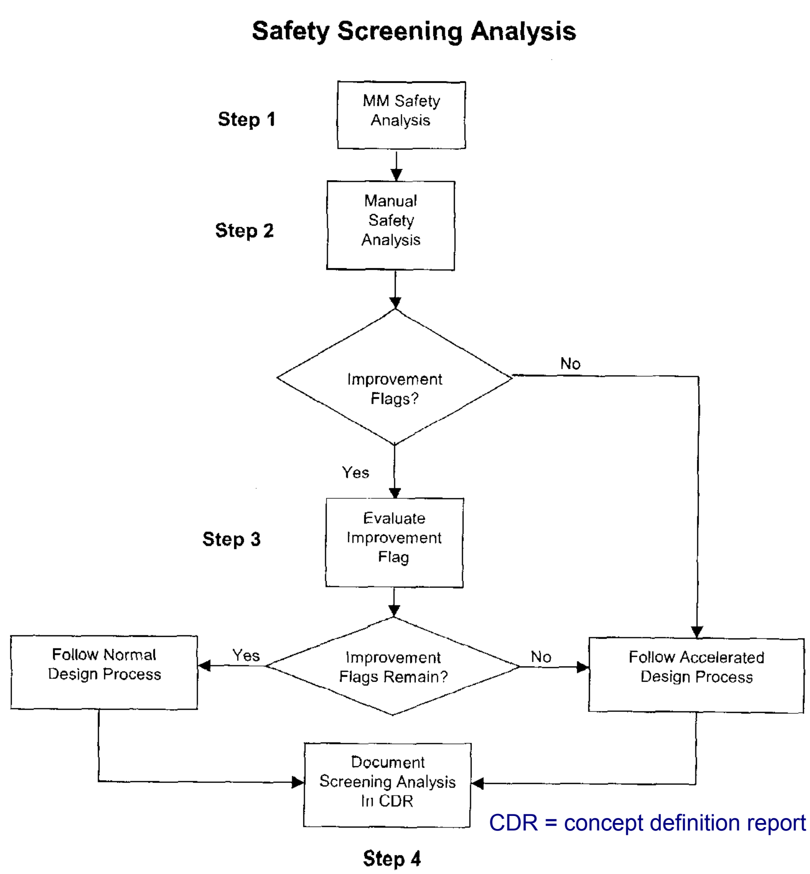

FIGURE 5 Wisconsin DOT safety screening analysis (*18*).

computer algorithms and manual techniques, which can be summarized as follows:

Metamanager safety module—The project is divided into segments. For each segment, pavement information, deficiency, and program management files are retrieved. The segments are labeled with either above- or below-average crash rates in each of five crash categories. An individual above-average crash rate is referred to as a "Crash Type Flag." A combination of Crash Type Flags that suggest geometric improvements may solve the crash problem generates an "Improvement Flag." The analysis algorithm identifies the deficiencies causing the Improvement Flag. If geometric deficiencies are not causative, Crash Type Flags do not result in Improvement Flags.

Manual crash review summary—Crash summary lists are reviewed manually to identify crash concentrations or tendencies that may not have been picked up by the metamanager analysis. This step is more subjective than the first, but of equal importance. Numerical guidance and an example are provided to assist the analyst in performing this review. An Improvement Flag may be added in this step.

Evaluate segments with Improvement Flags—The goal of this step is to determine if the Improvement Flag(s) assigned to a segment are valid. An Improvement Flag can be removed if the segment does not contain a substandard controlling criteria feature or it can reasonably be shown that substandard features do not significantly contribute to the types of crashes causing the problems.

Improvement Flags are addressed by reconstruction to eliminate the deficiency or for processing an individual design exception. The removal of Improvement Flags, and appropriate documentation, makes a segment eligible for the PES and accelerated design process. The process is depicted in Figure 5.

At least one of the Wisconsin DOT's eight district offices uses the PES to establish the scope of projects. All state highways in the district with scheduled projects are screened. The sections with no Improvement Flags are scheduled for resurfacing and those with some Improvement Flags are scheduled for rehabilitation, correcting the geometric deficiency as part of the project.

CHAPTER FIVE

CONCLUSIONS AND FUTURE RESEARCH NEEDS

This synthesis is based on survey responses from 46 state transportation agencies (STAs), a review of written procedures from 30 states, and the limited published literature relevant to design exceptions. Every STA is required to comply with the same federal regulation pertaining to design exceptions. However, the volume of design exceptions, the circumstances requiring their preparation and the methods employed vary widely among states. Many factors contribute to this wide range in practice. Conclusions that characterize and explain the diversity of design exception process experience among STAs, along with the reported principal benefits, problems, and potential improvements are summarized here.

- **Design Exception Volumes and Decision Factors**

  The average annual number of design exceptions prepared by STAs varies from one or two to approximately 500. This number is affected by numerous factors that can be grouped as project-related and nonproject-related. The latter group may include an STA's capital program size, jurisdictional mileage, and degree of urbanization. This report identifies project-related characteristics used to decide if a design exception is needed. The FHWA regulation establishes a base set of conditions for which design exceptions are required. Practice varies however, because the regulation is interpreted differently by states, and some STAs prepare design exceptions even though not required to do so under the FHWA regulation. The following summary of 46 STA survey responses outlines the use of project-related factors in determining the need for a design exception:

  - 28% (13 of 46) consider project location/system.
  - 13% (6 of 46) consider project funding source.
  - 65% (30 of 46) consider project scope/type.
  - 33% (15 of 46) prepare design exceptions for supplemental criteria.
  - 44% (20 of 45) have STA criteria values higher than AASHTO's and prepare design exceptions if the higher (state) values are not met.
  - 87% (40 of 46) have approved 3R (rehabilitation, restoration, or resurfacing) criteria; 93% (37 of 40) do not prepare design exceptions if 3R criteria are met.

  The results indicate considerable dispersion in nearly every element except for project funding source, which is generally not a determining factor. Use of 3R criteria in lieu of new/reconstruction criteria is also widespread; these criteria are developed by individual state agencies and therefore may differ.

  Approximately 20% (9 of 46) of STAs have experienced or anticipate an increase in design exceptions as a result of context-sensitive design.

- **Data Collection and Analysis Procedures**

  The procedures and organizational roles associated with processing design exceptions also vary widely among states. The written procedures of the STAs are an indicator of this diversity; they range from 4 to more than 80 pages. Design exceptions document a deliberative process wherein conflicting objectives are identified, an action is recommended, its consequences assessed, and a decision taken by authorized officials. As such, information must be accumulated and analyzed on a myriad of impacts and cost considerations. The potential safety implications of the substandard design feature are a central issue. Many of the STA procedures reviewed indicate such an analysis should be made, but provide no further guidance. Several STAs outline the information that should be considered (e.g., crash records) in the assessment. A small number of states provide detailed technical guidance on how to conduct the safety analysis. The identification of appropriate safety mitigation follows a pattern similar to safety analysis. The survey responses and review of state procedures indicate that safety enhancements are often used in conjunction with design exceptions. However, only a few STAs provide guidance on which mitigation is appropriate for specific substandard geometric features.

- **Organizational Roles**

  STAs are organized and staffed to meet the particular needs of their state. The design exception preparation, review, and approval processes are also unique to each STA and its relationship with partner agencies. Generally, the designer assembles the basic design exception documentation (i.e., information, analysis, and recommendation). The recommendation and documentation are submitted to STA organizational groups and officials for review and approval. The specific reviewing and approving entities vary by individual STA and project circumstance. Approximately 28 responding STAs use a committee and/or disciplinary functional unit(s) (e.g., design or safety bureaus) to review design exceptions. Approximately three-fourths of the STAs with decentralized design functions approve design exceptions at the headquarters (i.e., main office or central office). Only one STA involves its legal counsel in processing design exceptions. The FHWA is involved with approving design exceptions on the Interstate system in all states except Alaska. Additionally, 63% (29 of 46) of STAs indicated that the FHWA also approves some design exceptions on the non-Interstate National Highway System (NHS). In six responding STAs, the FHWA approves design exceptions for non-NHS projects.

- **Benefits, Problems, and Potential Improvements**

Almost all STAs view design exceptions as a value-adding process. Simply having a record of the decision process and its use in managing tort risk are the principal benefits cited by STAs responding to the survey. Five STAs reported having experience with design exception documentation being used in tort suits. The documentation was generally helpful in defending against the suits.

The most frequently identified design exception problems are

- Lack of supporting information,
- Inadequate guidance,
- Resource requirements (agency personnel, funds, and time), and
- Requests made late in the process.

The primary suggestions for streamlining and improving the design exception processes are

- Improved guidance;
- Clarification of controlling criteria; and
- Training, documentation formats, and checklists.

- **Unique Processes**

Several STAs have experience with design exceptions in connection with design–build projects. Most of these agencies make every effort to process the design exception prior to contractor procurement. Despite this effort, in some cases design exceptions are discovered after a design–build contract is awarded.

When certain conditions are met, the New Jersey and Wisconsin Departments of Transportation use programmatic design exceptions to address recurring situations that do not meet design criteria, but are not amenable to cost-effective remediation.

- **Future Research Needs**

Preparation of this synthesis revealed considerable information about STA design exception practices. However, its scope and contents were largely limited by the information available from three sources: published literature, responses to the questionnaire, and a review of STA written procedures. Accordingly, there are several topics that are of interest to the professional community that can only be addressed by additional research. Considerable variance among STA practices was observed, some of which is desirable because of the unique circumstances prevailing within individual states. Some of the variance may be attributable to knowledge gaps; several STAs indicated that current guidance is lacking or inadequate. Consequently, the following topics are recommended for future research:

Actual benefits—As a result of the questionnaire and literature search, it was determined that no study has been published on the benefits of preparing design exceptions. Respondents to the survey provided their perception of benefits, which are reported in chapter four. An evaluation of benefits could be conducted using a methodology suitable for application across geographic and institutional boundaries.

Tort liability implications—Although literature on this topic was identified and survey respondents provided some general characterizations, the tort liability risk associated with design exceptions remains largely uncharacterized. The literature is an overview of legal doctrine. No literature was identified that specifically investigated tort claims rooted in designed projects that do not meet all applicable geometric design criteria. A study could be undertaken to evaluate the magnitude of claims (number and monetary damages sought), plaintiff and defendant legal doctrines, awards and settlement amounts, and agency risk factors (i.e., design decision factors affecting the agency's defense) based on actual cases.

Critical criteria—Design criteria are intended to provide for a safe, operationally efficient and economic facility. As research advances, geometric design policy evolves and criteria values change. The relationship of criteria to operational efficiency and safety may also change. The universe of geometric design criteria might be reviewed to determine which have the strongest relationships to operational efficiency and safety.

Analytic techniques—Preparation of the synthesis revealed that many STAs provide very limited guidance on how to evaluate the safety implications of a design exception. Quantitative evaluation methods, developed through previous peer-reviewed research, may be applied directly to the evaluation of some geometric design criteria. This type of evaluation tool does not exist for all criteria. Future research could develop practitioner guidance for evaluating the safety implication of design exceptions. The guidance could be based on a combination of completed and new research.

Mitigation—Each geometric design criterion has unique implications to operational efficiency and safety. When an exception to the criteria is processed, countermeasures may be advisable. The synthesis summarizes the substantive guidance on mitigation [e.g., appropriate countermeasure(s) for a given situation] and varying levels of specificity on this subject among STAs. A future research effort could identify and provide guidance on the most effective mitigation measures for various design criteria and provide application guidance.

Design exception volumes—The number of design exceptions processed annually was found to vary widely among states. This has not been investigated and reported in any published study. Future research could identify the variables (e.g., capital program size and degree of urbanization) with a correlation to design exceptions volume.

These future research topics could result in the following information and implementation products:

- Safety analysis procedures and mitigation measures directly related to each geometric design "controlling" criterion.
- Guidance on appropriate safety analysis techniques and levels of economic justification procedures.
- A portfolio of generic examples that could serve as guidance in preparing supporting documentation.
- Identification of the primary factors that influence the number of design exceptions prepared by individual STAs.
- A detailed examination of the tort liability consequences of design exceptions.

This agenda could be advanced through a combination of strategies. Previous and ongoing safety studies may be adapted to adequately address several of the design exception topics. However, a considerable level of effort will also be required to collect, process, and analyze data from primary sources. Although this synthesis discussed programmatic information sources (e.g., procedures and policies), project level data (e.g., actual project documentation and specific factors used in litigation) will be needed to answer fundamental issues expressed in the synthesis survey results. Techniques such as focus groups and telephone interviews could yield information that was not practical to retrieve through the survey questionnaire.

The results of this research could also assist transportation agencies to implement emerging context-sensitive principles in a reasonable and responsive manner.

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APPENDIX A

Federal-Aid Policy Guide Excerpt

EXCEPTIONS

Reference: Federal Highway Administration, Federal-Aid Policy Guide, Subchapter G—Engineering and Traffic Operations, Part 625—Design Standards for Highways, Washington, D.C., October 1997.

(1) Approval within the delegated authority provided by FHWA Order M1100.1A may be given on a project basis to designs which do not conform to the minimum criteria as set forth in the standards, policies, and standard specifications for:

(i) Experimental features on projects; and
(ii) Projects where conditions warrant that exceptions be made.

(2) The determination to approve a project design that does not conform to the minimum criteria is to be made 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.

DESIGN EXCEPTIONS NON-REGULATORY SUPPLEMENT

Reference: Federal Highway Administration, Federal-Aid Policy Guide, Subchapter G—Engineering and Traffic Operations, Part 625—Design Standards for Highways, Washington, D.C., June 17, 1998.

a. General. The 23 CFR 625 provides that exceptions may be given on a project basis to designs which do not conform to the minimum criteria as set forth in the standards, policies, and standard specifications for: experimental features on projects and projects where conditions warrant that exceptions be made.

(1) Some project conditions that may warrant exceptions could be the extreme difficulty or high cost of obtaining right-of-way, cost of construction, mitigation of environmental impacts, or the preservation of historic or scenic values of the location. The careful application of the flexibility provided in the design standards and policies, appropriate use of design exceptions, and coordination with transportation enhancement activities can result in projects that provide safe and efficient transportation facilities and are sensitive and responsive to scenic and historic resources.

(2) Although all exceptions from accepted standards and policies should be justified and documented in some manner, the FHWA has established 13 controlling criteria requiring formal approval. These criteria are design speed, lane and shoulder width, bridge width, structural capacity, horizontal and vertical alignment, grade, stopping sight distance, cross slope, superelevation, and vertical and horizontal clearance (other than the "clear zone"). Design exceptions to these controlling criteria can, in the most part, be easily identified and defined. However, two items, horizontal clearance and design speed, warrant some further explanation and discussion.

(a) Horizontal Clearance: A recovery area clear of unyielding objects should be established for all projects. Criteria from the AASHTO Roadside Design Guide should be treated as guidance for setting individual project or statewide criteria or policies, not as a national standard requiring a design exception if not met.
(b) Design Speed: Design speed is a concept by which coordination of the various physical design elements is achieved. Design speed has a significant effect on the operation and safety of a highway because it is used to determine various individual design elements with specific dimensions such as stopping sight distance or horizontal curvature. Therefore, a "design speed exception" is necessarily an exception to individual physical design elements and accordingly must be justified on that basis.

(3) In a number of insta0nces, a range of specific values of minimum, maximum, and desirable are contained in the AASHTO policies and guides. It is FHWA policy that the lowest or highest value of the range, whichever is appropriate, is to be considered as the minimum or maximum acceptable for design of NHS projects.

(4) For preventive maintenance projects, no exceptions are needed for the retention of existing substandard features. In effect, the State is maintaining the project as built, and as it was agreed upon in the project agreement. However, any new substandard features created, or existing ones made worse, must be covered by an exception since such actions in effect change the project as built.

b. Evaluating Exceptions

(1) When evaluating a request for a design exception, consideration must be given to the effect of the variance from the design standard on the safety and operation of the facility and its compatibility with adjacent sections of roadway. Since safety enhancement is an essential element of any project design, exceptions should not be approved if the exception would result in degrading the relative safety of the roadway. Such factors as the functional classification of the road, the amount and character of the traffic, the type of project (i.e., new construction, reconstruction, or 3R), and the accident history should be considered in the evaluation. The cost of attaining full standards and any resultant impacts on scenic, historic, or other environmental features, as well as whether any other future improvements are programmed should also be taken into consideration.

(2) Depending on the nature of the variance from the design standard, it may not be necessary to look at all of the above factors. However, before an exception is approved there should be compelling reasons why the adopted criteria should not be used. Three issues should be considered in any analysis: (a) what is the degree to which a standard is being reduced; (b) will the exception affect other standards; and (c) are there any additional features being introduced, e.g., signing or delineation, that would mitigate the deviation?

(3) One of the factors that has a significant influence on the appropriate design criteria is design speed. Since design speed affects curvature, sight distance, and other speed related features, care must be taken in the selection of the most appropriate value. Any design which uses a design speed below the posted or regulatory speed limit should not be approved.

(4) The amount and character of the traffic actually using the route, or that can legally use it (including trucks with grandfathered lengths), should be determined and used in the design exception process whether or not the route is on the National Network. It is recommended that permanent Interstate lane widths less than 11 feet not be approved except in only the most extreme and special cases. If Interstate lane widths less than 11 feet are used, they should be on a temporary basis only.

c. Documentation. All exceptions to the design standards shall be identified and justified, taking into consideration the effect of any deviation from design standards on safety. The project files must include this information. Approved exceptions shall be identified either in project correspondence or on the project plans. Separate lists or a file of exceptions is recommended in order that the division office remains fully informed on the nature and extent of design exceptions being approved for given categories of projects.

d. Review and Approval. If the FHWA is involved in reviewing and approving plans, specifications, and estimates for any NHS project, then it also must review and approve design exceptions to standards applicable to that project. On those NHS projects on which the State has elected to apply one of the 23 U.S.C. 106(b) exemption provisions, which are administered under certification acceptance, or which are funded by other than Federal-aid funds, the State may approve design exceptions, but must evaluate and document the decision as if it were doing it for the FHWA. Design exceptions approved by the State for the FHWA are still subject to FHWA oversight through periodic process reviews.

APPENDIX B

Survey Questionnaire

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Project 20-5, Synthesis Topic 33-01

Design Exception Practices

It is not always practical to meet adopted geometric design standards. When faced with this condition, transportation agencies may process design exceptions to evaluate and document the relevant factors and conclusions.

A single relevant Federal Highway Administration regulation (23 CFR 625) pertains to all State Transportation Agencies (STA). Yet there is a very wide range of practice and requirements among the states. **A primary purpose of this survey is to determine *when* and *how* design exceptions are prepared by STAs. Another purpose is to identify the benefits, problems and potential improvements to the design exception process.**

We are interested in your agency's practices and experience with design exceptions. The information you supply will be used to prepare a report summarizing current practice and potential streamlining of design exceptions.

We request that you forward copies of your current policies, procedures, related standards, samples of pertinent published materials, and website addresses regarding DESIGN EXCEPTION PRACTICES in your STA. Please return your completed questionnaire and supporting documents by **June 30, 2002** to:

John M. Mason, Jr., Ph.D., P.E.
2497 Hickory Hill Drive
State College, PA 16803-3363

If you have any questions, please contact Dr. Mason at (814) 234-1983, or e-mail him at jmm7@psu.edu.

Below, please provide the name and associated information of the person completing this questionnaire and, if different, someone else that may be contacted for follow-up questions:

Name: ____________________

Title: ____________________

Agency: ____________________

Street Address: ____________________

City, State, Zip: ____________________

Telephone: ____________________

Fax: ____________________

E-mail Address: ____________________

Terminology

To improve communications, the following terms are used as defined below in conjunction with this survey:

- **Design exception:** The process and resulting documentation associated with geometric features created or perpetuated by a highway construction project that do not conform to the minimum criteria set forth in the standards and policies. This includes what some may refer to as design exemptions.

- **Controlling criteria**: The 13 elements identified by FHWA in the Federal-aid Policy Guide as requiring design exceptions; they are:

  - design speed
  - lane width
  - shoulder width
  - bridge width
  - structural capacity
  - horizontal alignment
  - vertical alignment
  - grade
  - stopping sight distance
  - cross slope
  - superelevation
  - vertical clearance
  - horizontal clearance (other than clear zone)

The first two sets of questions will help us understand <u>when</u> your agency prepares design exception documentation.

Project Characteristics

1. Under your agency's policy, is project *location/system* (e.g., Interstate, NHS, State system, off system) a factor in determining if a design exception is required? (check one)

   Yes ________
   No ________

2. Under your agency's policy, is project *funding source* (e.g., Federal aid, State only, State aid, local, private) a factor in determining if a design exception is required? (check one)

   Yes ________
   No ________

3. Under your agency's policy, is project *scope/type* (e.g., bridge, spot improvement, new construction, preventive maintenance) a factor in determining if a design exception is required? (check one)

   Yes ________
   No ________

Criteria for Which Design Exceptions Are Prepared

4. Does your agency prepare design exceptions for criteria other than the 13 "controlling criteria" identified by FHWA (e.g., design exemption, design variation, etc.)? (check one)

   Yes ________
   No ________

5. List below any additional criteria used by your agency in preparing design exceptions:

   a. ________________________ d. ________________________
   b. ________________________ e. ________________________
   c. ________________________ f. ________________________

6. Are some of your agency's criteria for new construction and reconstruction higher than AASHTO's? (check one)

   Yes ________
   No ________ (If "No," go to question 8)

7. If you answered "Yes" to question 6, please answer this question; otherwise proceed to question 8. If a design meets AASHTO criteria but not your agency's criteria, do you process a design exception? (check one)

   Yes ________
   No ________

8. Does your agency have 3R standards that are approved for Federal-aid projects? (check one)

   Yes ________
   No ________ (If "No," go to question 10)

9. If you answered "Yes" to question 8, please answer this question; otherwise proceed to question 10. If a 3R project meets your 3R standards, but not the standards for new construction, do you still process a design exception? (check one)

   Yes ________
   No ________

10. Using portion A of the table please indicate the information source most often relied on for various information for 3R project plan development. Use portion B to indicate the adequacy of these methods in determining if a design exception is needed.

A. Primary Information Source	**Horizontal Alignment Information**	**Vertical Alignment Information**	**Cross Section Information**
As-built drawings			
Field surveys			
Roadway inventory data			
Other (please indicate)			
B. Adequacy of Information Sources	**Meets Needs Completely**	**Meets Needs Marginally**	**Does Not Meet Needs**
As-built drawings			
Field surveys			
Roadway inventory data			
Other (please indicate)			

11. By checking the appropriate line below, indicate how your agency would typically prepare design exception documentation for a project with several different substandard features (e.g., below minimum radius and narrow travel way width).

   Analyze each substandard feature separately ________________________________

   Analyze the substandard features collectively ________________________________

12. By checking the appropriate line below, indicate how your agency would typically prepare design exception documentation for a project wherein the same criteria is violated at several locations (e.g., several curves with substandard superelevation).

    Analyze each substandard feature separately ______________________________

    Analyze the substandard features collectively ______________________________

FHWA/State/Local Approval

This set of questions will help us understand agency approval roles for design exceptions in your state.

13. Does the Stewardship Agreement (Exemption Agreement) that your agency has with the FHWA division office address the authority to approve design exceptions for Federal-aid projects? (check one)

    Yes ________
    No ________

14. Does the FHWA approve any design exceptions in your state? (check one)

    Yes ________
    No ________ (If "No," go to question 16)

15. If you answered "Yes" to question 14, please answer this question; otherwise proceed to question 16. Using portion A of the table please indicate the conditions under which FHWA has approval authority for design exceptions. Use portion B to indicate conditions not listed for which FHWA approval of design exceptions is required.

A. Project Location and Funding	**Check Box if FHWA Approval of Design Exceptions Is Required for These Projects**
On Interstate, Federal funds, regardless of cost	
On Interstate, Federal funds, depending on cost	
On Interstate, no Federal funds	
On NHS (not Interstate), Federal funds, regardless of cost	
On NHS (not Interstate), Federal funds, depending on cost	
On NHS (not Interstate), no Federal funds	
Off NHS, Federal-aid Road, Federal funds, regardless of cost	
Off NHS, Federal-aid Road, Federal funds, depending on cost	
Off NHS, Federal-aid Road, no Federal funds, depending on cost	

B. Other Conditions Requiring FHWA Approval of Design Exceptions	
1.	4.
2.	5.
3.	6.

16. This question pertains to projects administered by a local public agency (e.g., municipal or county government) and funded by State and/or Federal funds provided through your agency. If such a locally administered project requires a design exception under your agency's policy, which agency has final approval authority? (check one column per row)

Project Funding	**Final Approval Authority for Design Exception**			
	Local Agency	**State**	**FHWA**	**Varies (e.g., by system, cost)**
State-aid, local match				
Federal-aid, local match				
State- and Federal-aid				

Organizational Roles and Responsibilities

This set of questions will help us understand how the design exception process flows within your state.

17. For consultant design projects, who is primarily responsible for assembling information and analysis used to support a design exception request? (check one)

Consultant staff _______________
Agency staff _______________

18. Is the design function in your agency primarily centralized or decentralized (i.e., by district offices, regions)? (check one)

Centralized _______________
Decentralized _______________

19. If you answered "decentralized" to question 18, are design exceptions approved by a decentralized unit in your agency?

Yes _______
No _______

20. In your agency does the same unit responsible for project design (e.g., Regional Design) approve design exceptions or does a different unit (e.g., Design Bureau, Chief Engineer) approve them? (check one)

Same ______________
Different ______________

21. Does your agency independently review (i.e., someone not on the design team) each set of construction plans to determine if it includes any elements that require design exceptions? (check one)

Yes _______
No _______

22. Using the table below please indicate the internal state functional areas (portion A) that review design exception requests before they are sent to the approving official(s). Use portion B for listing other functional areas/offices in your STA that review design exceptions.

A. Function/Office	**This Unit Reviews Design Exceptions**	**This Unit Does Not Review Design Exceptions**
Agency Legal Office		
Agency-wide Committee		
Design (Quality Assurance) Bureau		
Design Exception Committee		
District/Region Safety Committee		
B. Other Functional Areas/Offices that Review Design Exceptions		
1.		
2.		
3.		
4.		

Data Collection

This set of questions will help us understand the type of information that is collected as an initial step in evaluating design exceptions in your state.

23. Using portion A of the table please indicate how often your agency collects the data items shown as an initial step in processing design exceptions for site-specific projects (place a check in one column per row). Use portion B to indicate data elements not listed and the frequency with which the items are collected.

A. Type of Information	**Gathered Routinely (or always)**	**Gathered Occasionally**	**Gathered Infrequently (or never)**
Accident history in project limits			
Accident severity information			
Collision/condition diagrams			
Cost to cure (construction to standards)			
Skid number data			
Traffic volume data			
B. Other Information Gathered	**Gathered Routinely (or always)**	**Gathered Occasionally**	**Gathered Infrequently (or never)**
1.			
2.			
3.			
4.			

Analysis Tools

This set of questions will help us understand how *"below-criteria"* design elements are evaluated.

24. Using portion A of the table please indicate how often your agency uses the following analysis tools to evaluate design criteria elements (place a check in one column per row). Use portion B to indicate other analysis techniques not listed and the frequency with which the items are used.

A. Type of Information	Gathered Routinely (or always)	Gathered Occasionally	Gathered Infrequently (or never)
Accident modification factors (other accident prediction model)			
Accident trends (e.g., history or occurrence indicators)			
Before–after studies			
Classic statistical methods (rank/rate)			
Collision/condition diagrams			
Cost-benefit analysis			
B. Other Information Gathered	**Gathered Routinely (or always)**	**Gathered Occasionally**	**Gathered Infrequently (or never)**
1.			
2.			
3.			
4.			
5.			

Your Experience

This set of questions will help us understand how many design exceptions your agency processes and if benefits from this process have ever been studied.

25. Please indicate on the discrete scale below where in the project development process design exceptions are developed and approved. If design exceptions are developed and approved at two distinctly separate stages of your agency's project development process, please indicate both of these locations on the scale.

______ 0% Project Initiation
______ 20% Preliminary Engineering
______ 40% Environmental Clearance
______ 60%
______ 80% Final Design
______ 100% Plans, Specifications & Estimates

26. How many design exceptions does your agency process in a typical year?

Annual number ______________

27. Does your agency have a centralized record of all design exceptions? (check one)

Yes _______
No _______

28. List the criteria for which design exceptions are most often prepared by your agency.

1. ___________________ 3. ________________________
2. ___________________ 4. ________________________

29. Has your agency ever conducted a study to determine the benefits associated with preparing design exceptions? (check one)

Yes ________
No ________ (If "No," go to question 31)

30. If you answered "Yes" to question 29, please answer this question; otherwise proceed to question 31. Using the table below please indicate the documented benefits of preparing design exceptions. Using portion A of the table, place a check in one column per row. If there are other documented benefits of preparing design exceptions that are not listed, please identify them in portion B of the table.

A. Benefits of Preparing Design Exceptions	**Study Indicates This Is a Benefit**	**Study Did Not Indicate This Is a Benefit**
Reduce liability exposure		
Reduce impacts		
Safety improved		
Some designs improved to meet criteria		
Successfully used to defend tort liability		
B. List Other Documented Benefits of Preparing Design Exceptions		
1.		
2.		
3.		
4.		

31. If documented design exceptions were not required by FHWA regulation, would your agency still prepare them? (check one)

Yes ________
No ________ (If "No," go to question 33)

32. If you answered "Yes" to question 31, please answer this question; otherwise proceed to question 33. Beyond the FHWA regulation, what are the reasons your agency prepares design exception documentation?

____
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33. If you have experience where design exception documentation was used in a tort lawsuit or claim, please describe the pertinent conditions and outcome. Was the documentation beneficial or detrimental to your agency?

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34. Has the advent of Context-Sensitive Design or Design Flexibility increased the number of design exceptions prepared in your agency? (check one)

Yes ________
No ________

If "Yes," explain.

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Problems with Design Exception Process

35. Please list any problems you have experienced with the design exception process.

____
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Improving the Design Exception Process

36. Please list any improvements you feel could be made to streamline the design exception process.

____
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37. Does your agency have any experience with design exceptions on design–build projects? If yes, please describe how the process is similar and different compared to a conventional design project. (check one)

Yes ________
No ________

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____

38. Using the table below please list the most common mitigation measures utilized for design exceptions of the corresponding criteria. Use portion A of the table to list the mitigation measures (see example provided). If there are mitigation measures used for other than the controlling criteria, please cite them and the corresponding criteria in portion B of the table (attach additional comments as appropriate).

A. Design Criteria	**Most Common Mitigation Measure**	**Next Most Common Mitigation Measure**	**Next Most Common Mitigation Measure**
Example: Stopping sight distance	*Lower speed limit*	*Warning signs*	*?????*
Design speed			
Lane width			
Shoulder width			
Bridge width			
Structural capacity			
Horizontal alignment			
Vertical alignment			
Grade			
Stopping sight distance			
Cross slope			
Superelevation			
Vertical clearance			
Horizontal Clearance			
B. Other Criteria	**Most Common Mitigation Measure**	**Next Most Common Mitigation Measure**	**Next Most Common Mitigation Measure**
1.			
2.			
3.			
4.			
5.			

39. What documentation (e.g., procedures, policies, analytical tools, etc.) is available in your state to guide you in preparing design exceptions?

____

____

____

____

Please forward the documentation cited in the above response by June 30, 2002 to:

John M. Mason, Jr., Ph.D., P.E.
2497 Hickory Hill Drive
State College, PA 16803-3363

APPENDIX C

Summary of Survey Responses

Project Characteristics

1. Under your agency's policy, is project *location/system* (e.g., Interstate, NHS, State system, off system) a factor in determining if a design exception is required? (check one)

    Yes 13
    No 33

2. Under your agency's policy, is project *funding source* (e.g., Federal aid, State only, State aid, local, private) a factor in determining if a design exception is required? (check one)

    Yes 6
    No 40

3. Under your agency's policy, is project *scope/type* (e.g., bridge, spot improvement, new construction, preventive maintenance) a factor in determining if a design exception is required? (check one)

    Yes 30
    No 16

Criteria for Which Design Exceptions Are Prepared

4. Does your agency prepare design exceptions for criteria other than the 13 "controlling criteria" identified by FHWA (e.g., design exemption, design variation, etc.)? (check one)

    Yes 15
    No 31

5. List below any additional criteria used by your agency in preparing design exceptions:

Criterion	Frequency
None	31
Cut/Fill Slopes	4
Roadside Features, including culverts	3
Median Width	3
Guardrail	2
Level of Service	2
Median Opening Spacing	2
Intersection Sight Distance	2
Ramp Lengths	2
Right-of-Way Width/Impacts	1
Interchange Ramp Spacing	1
Bridge Hydraulics	1
Interchange Lighting	1
Type of Shoulder Construction	1
Right-turn Lanes	1

Intersection Skew Angle	1
Design Storms	1
Bridge Rail	1
High Accident Locations	1
Mailbox Supports	1
Signs/Signals/Pavement Markings	1
Safety Dikes	1
Hydraulics	1
Limited Access Use by Utilities	1
Control Zone Use by Utilities	1
Width of Shoulder Surfacing	1
Number of Lanes	1
Cross-slope Rollover	1
Access Control	1
Pedestrian Accommodation	1
Sight Flares	1
Channelization	1
Ditch Slope & Width	1
Clear Zone	1
Lane Drop Length	1
Interstate Access Control Breaks	1

6. Are some of your agency's criteria for new construction and reconstruction higher than AASHTO's? (check one)

   Yes 24
   No 21 (If "No," go to question 8)

7. If you answered "Yes" to question 6, please answer this question; otherwise proceed to question 8. If a design meets AASHTO criteria but not your agency's criteria, do you process a design exception? (check one)

   Yes 20
   No 4

8. Does your agency have 3R standards that are approved for Federal-aid projects? (check one)

   Yes 40
   No 6 (If "No," go to question 10)

9. If you answered "Yes" to question 8, please answer this question; otherwise proceed to question 10. If a 3R project meets your 3R standards but not the standards for new construction, do you still process a design exception? (check one)

   Yes 3
   No 37

10. Using portion A of the table please indicate the information source most often relied on for various information for 3R project plan development. Use portion B to indicate the adequacy of these methods in determining if a design exception is needed.

A. Primary Information Source	Horizontal Alignment Information	Vertical Alignment Information	Cross Section Information
As-built drawings	26	28	15
Field surveys	29	29	33
Roadway inventory data	4	4	9
Construction plans	1	1	1
Photogrammetry	1		1
Existing plans (not as-built)	1	1	1
B. Adequacy of Information Sources	**Meets Needs Completely**	**Meets Needs Marginally**	**Does Not Meet Needs**
As-built drawings	8	26	2
Field surveys	39	7	3
Roadway inventory data	5	14	11
Construction plans		1	
Photogrammetry/video logs		1	
Traffic & accident data		1	
Existing plans (not as-built)		1	

11. By checking the appropriate line below, indicate how your agency would typically prepare design exception documentation for a project with several different substandard features (e.g., below minimum radius and narrow travel way width).

    Analyze each substandard feature separately 35

    Analyze the substandard features collectively 9

    Analyze the substandard features both separately and collectively 2

12. By checking the appropriate line below, indicate how your agency would typically prepare design exception documentation for a project wherein the same criteria is violated at several locations (e.g., several curves with substandard superelevation).

    Analyze each substandard feature separately 27

    Analyze the substandard features collectively 16

    Analyze the substandard features both separately and collectively 3

FHWA/State/Local Approval

This set of questions will help us understand agency approval roles for design exceptions in your state.

13. Does the Stewardship Agreement (Exemption Agreement) that your agency has with the FHWA division office address the authority to approve design exceptions for Federal-aid projects? (check one)

    Yes 45
    No 1

14. Does the FHWA approve any design exceptions in your state? (check one)

    Yes 45
    No 1 (If "No," go to question 16)

15. If you answered "Yes" to question 14, please answer this question; otherwise proceed to question 16. Using portion A of the table please indicate the conditions under which FHWA has approval authority for design exceptions. Use portion B to indicate conditions not listed for which FHWA approval of design exceptions is required.

A. Project Location and Funding	**Check Box if FHWA Approval of Design Exceptions Is Required for These Projects**
On Interstate, Federal funds, regardless of cost	21
On Interstate, Federal funds, depending on cost	26 (2 > $1 M)
On Interstate, no Federal funds	15
On NHS (not Interstate), Federal funds, regardless of cost	10
On NHS (not Interstate), Federal funds, depending on cost	22 (1 > $5 M)
On NHS (not Interstate), no Federal funds	8
Off NHS, Federal-aid Road, Federal funds, regardless of cost	1
Off NHS, Federal-aid Road, Federal funds, depending on cost *Alabama:* FHWA approves bridge project exceptions off NHS if cost >$5 million. *Hawaii:* In excess of $1 million, Hawaii DOT submits design exception to FHWA for approval even if it's off the NHS as long as Federal funding is used. *Idaho:* FHWA is on design exception committee. *Massachusetts:* In excess of $10 million, Mass. Highway Department submits design exception to FHWA for approval even if it's off the NHS as long as Federal funding is used. *Virginia:* In excess of $10 million, Virginia DOT submits design exception to FHWA for approval even if it's off the NHS.	5
Off NHS, Federal-aid Road, no Federal funds, depending on cost	1
B. Other Conditions Requiring FHWA Approval of Design Exceptions	
Interchange spacing (CA)	1
New or modified Interstate access (CA)	1
Any project with Federal funds that FHWA designates "full oversight" (CT)	1
ITS projects, depending on cost (DE)	1
FHWA is on exception committee (ID)	1
Interstates depending on scope (IL)	1
FHWA selected project on NHS (IA)	1
Project involving new technology, FHWA grants, or new initiatives (MD)	1
Bridge projects >$10 million (MN)	1
Design–build projects (MN)	1
Major bridge projects (MO)	1
ITS projects (MO)	1
Major, unusual projects (NJ)	1
Appalachian Development Highway System, regardless of cost (TN)	1
Off NHS, Federal-aid Road, at state request (TX)	1
NHS, Interstate, reconstruction, or new construction (UT)	1
NHS, non-Interstate, requires EIS (UT)	1
Pedestrian paths where ADA issues are involved (VT)	1
NHS, new construction >$1 million (WI)	1
NHS, 3R >$2 million (WI)	1

16. This question pertains to projects administered by a local public agency (e.g., municipal or county government) and funded by State and/or Federal funds provided through your agency. If such a locally administered project requires a design exception under your agency's policy, which agency has final approval authority? (check one column per row)

Project Funding	**Final Approval Authority for Design Exception**			
	Local Agency	**State**	**FHWA**	**Varies (e.g., by system, cost)**
State-aid, local match		35		3
Federal-aid, local match	1	25	6	10
State- and Federal-aid		27	3	10

Organizational Roles and Responsibilities

This set of questions will help us understand how the design exception process flows within your state.

17. For consultant design projects, who is primarily responsible for assembling information and analysis used to support a design exception request? (check one)

    Consultant staff 41
    Agency staff 5

18. Is the design function in your agency primarily centralized or decentralized (i.e., by district offices, regions)? (check one)

    Centralized 27

    Decentralized 17

    Both 2

19. If you answered "decentralized" to question 18, are design exceptions approved by a decentralized unit in your agency?

    Yes 3

    No 14

    Both 2

20. In your agency does the same unit responsible for project design (e.g., Regional Design) approve design exceptions or does a different unit (e.g., Design Bureau, Chief Engineer) approve them? (check one)

    Same 12

    Different 33

    Both 1

21. Does your agency independently review (i.e., someone not on the design team) each set of construction plans to determine if it includes any elements that require design exceptions? (check one)

Yes 22
No 24

22. Using the table below please indicate the internal state functional areas (portion A) that review design exception requests before they are sent to the approving official(s). Use portion B for listing other functional areas/offices in your STA that review design exceptions.

A. Function/Office	This Unit Reviews Design Exceptions	This Unit Does Not Review Design Exceptions
Agency Legal Office	1	44
Agency-wide Committee	1	44
Design (Quality Assurance) Bureau	22	23
Design Exception Committee	8	37
District/Region Safety Committee	3	42
B. Other Functional Areas/Offices that Review Design Exceptions		
Roadway Group—Predesign Section (AZ)		
Roadway Group—Design Section (AZ)		
Mandatory Reviews by Headquarters Design Liaisons (CA)		
Advisory Reviews by District Design Chief (CA)		
Traffic Section (ME)		
Division Office (ME)		
Construction Personnel (ME)		
Environmental Personnel (ME)		
Utilities (ME)		
Division Chief (MD)		
In-house Design Head (MA)		
Consultant Design Head (MA)		
Traffic Design Head (MA)		
District Projects Head (MA)		
Geometric Review Engineer (MI)		
State Geometric Design Engineer (MN)		
Design Administrator then Chief Engineer (MS)		
Bridge Office (MO)		
Consultant Design Section for consultant projects (MT)		
Road Design Section for in-house projects (MT)		
Roadway Design Engineer (NE)		
Deputy Director of Engineering (NE)		
Board of Public Roads Classifications and Standards (NE)		
Safety and Traffic Division (NV)		
Regional Design Group (NY)		
Design Division—Main Office (NY)		
Office of Engineering—Main Office (NY)		
Office of Roadway Engineering Services (OH)		
Geometric Design Engineer (OK)		
Local Area Manager (OR)		
Local Design Manager (OR)		
Director of Bridge or Design Divisions (TN)		
Project Manager (UT)		
Region Preconstruction Engineer (UT)		
Division Administrator (reviews and approves—VA)		
Assistant Division Administrator (reviews—VA)		
District Project Engineer or Construction Manager (reviews—VA)		
Deputy State Highway Engineer—Development (WV)		
Project Development & Highway Development Engineer (WY)		

Data Collection

This set of questions will help us understand the type of information that is collected as an initial step in evaluating design exceptions in your state.

23. Using portion A of the table please indicate how often your agency collects the data items shown as an initial step in processing design exceptions for site-specific projects (place a check in one column per row). Use portion B to indicate data elements not listed and the frequency with which the items are collected.

A. Type of Information	**Gathered Routinely (or always)**	**Gathered Occasionally**	**Gathered Infrequently (or never)**
Accident history in project limits	39	6	
Accident severity information	30	10	5
Collision/condition diagrams	11	21	12
Cost to cure (construction to standards)	33	6	6
Skid number data	6	9	28
Traffic volume data	38	5	1
B. Other Information Gathered	**Gathered Routinely (or always)**	**Gathered Occasionally**	**Gathered Infrequently (or never)**
Existing Geometry	3 (DE, MD, WA)	1 (NV)	
AASHTO Requirements	1 (MD)		
Design/Posted Speed	3 (DE, MI, TN)		
Controlling Criteria		1 (VA)	
Examples		1 (MN)	
Future Plans for Improvements	1 (MO)		
As-built Plans	1 (AZ)		
Typical Section	2 (DE, WV)		
Contributing Factors	1 (KS)		
Statewide Average for Similar Roadways	1 (KS)		
Vertical Alignment Data		1 (KS)	
Adjacent Facility Characteristics	1 (NY)	1 (AL)	
Social, Economic, Environmental Impacts	4 (CT, MA, NJ, NY)		
Right-of-Way Constraints/Costs	4 (CT, MA, NJ, PA)		
Public Comment/Community Support		2 (MA, NJ)	
Functional Class/Terrain	1 (TN)		
Design Vehicle		1 (PA)	
Design Variances	1 (WA)		
Roadside Data		1 (WA)	
Pavement Structure, Wear, and Rutting	1 (WA)		
Utility Relocation Cost Estimate	1 (NJ)		

Analysis Tools

This set of questions will help us understand how *below-criteria* design elements are evaluated.

24. Using portion A of the table please indicate how often your agency uses the following analysis tools to evaluate design criteria elements (place a check in one column per row). Use portion B to indicate other analysis techniques not listed and the frequency with which the items are used.

A. Type of Information	Gathered Routinely (or always)	Gathered Occasionally	Gathered Infrequently (or never)
Accident modification factors (other accident prediction model)	5	13	27
Accident trends (e.g., history or occurrence indicators)	24	9	13
Before–after studies	1	16	28
Classic statistical methods (rank/rate)	10	11	23
Collision/condition diagrams	10	19	16
Cost-benefit analysis	16	18	11
B. Other Information Gathered	**Gathered Routinely (or always)**	**Gathered Occasionally**	**Gathered Infrequently (or never)**
Existing Geometry, Design Speed, Other Features	1		
AASHTO Requirements	1		
Right-of-Way and Environmental Impacts	2		
Constructibility of "Cure"	1		
Mitigating Conditions and Related Improvements	1		
Operational Function		1	
Ride Quality		1	
Factors Used in KDOT Priority Formula	1		
Network Optimization System Survey	1		
Design Features of Adjacent Highway Sections	1		

Your Experience

This set of questions will help us understand how many design exceptions your agency processes and if benefits from this process have ever been studied.

25. Please indicate on the discrete scale below where in the project development process design exceptions are developed and approved. If design exceptions are developed and approved at two distinctly separate stages of your agency's project development process, please indicate both of these locations on the scale.

1 0% Project Initiation
26 20% Preliminary Engineering
13 40% Environmental Clearance
18 60%
10 80% Final Design
2 100% Plans, Specifications & Estimates

26. How many design exceptions does your agency process in a typical year?

Annual number Range = 1 to 500; Average = 50

27. Does your agency have a centralized record of all design exceptions? (check one)

Yes 23
No 23

28. List the criteria for which design exceptions are most often prepared by your agency.

Criterion	Frequency
Horizontal Alignment	25
Shoulder Width	24
Vertical Alignment	20
Stopping Sight Distance	18
Lane Width	12
Design Speed	12
Superelevation	9
Bridge Width	8
Grade	7
Horizontal Clearance	7
Vertical Clearance	3
Cost to Construct to Full Standard	2
Environmental Impacts	1
Context-Sensitive Solutions	1
Bridge Hydraulics	1
Cut/Fill Slopes	1
Safety	1
Right-of-Way Availability	1
Median Opening Spacing	1
Bridge Rail	1
Level of Service	1
Design Specification	1
Intersection Sight Distance	1
Cross Slope	1
Pavement Width	1

29. Has your agency ever conducted a study to determine the benefits associated with preparing design exceptions? (check one)

Yes 0
No 46 (If "No," go to question 31)

30. If you answered "Yes" to question 29, please answer this question; otherwise proceed to question 31. Using the table below please indicate the documented benefits of preparing design exceptions. Using portion A of the table, place a check in one column per row. If there are other documented benefits of preparing design exceptions that are not listed, please identify them in portion B of the table.

Benefits of Preparing Design Exceptions	Study Indicates This Is a Benefit	Study Did Not Indicate This Is a Benefit
Reduce liability exposure	0	0
Reduce impacts	0	0
Safety improved	0	0
Some designs improved to meet criteria	0	0
Successfully used to defend tort liability	0	0

31. If documented design exceptions were not required by FHWA regulation, would your agency still prepare them? (check one)

Yes 43

No 2 (If "No," go to question 33)

Unknown 1

32. If you answered "Yes" to question 31, please answer this question; otherwise proceed to question 33. Beyond the FHWA regulation, what are the reasons your agency prepares design exception documentation?

- Reduces liability exposure (22).
- Ensures design exception documentation/review/good engineering practice (21).
- Improves safety (3).
- Future reference material (3).
- Minnesota DOT has adopted geometric design standards for all on-system routes.
- Provides consistent cross section for driver expectation.
- Efficient use of available funds.

33. If you have experience where design exception documentation was used in a tort lawsuit or claim, please describe the pertinent conditions and outcome. Was the documentation beneficial or detrimental to your agency?

- None (41).
- Poor documentation can be harmful to agency.
- Minnesota has had several claims and lawsuits. State has argued that design is discretionary, thus DOT has discretionary immunity.
- Documentation is beneficiary.
- California has experienced tort lawsuits or claims where design exception documentation was used—adequate documentation has served the state well.
- Washington indicates increased tort exposure as a result of design exceptions, but decreased risk with adequate documentation.

34. Has the advent of Context-Sensitive Design or Design Flexibility increased the number of design exceptions prepared in your agency? (check one)

Yes 9

No 37

If "Yes," explain.

- Virginia: Resulted in new criteria—pave in place, rural roads program, more use of 3R.
- New Mexico: No explanation.
- Oklahoma: Better documentation of project decisions.
- North Carolina: Context-sensitive design has created a willingness to deviate from minimum AASHTO criteria.
- Nebraska: Reduced encroachments to reduce impacts to endangered species, historic sites, etc.
- New York: Design exceptions are allowed and encouraged. Slightly more exceptions may occur as a result of context-sensitive design; however, NYSDOT has been utilizing design exceptions routinely for avoidance and mitigation of social, economic, and environmental impacts and does not expect a large increase in design exceptions. Many context-sensitive designs can be accomplished while achieving minimum standards.
- Wyoming: Increased thrust to use lower design standards by environmental groups and resource agencies.
- Washington: It is believed that context-sensitive design will increase the number of design exceptions substantially without changes in the design manual and without clarification from AASHTO and FHWA.
- Delaware: Has increased the number of cross-section width design exceptions.

Problems with Design Exception Process

35. Please list any problems you have experienced with the design exception process.

State	Problems
Alabama	Inadequate documentation of "cost to cure."
Alaska	None
Arizona	Most problems are associated with proper justification. Timely recognition of the need for an exception is an issue.
California	No quality assurance program in place to make sure all design exceptions are identified and processed. No procedure for recording and storing exceptions in a timely manner. Need to identify design exceptions earlier in project development process.
Florida	Horizontal clearance criteria is tied to clear zone criteria, thus a large number of exceptions are processed for horizontal clearance. Bridge rail has been linked to structural capacity, thus a large number of structural capacity exceptions have been processed when bridge rails do not meet certain crash-worthy standards in addition to those processed for the load-carrying capacity of the bridge.
Idaho	Design exceptions are so infrequent that often times documentation is so poor that additional information is needed.
Iowa	Perception is that design exceptions are difficult to complete.
Kansas	The amount of resources required to gather data, analyze, discuss need for exception vs. designing to criteria, and process the design exception.
Kentucky	Process is too far-reaching—need more design flexibility.
Maryland	Design exception process should be improved internally and all documentation archived in a central location.
Massachusetts	Too much time to process. Inconsistent reports. Variable prices from consultants to prepare. Consensus building with communities. Lack of safety analysis to support exception. Subjective analysis of constraints (instead of quantitative). Limited staff time for reviews. No clear definition of all 13 controlling criteria. Poor communication between transportation department and proponents.
Michigan	Late submittals risk possibility of non-approval and redo of design.
Minnesota	Lack of clarity regarding submission requirements. Some feel design exception process is perfunctory and serves no purpose (important for liability reasons).
Mississippi	Have been given verbal approval by FHWA, then not given written approval.
Missouri	Confusion over documentation needs.
Montana	Inconsistent. Lack of documentation/justification.
Nebraska	Takes too much time to approve a design exception.
New Jersey	Some preparers do not understand the purpose. Some explanations are illogical or implausible. Hostage situations develop when design exception reports are prepared late in the process. Designers are inexplicably reluctant to follow examples, instructions, and formats.
New York	Occassional non-compliance with departmental guidance on report preparation.
Ohio	The process is very cumbersome for resurfacing projects and provides little benefit.

Oregon	Not performed early enough in the design process.
Pennsylvania	Incomplete submissions or submissions that do not support approval.
South Dakota	Can be difficult to determine cost to cure. Time consuming to prepare exceptions.
Utah	Feels design exceptions should be reviewed and approved by region that requested them (better understanding of project and local needs).
Virginia	A clear, comprehensive policy/procedure was not available until recently. Lack of necessary data presented to approver.
Washington	Exception process can be time and resource consuming.
Wisconsin	Some exceptions are recommended on new construction projects when the cost to meet standard is a relatively small percentage of the total construction cost (i.e., 1 to 2 percent).
Wyoming	Field personnel want exceptions, but unwilling to document or justify them.

Improving the Design Exception Process

36. Please list any improvements you feel could be made to streamline the design exception process.

State	Improvements
California	Checklists for designers to use to identify nonstandard features on existing and proposed facilities. Project auditing to make sure design exceptions are processed. Identify when design exceptions shall be processed during the design process.
Florida	Eliminate design speed from list of controlling criteria. AASHTO Green Book contains too many qualifiers (e.g., “if possible,” “should,” “when feasible,” etc.)—has allowed FHWA and states to interpret differently. FHWA should clearly define horizontal clearance. FHWA should clearly define structural capacity.
Hawaii	Allow existing conditions which violate current design standards, but not those during the original construction, to be exempt from the design exception process.
Iowa	Education and documentation of the process.
Kentucky	Use on the 13 controlling criteria for design exceptions.
Maryland	Centralized storage of approved requests.
Michigan	Incorporate design exceptions into the scoping process.
Minnesota	Clearer communication with the FHWA on needed support data and expectation of design personnel as to time frames involved.
Mississippi	Provide more guidance/examples of design exceptions.
Montana	Better defined process.
New Jersey	Develop expert systems to identify substandard values and minimum values. Make report formats available on Web. Create a database of approved/denied proposals. List countermeasures for each substandard feature. Provide design exception preparation training to designers.
Ohio	Revise the process for resurfacing projects.
Oklahoma	Additional guidelines from the FHWA.
Pennsylvania	Develop a checklist form that would standardize submissions. Provide checklist form to all internal and external users.
South Carolina	Recognize areas earlier in the design process.
Utah	Online request and approval.
Washington	Develop boilerplate documents/guidelines on the development of design documentation. Provide design exception education and training.
Wyoming	Define what is a reasonable exception.

37. Does your agency have any experience with design exceptions on design–build projects? If yes, please describe how the process is similar and different compared to a conventional design project. (check one)

Yes 10
No 36

- Arizona: On design–build reconstruction projects most design exceptions are identified in the scope of work. Design exceptions during the actual design–build are many times identified too late in the construction process to adequately address.
- California: The Department's experience is limited to their oversight role on transit and toll road authorities. Design exceptions are processed as they are encountered and if it is determined a design exception is the best solution.
- Georgia: All known substandard design features that will not be corrected require a design exception; any additional items found during construction will also be processed for a design exception.
- Indiana: Process was the same.
- New Jersey: Best addressed before awarding design–build contracts.
- Ohio: Known required design exceptions are obtained before the Scope of Services. The design build team advised of any future design features that do not meet design criteria and prepare and submit the design exception for approval.
- Oregon: Process was the same.
- Utah: Process was the same.
- Washington: No explanation.

38. Using the table below please list the most common mitigation measures utilized for design exceptions of the corresponding criteria. Use portion A of the table to list the mitigation measures (see example provided). If there are mitigation measures used for other than the controlling criteria, please cite them and the corresponding criteria in portion B of the table (attach additional comments as appropriate).

A. Design Criteria	**Most Common Mitigation Measure**	**Next Most Common Mitigation Measure**	**Next Most Common Mitigation Measure**
Example: Stopping sight distance	*Lower speed limit*	*Warning signs*	*?????*
Design speed	Warning signs (5) Lower speed limit (13)	Lower speed limit Warning signs (6)	
Lane width	Signs Lower speed limit (5) Warning signs (5) Add delineation Narrow lanes Pavement markings Pavement edge lines	Advisory speed Raised pavement marker	Warning signs
Shoulder width	Pave only part Lower speed limit (4) Warning signs (4) Rumble strips Add delineation Occasional turnouts Narrow shoulder Pavement markings Pavement edge lines	Video camera Surveillance Advisory signs Use different material (i.e., grass, gravel) Delineators Raise pavement marker	Warning signs (2)
Bridge width	Warning signs (16) Restrict traffic Add delineations Lower speed limit (2) Matching pavement (2)	Tapers Warning signs (2) Lower speed limit (2) Rumble strips	

Structural capacity	Load limit signs (10) Restrict traffic Warning sign (10) Replace bridge Lower speed limit	Warning signs (2) Load limit signs (2)	
Horizontal alignment	Lower speed limits (10) Warning/advisory signs (19)	Warning beacons/signs (4) Slopes Lower speed limit Widen pavement/ shoulder/clear zone (2) Chevrons Antiskid pavement	Clear area Superelevation Lower speed limit
Vertical alignment	Meets AASHTO Lighting Lower speed limit (8) Warning signs (10) Intersection relocation	Lighting (2) Lower speed limit (3) Warning/advisory signs (3) Pavement markings Fixed object removal	Warning beacon Lighting Lower speed limit
Grade	Warning signs (14) Lower speed limit (4) Truck climbing lane (5) Passing lanes	Truck lane (4) Warning signs (3) Curbs/inlets	Truck escape ramp

A. Design Criteria	**Most Common Mitigation Measure**	**Next Most Common Mitigation Measure**	**Next Most Common Mitigation Measure**
Stopping sight distance	Remove obstructions Lower speed limit (9) Warning signs (8) Rumble strips Lighting Intersection relocation	Warning beacon/signs (5) Lighting Lower speed limit (2) Fixed object removal Shoulder widening	Signalize intersection Lighting (2)
Cross slope	Improve drainage (2) Lower speed limit (2) Guardrail (2) Warning/advisory signs (4) Modified pavement	Correct Lower speed limit	
Superelevation	Ride quality Lower speed limit (7) Slopes Warning/advisory signs (11)	Speed limit sign/change Warning signs (2) Antiskid pavement	
Vertical clearance	Warning signs (24) Mill roadway underneath structure Restrict traffic	Post warning sign (2) Alternative route (2)	
Horizontal Clearance	Warning signs (11) Traffic barrier (4) Restrict traffic Add delineation Lower speed limit (3)	Width of adjacent shoulder Warning signs (2) Traffic calming Alternate route	
B. Other Criteria	**Most Common Mitigation Measure**	**Next Most Common Mitigation Measure**	**Next Most Common Mitigation Measure**
Weave/distance between ramp termini	Compressed CD lane	Basket weave ramps	
Intersection sight distance	Clear sight triangle Signalization		
Lane drop length	Warning signs		
Accel./decel. lanes at interchanges	Warning signs	Convert to stop	

APPENDIX D

Survey Responses by State Transportation Agencies

Table D1 provides responses by each STA for survey questions with discrete choices. Tables D2 through D11 provide individual STA responses for the survey question noted.

TABLE D1
STA RESPONSES FOR DISCRETE CHOICE QUESTIONS

State	1	2	3	4	6	7	8	9	11
Alabama	N	N	Y	N	N		N		Separate
Alaska	N	N	N	N	N		Y	N	Separate
Arizona	N	N	Y	Y	Y	Y	N		Separate
Arkansas	N	N	N	N	N		N	N	Separate
California	Y	N	Y	Y	Y	Y	Y	N	Separate
Connecticut	N	N	Y	Y	Y	Y	Y	N	Separate
Delaware	N	N	Y	N	N		N		Separate/Collective
District of Columbia	Y	Y	Y	N	N		N		Separate
Florida	N	N	N	Y	Y	N	Y	N	Separate
Georgia	N	N	Y	Y	Y	Y	Y	N	Separate
Hawaii	N	N	Y	Y	N		Y	N	Collective
Idaho	Y	Y	Y	N	N		Y	N	Separate
Illinois	N	Y	Y	Y	Y	Y	Y	N	Separate
Indiana	N	N	N	Y	N		Y	N	Separate
Iowa	N	N	Y	Y	Y	Y	Y	N	Collective
Kansas	N	N	N	N	Y	N	Y	N	Separate
Kentucky	N	N	N	Y	Y	Y	Y	N	Collective
Maine	N	N	N	N	Y	Y	Y	N	Separate
Maryland	N	Y	Y	N	(Skip)		Y	N	Separate
Massachusetts	N	N	Y	N	N		N		Separate
Michigan	Y	Y	Y	N	Y	Y	Y	N	Separate
Minnesota	Y	N	Y	N	Y	Y	Y	N	Separate
Mississippi	N	N	N	Y	Y	Y	Y	N	Separate
Missouri	N	N	N	Y	N		Y	N	Separate
Montana	Y	N	Y	Y	Y	Y	Y	Y	Separate
Nebraska	Y	N	Y	Y	Y	Y	Y	N	Separate
Nevada	Y	N	Y	N	N		Y	N	Separate
New Jersey	Y	N	Y	Y	Y	Y	Y	N	Separate
New Mexico	N	N	Y	N	N		Y	N	Collective
New York	N	N	N	Y	Y	Y	Y	N	Separate
North Carolina	N	N	N	N	N		Y	Y	Collective
Ohio	N	N	Y	N	N		Y	N	Separate
Oklahoma	Y	Y	Y	N	N		Y	N	Separate
Oregon	N	N	N	Y	Y	Y	Y	N	Separate
Pennsylvania	N	N	Y	Y	Y	Y	Y	N	Collective
South Carolina	N	N	Y	N	N		N		Separate
South Dakota	Y	N	Y	N	N		Y	N	Collective
Tennessee	N	N	Y	N	N		Y	N	Separate
Texas	N	N	Y	N	N		Y	N	Separate/Collective
Utah	N	N	N	N	Y	Y	Y	N	Separate
Vermont	N	N	N	Y	N		Y	Y	Separate
Virginia	N	N	N	Y	Y	N	Y	N	Collective
Washington	Y	N	Y	N	Y	Y	Y	N	Separate
West Virginia	Y	N	Y	N	N		Y	N	Separate
Wisconsin	N	N	N	N	Y	Y	Y	N	Separate
Wyoming	N	N	Y	N	Y	N	Y	N	Collective

TABLE D1 (*continued*)

State	12	13	14	17	18
Alabama	Separate	Y	Y	Consultant	Decentralized
Alaska	Separate	Y	N	Consultant	Decentralized
Arizona	Separate	Y	N	Consultant	Centralized
Arkansas	Separate	Y	Y	Consultant	Centralized
California	Separate/Collective (depends on impacts)	Y	Y	Consultant	Decentralized
Connecticut	Separate	Y	Y	Consultant	Centralized
Delaware	Separate/Collective	Y	Y	Consultant	Centralized
District of Columbia	Separate	N	Y	Consultant	Centralized
Florida	Separate	Y	Y	Consultant	Decentralized
Georgia	Collective	Y	Y	Consultant	Centralized
Hawaii	Separate	Y	Y	Consultant	Centralized
Idaho	Collective	Y	Y	Consultant	Decentralized
Illinois	Collective	Y	Y	Consultant	Decentralized
Indiana	Separate	Y	Y	Consultant	Centralized
Iowa	Collective	Y	Y	Agency	Centralized/Decentralized (3R only)
Kansas	Collective	Y	Y	Consultant	Centralized
Kentucky	Separate	Y	Y	Agency	Decentralized
Maine	Separate	Y	Y	Consultant	Centralized
Maryland	Separate	Y	Y	Consultant	Centralized
Massachusetts	Separate	Y	Y	Consultant	Centralized
Michigan	Collective	Y	Y	Consultant	Centralized/Decentralized
Minnesota	Separate	Y	Y	Consultant	Decentralized
Mississippi	Separate	Y	Y	Consultant	Centralized
Missouri	Separate	Y	Y	Consultant	Decentralized
Montana	Separate	Y	Y	Consultant	Centralized
Nebraska	Collective	Y	Y	Agency	Centralized
Nevada	Separate	Y	Y	Consultant	Centralized
New Jersey	Separate	Y	Y	Consultant	Centralized
New Mexico	Collective	Y	Y	Consultant	Centralized
New York	Separate	Y	Y	Consultant	Decentralized
North Carolina	Collective	Y	Y	Consultant	Centralized
Ohio	Collective	Y	Y	Consultant	Decentralized
Oklahoma	Separate	Y	Y	Consultant	Centralized
Oregon	Collective	Y	Y	Consultant	Centralized
Pennsylvania	Collective	Y	Y	Consultant	Decentralized
South Carolina	Collective	Y	Y	Consultant	Centralized
South Dakota	Collective	Y	Y	Consultant	Centralized
Tennessee	Separate	Y	Y	Agency	Centralized
Texas	Separate/Collective	Y	Y	Consultant	Decentralized
Utah	Separate	Y	Y	Consultant	Decentralized
Vermont	Separate	Y	Y	Consultant	Centralized
Virginia	Collective	Y	Y	Consultant	Decentralized
Washington	Separate	Y	Y	Consultant	Decentralized
West Virginia	Separate	Y	Y	Agency	Centralized
Wisconsin	Separate	Y	Y	Consultant	Decentralized
Wyoming	Collective	Y	Y	Consultant	Centralized

TABLE D1 (*continued*)

State	19	20	21	25
Alabama	N	Different	Y	60%/80%
Alaska	Y	Same	Y	40%
Arizona		Different	Y	20%
Arkansas		Different	Y	60%
California	Y (Advisory); N (Mandatory)	Same (Advisory); Different (Mandatory)	Y	20%/40%/60%
Connecticut		Different	Y	20%/80%
Delaware		Same	N	20%/60%
District of Columbia		Different	Y	60%
Florida	N	Same	N	20%/60%
Georgia		Different	N	20%
Hawaii		Different	N	20%
Idaho	N	Different	N	20%
Illinois	N	Different	N	40%
Indiana		Same	Y	20%/40%/60%
Iowa	Y	Same	N	20%
Kansas		Different	N	40%
Kentucky	N	Different	Y	20%/60%
Maine		Same	N	100%
Maryland		Different	N	40%/80%
Massachusetts		Different	N	20%
Michigan	N	Different	Y	80%
Minnesota	N	Different	N	60%
Mississippi		Different	N	60%
Missouri	N	Different	Y	20%/40%/60%/80%
Montana		Same	N	40%
Nebraska		Different	N	20%/80%
Nevada		Different	Y	20%/80%
New Jersey		Different	Y	60%
New Mexico		Same	N	20%
New York	Y or N (depends on system, cost, funding source)	Different	Y	40%
North Carolina		Same	N	40%
Ohio	N	Different	Y	20%
Oklahoma		Same	Y	20%
Oregon		Different	N	20%/80%/100%
Pennsylvania	N	Different	N	60%
South Carolina		Different	Y	80%
South Dakota		Different	N	20%/60%/80%
Tennessee		Same	Y	40%
Texas	N	Different	Y	20%
Utah	N	Different	Y	20%
Vermont		Same	N	20%
Virginia	N	Different	Y	20%/40%/60%
Washington	Y	Different	N	20%/60%
West Virginia		Different	N	40%/60%
Wisconsin	N	Different	Y	0%/60%
Wyoming		Different	N	20%/60%

TABLE D1 (*continued*)

State	26	27	29	31	34	37
Alabama	5	Y	N	Y	N	N
Alaska	Unknown	N	N	Y	N	N
Arizona	10 (new or reconstruction); 30 (pavement preservation)	N	N	Y	N	Y
Arkansas	<5	Y	N	Y	N	N
California	500	Y	N	Y	N	Y
Connecticut	50 to 60	N	N	Y	N	N
Delaware	10 to 15	Y	N	Y	Y	N
District of Columbia	2	N	N	N		N
Florida	40	Y	N	Y	N	N
Georgia	35	Y	N	Y	N	Y
Hawaii	5	N	N	Y	N	N
Idaho	7	Y	N	Y	N	N
Illinois	100	N	N	Y	N	N
Indiana	47	N	N	Y	N	Y
Iowa	80	Y	N	Y	N	N
Kansas	6 projects (1 to 10 elements each)	N	N	Y	N	N
Kentucky		N	N	Y	N	N
Maine	20	Y	N	Y	N	N
Maryland	Unknown	N	N	Y	N	N
Massachusetts	20	N	N	Y	N	Y
Michigan	100	N	N	Y	N	N
Minnesota	40	N	N	Y	N	N
Mississippi	4	Y	N	Y	N	N
Missouri	200–250	Y	N	Y	N	N
Montana	25–30	N	N	Y	N	N
Nebraska	20	Y	N	Y	Y	N
Nevada	1 or 2	N	N	Y	N	N
New Jersey	120	Y	N	Y	N	Y
New Mexico	10	N	N	Y	Y	N
New York	unknown	N	N	Y	Y	N
North Carolina	68	N	N	Y	Y	N
Ohio	225	Y	N	Y	N	Y
Oklahoma	<5	N	N	Y	Y	N
Oregon	300	Y	N	Y	N	Y
Pennsylvania	76	Y	N	Y	N	N
South Carolina	2	Y	N	Y	N	N
South Dakota	5 to 10	Y	N	Y	N	N
Tennessee	5	Y	N	Y	N	N
Texas	12 to 18	N	N	Unknown	N	N
Utah	24	Y	N	Y	N	Y
Vermont	10	Y	N	Y	N	N
Virginia	24 (road) & 12 (bridge)	Y	N	Y	Y	N
Washington	unknown	N	N	Y	Y	Y
West Virginia	<100	N	N	N	N	N
Wisconsin	30	Y	N	Y	N	N
Wyoming	10 to 15	N	N	Y	Y	N

TABLE D2
RESPONSE TO QUESTION 5

STA	Supplemental Design Criteria
Alabama	None
Alaska	None
Arizona	None
Arkansas	None
California	None
Connecticut	None
Delaware	None
District of Columbia	None
Florida	• Limited access use by utilities • Control zone use by utilities
Georgia	• Median opening spacings • Right-turn lanes • Clear zone • Intersection skew angle • Design storm
Hawaii	Hydraulics
Idaho	None
Illinois	None
Indiana	None
Iowa	• Foreslopes • Transverse slopes • Culverts within clear zone • Safety dikes • Clear zone hazards (trees, poles, etc.)
Kansas	None
Kentucky	• Ditch slope and width • Side slopes • Clear zone
Maine	None
Maryland	None
Massachusetts	None
Michigan	None
Minnesota	None
Mississippi	• Crossover spacing • Sight flares • Channelization • Median width
Missouri	• Bridge hydraulics • Interchange ramp spacing • Guard rail • Interchange lighting • Location of non-roadway facilities on the right-of-way • Type of shoulder construction
Montana	• Cut/fill slopes • Intersection sight distance
Nebraska	• Width of shoulder surfacing • Median width • Number of lanes
Nevada	None

TABLE D2 (*Continued*)

STA	Supplemental Design Criteria
New Jersey	• Lane drop length • Acceleration/deceleration lane length at interchanges • Sight distance at intersections and driveways
New Mexico	None
New York	• Rollover • Level of service • Control of access • Pedestrian accommodation • Median width
North Carolina	None
Ohio	None
Oklahoma	None
Oregon	Roadside slopes
Pennsylvania	Ramp lengths
South Carolina	None
South Dakota	None
Tennessee	None
Texas	None
Utah	None
Vermont	• Foreslopes • Guard rail • Bridge rail • High accident locations • Level of service • Mailbox supports • Signs/signals/pavement markings
Virginia	Interstate access control breaks
Washington	None
West Virginia	None
Wisconsin	None
Wyoming	None

TABLE D3
RESPONSE TO QUESTION 10

STA	As-built drawings	Field surveys	Roadway inventory data	Construction plans	Photogrammetry or video logs	Traffic and accident data	Existing plans
Alabama	H, V, CS						
Alaska		H, V, CS					
Arizona	H, V, CS						
Arkansas		H, V, CS					
California	H, V, CS	H, V, CS					
Connecticut		H, V, CS					
Delaware		H, V, CS					
Florida		H, V, CS					
Georgia		H, V, CS					
Hawaii	H, V, CS						
Idaho		H, V, CS					
Illinois	CS	H, V					
Indiana		H, V, CS					
Iowa	H, V, CS	CS	H, V, CS				
Kansas	H, V	H, V, CS					
Kentucky	H, V	H, V					
Maine	H, V	H, V, CS	CS				
Maryland	H, V	CS					
Massachusetts		H, V, CS	H, V	H, V, CS			
Michigan	H, V, CS	H, V					
Minnesota	H, V	CS	CS				
Mississippi	V	CS					
Missouri	H, V, CS	V, CS	H, V, CS				
Montana	H, V	CS	CS				
Nebraska	H, V, CS	H, V, CS	CS				
Nevada	H, V, CS						
New Jersey	H, V, CS	H, V, CS					
New Mexico	H, V, CS	H, V					
New York	H, V	CS			H, CS		
North Carolina		H, V, CS					
Ohio							H, V, CS
Oklahoma	H, V, CS						
Oregon		H, V	CS				
Pennsylvania	H, V	H, V, CS	CS				
South Carolina	H, V	H, V, CS					
South Dakota	H, V	H, V, CS	H, V				
Texas	H, V, CS	H, V, CS					
Utah	V	H, CS					
Vermont		H, V, CS					
Virginia	H, V, CS	H, V, CS					
Washington		H, V, CS					
West Virginia		H, V, CS					
Wisconsin	H, V	CS					
Wyoming	H, V	CS	CS				
Note: H = Horizontal alignment information; V = vertical alignment information; CS = cross-section information.							

TABLE D3 (*continued*)

STA	As-built drawings	Field surveys	Roadway inventory data	Construction plans	Photogrammetry or video logs	Traffic and accident data	Existing plans
Alabama	M	C					
Alaska		C					
Arizona	M	M	N				
Arkansas	M	C	N				
California	M	C	N				
Connecticut		C					
Delaware	N	C	N				
Florida	N	C	N				
Georgia		C, M, N					
Hawaii	C	M	M				
Idaho	M	C	N				
Illinois	C	C	M				
Indiana		C					
Iowa	M	C	C				
Kansas	C	C					
Kentucky	M	C					
Maine	M	C	C				
Maryland	M	M					
Massachusetts		C	M	M			
Michigan	M	C	N				
Minnesota	C, M	C, M	M, N				
Mississippi	M	C	C				
Missouri	C	C	C				
Montana	M	C	M				
Nebraska	M	C	M				
Nevada	M	C	M				
New Jersey	M	C					
New Mexico	M	C	M				
New York	M	C	M		M	M	
North Carolina	C	C	M				
Ohio							M
Oklahoma	C						
Oregon		C, M	N				
Pennsylvania	M	C	C				
South Carolina	M	C	M				
South Dakota	M	C	M				
Texas	C	C					
Utah	M	C, N					
Vermont	M	C	N				
Virginia	M	C	N				
Washington		C, M, N					
West Virginia		C					
Wisconsin	M	C	M				
Wyoming	M	C	M				

Note: C = Meets needs completely; M = meets needs marginally; N = does not meet needs.

TABLE D4
RESPONSE TO QUESTION 15

STA	Interstate			On NHS			Off NHS, Federal-aid Road			Other
	Federal funds, regardless of cost	Federal funds, depending on cost	No Federal funds	Federal funds, regardless of cost	Federal funds, depending on cost	No Federal funds	Federal funds, regardless of cost	Federal funding, depending on cost	No Federal funds	
Alabama	X		X		X			X		
Arizona		X	X							
Arkansas	X		X	X		X				
California		X								
Connecticut		X			X					X
Delaware		X			X					X
District of Columbia	X			X						
Florida		X								
Georgia	X									
Hawaii		X			X			X		
Idaho	X	X	X	X	X	X	X	X	X	X
Illinois		X								X
Indiana		X			X					
Iowa	X			X						X
Kansas		X								
Kentucky	X									
Maine		X			X					
Maryland		X			X					X
Massachusetts	X				X			X		
Michigan		X			X					
Minnesota		X (>$1M)								X
Mississippi	X		X		X (>$5M)					
Missouri		X (>$1M)								X
Montana	X		X	X		X				
Nebraska		X								
Nevada	X	X	X	X	X					
New Jersey	X		X		X					X

TABLE D4 (*continued*)

STA	**Interstate**			**On NHS**			**Off NHS, Federal-aid Road**			**Other**
	Federal funds, regardless of cost	**Federal funds, depending on cost**	**No Federal funds**	**Federal funds, regardless of cost**	**Federal funds, depending on cost**	**No Federal funds**	**Federal funds, regardless of cost**	**Federal funds, depending on cost**	**No Federal funds**	
New Mexico	X				X					
New York		X (>$1M)								
North Carolina		X	X		X	X				
Ohio	X		X	X		X				
Oklahoma	X	X	X	X	X	X				
Oregon		X			X					
Pennsylvania		X			X					
South Carolina	X		X	X		X				
South Dakota		X								
Tennessee	X		X							X
Texas		X			X					X
Utah										X
Vermont	X									X
Virginia	X				X			X		
Washington	X		X							
West Virginia		X			X					
Wisconsin		X			X					X
Wyoming	X		X	X		X				
Note: Results from the “Other” column are shown in Appendix C.										

TABLE D5
RESPONSE TO QUESTION 16

STA	State-aid, local match	Federal-aid, local match	State- and Federal-aid
Alabama	State	State	State
Alaska	State	State	State
Arizona		Local	
Arkansas	State	State	State
California	Varies	Varies	Varies
Connecticut	State	State	State
District of Columbia		FHWA	
Florida	State	Varies	Varies
Georgia	State	State	State
Hawaii		Varies	Varies
Idaho	State	State	State
Illinois	State	State	State
Indiana		State	
Iowa	State	State	State
Kansas	State	State	State
Kentucky	State	State	State
Maine	State	State	State
Maryland	Varies	Varies	Varies
Massachusetts	State	Varies	Varies
Michigan	State	State	State
Minnesota	State	State	State
Mississippi	State	State	State
Missouri	State	State	State
Nebraska	State	State	State
Nevada	State	Varies	Varies
New Jersey	State	State	State
New Mexico	State	FHWA	FHWA
New York	Varies	Varies	Varies
North Carolina	State		State
Ohio	State	Varies	Varies
Oklahoma		FHWA	FHWA
Oregon	State	Varies	Varies
Pennsylvania	State	Varies	State
South Carolina	State	FHWA	FHWA
South Dakota	State	State	State
Tennessee	State	State	State
Texas		FHWA	
Utah	State	State	State
Vermont	State	State	State
Virginia	State	State	State
Washington	State	FHWA	State
West Virginia	State		Varies
Wisconsin	State	State	State
Wyoming	State	State	State

TABLE D6
RESPONSE TO QUESTION 22

STA	Agency legal office	Agency-wide committee	Design bureau (QA)	Design exception committee	District/region safety committee	Other
Alabama	N	N	Y	Y	N	
Arizona	N	N	N	N	N	X
Arkansas	N	N	Y	N	N	
California	N	N	N	N	N	X
Connecticut	N	N	N	Y	N	
Delaware	N	N	N	N	N	
District of Columbia	N	N	Y	N	N	
Florida	N	N	Y	N	N	
Georgia	N	N	Y	N	N	
Hawaii	N	N	N	N	N	
Idaho	N	N	Y	Y	N	
Illinois	N	N	Y	N	N	
Indiana	N	N	Y	N	N	
Iowa	N	N	Y	N	N	
Kansas	N	N	Y	N	N	
Kentucky	N	N	Y	N	N	
Maine	N	N	Y	N	N	X
Maryland	N	N	N	N	N	X
Massachusetts	N	N	N	N	N	X
Michigan	N	N	N	N	Y	X
Minnesota	N	N	N	N	N	X
Mississippi	N	N	N	N	N	X
Missouri	N	N	N	N	N	X
Montana	N	N	N	N	N	X
Nebraska	Y	N	N	N	N	X
Nevada	N	N	Y	N	N	X
New Jersey	N	N	N	Y	N	
New Mexico	N	N	Y	N	N	
New York	N	N	Y	N	N	X
North Carolina	N	N	N	N	N	
Ohio	N	N	N	N	N	X
Oklahoma	N	N	N	N	N	X
Oregon	N	N	N	N	N	X
Pennsylvania	N	N	Y	N	Y	
South Carolina	N	N	Y	Y	N	
South Dakota	N	Y	Y	Y	Y	
Tennessee	N	N	N	N	N	X
Texas	N	N	Y	Y	Y	
Utah	N	N	Y	N	N	X
Vermont	N	N	N	Y	N	
Virginia	N	N	N	N	N	X
Washington	N	N	Y	N	N	
West Virginia	N	N	N	N	N	X
Wisconsin	N	N	Y	N	N	
Wyoming	N	N	N	N	N	X

Note: Y = Unit indicated does review design exceptions; N = unit indicated does not review design exceptions; X = unit other than those indicated above reviews design exceptions (see Appendix C for results).

TABLE D7
RESPONSE TO QUESTION 23

STA	Accident history in project limits	Accident severity information	Collision or condition diagrams	Cost to cure	Skid number data	Traffic volume data	Other
Alabama	R	R	R	R	I	R	X
Alaska	R	R	R	R	I	R	
Arizona	R	I	O	O	I	R	X
Arkansas	O	O	O	O	O	R	
California	R	R, O	O	R	O	R	
Connecticut	R	R	O	R	O	R	X
Delaware	R	R	R	R	I	R	X
District of Columbia	R	R	R	R	R	R	
Florida	R	O	O	R	I	R	
Georgia	R	R	O	R	I	R	
Hawaii	R	I	I	I	I	O	
Idaho	R	R	R	R		R	
Illinois	R	R	R	R	R	R	
Indiana	R	R	R	R	I	R	
Iowa	R	R	R	R	O	R	
Kansas	R	R	I	R	I	R	X
Kentucky	O	O	I	I	I	R	
Maine	R	R	O	I	I	R	
Maryland	R	O	R	R	I	O	X
Massachusetts	R	R	O	I	I	R	X
Michigan	R	R	O	R	O	R	X
Minnesota	R	R	O	O	I		X
Mississippi	O	O	I	O	O	O	
Missouri	O	I	I	R	I	R	X
Montana	R	R	O	R	I	O	
Nebraska	R	R	O	R	I	R	
Nevada	R	R	I	R	R	R	X
New Jersey	R	O	R	R	I	I	X
New Mexico	R	R	O	R	I	R	
New York	R	R	O	R	I	R	X
North Carolina	R	R	I	O	I	R	
Ohio	R	R	O	I	O	R	
Oklahoma	R	R	I	R	R	R	
Oregon	R	R		R		R	
Pennsylvania	R	O	R	R	O	R	X
South Carolina	R	R	I	R	I	R	
South Dakota	R	O	O	R	I	R	
Tennessee	O	O	O	O	I	R	X
Texas	R	R	O	R	I	R	
Utah	R	R	R	R	R	R	
Vermont	R	I	I	R	I	R	
Virginia	O	I	I	I	I	R	X
Washington	R	R	O	R	R	R	X
West Virginia	R	O	I	R	I	O	X
Wisconsin	R	R	O	R	I	R	
Wyoming	R	R	O	R	O	R	

Note: R = Data gathered routinely; O = data gathered occasionally; I = data gathered infrequently; X = other information gathered (see Appendix C for results).

TABLE D8
RESPONSE TO QUESTION 24

STA	Accident modification factors	Accident trends	Before–after studies	Classical statistics	Collision or condition diagrams	Cost-benefit analysis	Other
Alabama	I	O	I	I	R	O	
Alaska	I	R	I	I	R	R	
Arizona	I	O	O	R	O	O	
Arkansas	I	O	I	I	O	O	
California	O	R	O	R	O	O	
Connecticut	I	R	O	R	I	O	
Delaware	I	R	I	O	R	O	
District of Columbia	O	O	O	O	O	O	
Florida	R	R	O	I	O	R	
Georgia		R					
Hawaii	I	I	I	I	I	I	
Idaho	R	I	I	R	R	R	
Illinois	O	R	O	O	R	O	
Indiana	R	I	I	R	R	R	
Iowa	O	O	O	I	O	R	
Kansas	I	R	I		I	I	X
Kentucky	I	I	I	O	I	O	
Maine	O	R	O	I	O	O	
Maryland	O	R	O	I	O	R	X
Massachusetts	I	I	I	I	O	O	
Michigan	I	R	I	I	O	R	
Minnesota	O	O	I	R	I	I	
Mississippi	I	I	I	I	I	I	
Missouri	R	R	O	I	I	R	
Montana	O	R	O	I	O	O	
Nebraska	O	R	I	I	R	O	
Nevada	I	I	O	I	O	O	
New Jersey	I	R	I	R	O	I	
New Mexico	I	R	O	O	O	O	
New York	O	R	I	R	O	R	X
North Carolina	I	I	I	I	I	I	
Ohio	I	I	I	R	R	O	
Oklahoma	I	R	O	I	I	R	
Oregon	I	R	I	I	I	R	
Pennsylvania	I	O	I	I	R	I	
South Carolina	I	I	I	I	I	I	
South Dakota	O	R	O	O	O	R	
Tennessee	I	I	I	I	I	I	
Texas	R	R	I	O	O	R	
Utah	O	R	R	O	R	R	
Vermont	I	I	I	I	I	O	
Virginia	I	I	I	I	I	I	
Washington	O	R	O	R	O	R	
West Virginia	I	O	I	O	I	R	
Wisconsin	I	R	I	O	O	O	
Wyoming	I	O	I	O	O	O	

Note: R = Data gathered routinely; O = data gathered occasionally; I = data gathered infrequently; X = other information gathered (see Appendix C).

TABLE D9
RESPONSE TO QUESTION 28

STA	Design speed	Lane width	Shoulder width	Bridge width	Structural capacity	Horizontal alignment	Vertical alignment	Grade	Stopping sight distance	Cross slope	Superelevation	Vertical clearance	Horizontal clearance	Other
Alabama			X				X		X					
Arizona									X					
Arkansas		X	X	X							X			
California		X	X			X	X		X		X			
Connecticut			X			X	X	X	X					a
Delaware	X	X	X	X		X								
District of Columbia		X												
Florida							X		X		X		X	
Georgia									X				X	b
Hawaii		X	X									X		
Idaho	X		X			X	X							
Illinois														c,d,e
Iowa				X		X	X							f
Kansas	X		X	X		X	X							
Kentucky	X													
Maine		X												f
Maryland						X	X		X		X			
Massachusetts	X	X	X			X	X							
Michigan			X						X		X	X		
Minnesota			X	X		X	X		X					
Mississippi			X										X	
Missouri		X	X	X				X	X					g
Montana						X	X							h
Nebraska		X	X	X				X						
Nevada	X	X	X				X							
New Jersey									X		X	X		
New Mexico	X					X	X		X					
New York		X	X			X			X					i
North Carolina	X					X	X		X					
Ohio		X	X			X			X		X			
Oklahoma	X		X	X			X							
Oregon			X			X	X							
Pennsylvania			X	X		X		X	X					
South Dakota						X	X	X		X				
Tennessee	X		X			X		X						
Texas						X	X							
Utah														d,j,k
Vermont			X	X					X					l
Virginia	X	X	X						X		X			
West Virginia	X		X			X		X						
Wisconsin		X				X			X				X	
Wyoming						X	X				X			

Notes: a = Intersection sight distance; b = median opening spacing; c = safety; d = cost; e = right-of-way availability; f = clear zone; g = bridge hydraulics; h = cut/fill slopes; I = level of service; j = environmental impacts; k = context-sensitive solutions; l = bridge rail.

TABLE D10
RESPONSE TO QUESTION 32

STA	Reasons for Preparing Design Exception Documentation
Alabama	Documents engineering decision-making process.
Alaska	Documents engineering decision-making process and ensures design is performed in accordance with standard practice.
Arizona	Reduces liability exposure and is a record of documentation for future reference.
Arkansas	Documents engineering decision-making process.
California	Documents engineering decision-making process and provides assistance for tort claims.
Connecticut	Management approves deviations from guidelines.
Delaware	Documents engineering decision-making process.
Florida	Good engineering practice.
Georgia	Reduces tort liability exposure.
Hawaii	Reduces tort liability exposure.
Idaho	Reduces tort liability exposure.
Illinois	Reduces tort liability exposure; improves safety; provides consistent cross-section for driver expectations.
Indiana	To provide safety standards.
Iowa	Reduces exposure to tort liability; excellent future reference material.
Kansas	Documents engineering decision-making process; reduces tort liability exposure.
Kentucky	Documents engineering decision-making process.
Maine	Documents engineering decision-making process.
Maryland	To ensure proper design review when design criteria are not met.
Massachusetts	Documents engineering decision-making process; reduces tort liability exposure.
Michigan	Documents engineering decision-making process; reduces tort liability exposure.
Minnesota	Reduces tort liability exposure.
Mississippi	Reduces tort liability exposure.
Missouri	Reduces tort liability exposure.
Montana	MDOT has adopted geometric design standards for all on-system routes.
Nebraska	Nebraska has geometric design standards that govern all public roads in the state.
New Jersey	Documents engineering decision-making process; reduces tort liability exposure.
New Mexico	Documents engineering decision-making process.
New York	Documents engineering decision-making process; reduces tort liability exposure.
North Carolina	Documents engineering decision-making process.
Ohio	Reduces tort liability exposure.
Oklahoma	Future reference material.
Oregon	Reduces tort liability exposure.
Pennsylvania	Reduces tort liability exposure.
South Carolina	Documents engineering decision-making process.
South Dakota	Documents engineering decision-making process; ensures substandard feature was reviewed.
Tennessee	Documents engineering decision-making process; reduces tort liability exposure.
Utah	Documents engineering decision-making process.
Vermont	Reduces tort liability exposure.
Virginia	Documents engineering decision-making process; reduces tort liability exposure.
Washington	Documents engineering decision-making process; reduces tort liability exposure.
West Virginia	Reduces tort liability exposure.
Wisconsin	Efficient use of available funds; reduces tort liability exposure.
Wyoming	Documents engineering decision-making process.

TABLE D11
RESPONSE TO QUESTION 38

STA	Mitigation Level	Design speed	Lane width	Shoulder width	Bridge width	Structural capacity	Horizontal alignment	Vertical alignment	Grade	Stopping sight distance	Cross slope	Superelevation	Vertical clearance	Horizontal clearance	Other
Alabama	1	a			a		a	a	a				a		
	2								b						
	3														
Arkansas	1		c	c	c		c	c	c	c		c		c	
	2														
	3														
California	1	d		e	a	f	a	a	h	i	j	j	a	k	
	2			a		g									
	3														
Connecticut	1	d					a	a	a				a		l
	2														
	3														
Delaware	1	d					a		a	d			a		
	2														
	3														
Georgia	1	d		a	a	a	d	a	a	d	a	d	a	a	
	2	a		m	d	g	a	d		a		a			
	3														
Hawaii	1		n	n	n		a	a	a				a	n	
	2														
	3														
Illinois	1					g	a		h			a	a		
	2														
	3														
Kansas	1				a	g	a	a				a	a		
	2														
	3														
Kentucky	1	d	d	d	d	d	d	d	d	d	d	d	d	d	
	2														
	3														
Maine	1		o	p						a			a	d	
	2									d				q	
	3														

TABLE D11 (*continued*)

STA	Mitigation Level	Design speed	Lane width	Shoulder width	Bridge width	Structural capacity	Horizontal alignment	Vertical alignment	Grade	Stopping sight distance	Cross slope	Superelevation	Vertical clearance	Horizontal clearance	Other
Maryland	1	a				a	d	i	a	s	j	u	v	k	x
	2						a	d	h	r		d	a	w	y
	3							r		t					
Michigan	1	a	a												
	2	d													
	3														
Minnesota	1						a		h						
	2														
	3														
Mississippi	1	d	d			g	d	d		a		a	a	a	
	2														
	3														
Missouri	1				a	g	a		a	a			a		
	2														
	3														
Montana	1	a			a	a	a		h		k	z	a		
	2						z		a						
	3						aa								
Nevada	1	d	d	d		a	d	d		d		a	a		
	2	a						i		i					
	3														
New Jersey	1		bb	bb	a	a	a		a	a	z	a	a	a	ff
	2		cc	cc			dd		ee	w		dd			gg
	3		a	a						i					
New Mexico	1	d	a		a	a	a	a	a	a			a	a	
	2				d										
	3														
New York	1				a	a	a	a	a	a		a	a	a	
	2						w	cc	h						
	3														
North Carolina	1	d			a	g	a		a				a	k	
	2	a												a	
	3														

TABLE D11 (*continued*)

STA	Mitigation Level	Design speed	Lane width	Shoulder width	Bridge width	Structural capacity	Horizontal alignment	Vertical alignment	Grade	Stopping sight distance	Cross slope	Superelevation	Vertical clearance	Horizontal clearance	Other
Ohio	1				a	a	a					a	a		
	2														
	3														
Oklahoma	1	d	a	hh	a	a	a	a	h	hh	a	a	a	a	
	2	a			hh		d	d	a	a					
	3														
Pennsylvania	1		bb	bb	ii	a	a	jj	h	jj		a	a	a	
	2			cc	a		w	aa		aa			kk		
	3			a			z	i		i					
South Dakota	1	d	a	a	a	a	d	d	a	d	k	d	a	a	
	2	a					a	a		a	d				
	3														
Utah	1			ll	a	g	d	i					a	a	
	2				mm										
	3														
Virginia	1	d	d	d	g	g	d	d	d	d	d	d	g	g	
	2	a			a	a							a	a	
	3														
Washington	1		a	a	a	g	a	a	a	a	a	a	a	a	
	2		d				d	d	h	d	a		kk	kk	
	3														
West Virginia	1	a	a	a	a	a	c	c	c	c	a	a	a	k	
	2						a	a	a	a					
	3														
Wyoming	1	d				g	a	d	a	d		d	a	a	
	2	a				a						a			
	3														

Notes: 1 = Most common mitigation measure; 2 = next most common mitigation measure; 3 = third most common mitigation measure.
a = advisory/warning signs; b = climbing lane; c = lower design speed; d = lower speed limit; e = add turnouts; f = replace bridge; g = restrict traffic/loads; h = passing lanes/emergency escape ramps; i = lighting; j = improve drainage; k = traffic barriers; l = clear sight line for intersection sight distance; m = video surveillance; n = delineation; o = narrow lane; p = narrow shoulder; q = traffic calming; r = warning beacon; s = remove obstructions; t = signalize intersection; u = improve ride quality; v = mill roadway underneath structure; w = widen shoulder; x = compressed collector–distributor lane for distance between ramp termini; y = basketweave ramps for distance between ramp termini; z = modify pavement cross slope; aa = widen clear zone; bb = pavement edgelines; cc = raised pavement markings; dd = antiskid pavement; ee = curbs/inlets; ff = warning sign for intersection sight distance/lane drop/ramp lengths; gg = convert to stop for ramp length criteria; hh = rumble strips; ii = match pavement; jj = intersection relocation; kk = alternate route; ll = pave only part of shoulder; and mm = tapers.

APPENDIX E

Sample State Transportation Agency Design Exception Content and Format Guidance Exhibits and Ohio DOT Samples

Fact Sheet Exceptions to Mandatory Design Standards

Prepared by:

____
Registered Civil Engineer

Submitted by ____________________ ________ ________
(Name), Design Engineer — Date — Telephone

Recommended for Approval ____________________ ________ ________
(Name), Project Manager — Date — Telephone

Concurrence by ____________________ ________ ________
* (Name), Branch Chief or DDC, Design — Date — Telephone

Approved by ____________________ ________
Project Development Coordinator for DLP — Date

* Required if the Project Manager is not a Supervising T.E. or above.

FIGURE E-1 California content and format guidance exhibit.

Topic #625-000-007 January 2000
Plans Preparation Manual, Volume I - English

TO:[a] ____________________ DATE: __________

SUBJECT: **DESIGN EXCEPTION**

Financial Project ID : ______________
State Road number: ______________
Fed Aid No: ______________________
Project description: ________________
New construction ________RRR ______

Design Exception for the following element:

( ) Design Speed[d]	( ) Lane Widths	( ) Shoulder Widths	( ) Bridge Widths
( ) Structural Capacity	( ) Vertical Clearance	( ) Grades	( ) Cross Slope
( ) Superelevation	( ) Horizontal Alignment	( ) Vertical Alignment	( ) Stopping Sight Distance
( ) Horizontal Clearance			

Include a brief statement concerning the project and items of concern.

Attach all supporting documentation to this exhibit in accordance with **Section 23.6**.

Recommended By [b]: ______________________ Approval: [c]: ________________

Concurrence[d]: ______________________________

Concurrence[e]: ______________________________
State Structures Design Engineer

(a) Design Exceptions on projects having full federal oversight and involvement are addressed to the FHWA Division Administrator. All other Design Exceptions are sent to the District Design Engineer.

(b) Design Exceptions on projects having full federal oversight and involvement are recommended by the District Design Engineer. All other Design Exceptions are recommended by the Responsible Professional Engineer.

(c) Design Exceptions on projects having full federal oversight and involvement are approved by the FHWA Division Administrator. All other Design Exceptions are approved by the District Design Engineer.

(d) Design Exceptions for Design Speed on the FIHS system requires concurrence from the State Highway Engineer. All other Design Exceptions require concurrence from the State Roadway Design Engineer.

(e) Design Exceptions impacting the geometry, vertical clearance, layout of structures, or superstructure cross-slope require concurrence from the State Structures Design Engineer.

FIGURE E-2 Florida content and format guidance exhibit.

Example: Design Exception or Variance Report

D.O.T. 66

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

INTERDEPARTMENT CORRESPONDENCE

FILE *Project Number and County*
P. I. Number

OFFICE

DATE

FROM *Project Manager*

TO *Project Review Engineer*

SUBJECT **Request for Design *Exception (or Variance)***

Approval of a Design *Exception (or Variance)* is requested for this project.

Provide a general description of the project including the length of the project, beginning and ending mile logs, the general location of the project including any city and county limits or proximity there to, Speed design, and describe the proposed typical sections and other major improvements to be constructed.

Describe the feature(s) requiring a design exception or a design variance. Give the values of the current guidelines and the values that are proposed to be used. Include the value of the beginning and the ending mile points for the design feature.

Describe current and future traffic data and/or attach traffic diagrams with all traffic data including the accident history within the project limits for the last three years. In particular address and summarize the accident experience related to the feature requiring a design exception or variance request.

Summarize why the current guidelines cannot be met.

Summarize the cost estimate for construction and right-of-way for constructing or reconstructing the design feature to meet current guidelines. If mitigation or safety enhancements costs are significant, summarize these costs at this point.

Describe any mitigation proposed to lessen the impact of not meeting current guidelines. BE SURE TO INCLUDE SAFETY ENHANCEMENT FEATURES (Such as signing, striping, etc.) TO BE CONSTRUCTED IF THIS EXCEPTION IS APPROVED.

The Project Manager must make a recommendation to the approving authority for action. Any conditions to the approval of this exception should be clearly stated.

FIGURE E-3 Georgia content and format guidance exhibit.

The request for design exception will include the following:

1. The vehicular traffic - volume, type and speed; functional classification and type of highway, as well as discussing the proposed improvement.
2. The crash~~accident~~ record analysis, to include: (a) crash~~accident~~ rate vs. Statewide rate (b) cause of crash~~accidents~~, and (c) cost of crash~~accidents~~.
3. A discussion that the proposed work is a short-term improvement (4-7 years) or long-term improvement (10-15 years).
4. The relationship of the proposed section to the adjoining sections of roadway at both termini.
5. A discussion of all exceptions being requested and what the estimated cost (both money and time) would be to achieve full standards.
6. Any Comments from the public.
7. The expected safety of the section if constructed with the design exception.

The format of the document supporting the design exception should follow the order of the 7 items listed above. The document should conclude with a signature and date line for the Assistant Secretary and State Transportation Engineer to either "concur" or "not concur" in the request.

FIGURE E-4 Kansas content and format guidance exhibit.

Critical Design Element	Existing Condition, Minimum	Proposed Condition, Minimum	MnDOT Standard for New Construction/ Reconstruction	Reference MnDOT Road Design Manual
Horizontal Alignment, Radius	__.__m (___ ft)	__.__m (___ ft)	___ m (___ ft) min.	Table 3-2.03A or Table 3-2.03B
Grades, Percent	___% maximum		___% maximum	Table 3-4.02A
Vertical Alignment, K value				
Crest	___/m% (__ ft/%) min.	___/m% (__ ft/%) min.	___/m% (__ ft/%) min.	Figure 3-4.04A
Sag	___/m% (__ ft/%) min.	___/m% (__ ft/%) min.	___/m% (__ ft/%) min.	Figure 3-4.04D
Normal Cross Slope			0.02	Table 4-3.01A
Superelevation			0.06 maximum	Chapter 3, Section 3-3.0
Vertical Clearance				Table 9-2.01B
Highway under bridge	___ m (___ ft)		5.0 m (16 ft-4 in)	
Railroad under bridge	___ m (___ ft)		7.0 m (23 ft-0 in)	
Highway under sign or pedestrian bridge	___ m (___ ft)		5.3 m (17 ft-4 in)	

Table Notes:
An asterisk preceding proposed condition indicates a Geometric Design Exception. See Geometric Design Exception Justification below for additional information.

Interstate/STRAHNET system
( ) This project does not involve work on the Interstate/STRAHNET system.
( ) This project involves work on the Interstate/STRAHNET system.

- ( ) At the completion of this project, all bridges will meet the 4.9 m (16 foot) standard for vertical clearance over Interstate highways.
- ( ) At the completion of this project the vertical clearance of the bridge will remain unchanged. The scope of work involves limited repair of the bridge or roadway pavement. The project scope does not provide the opportunity to alter the vertical clearance situation. FHWA will be requested to coordinate with the Department of Defense – MTMCTEA at least three months before letting.

Preservation projects where proposed Critical Elements are less than the New Construction Reconstruction standard:

Geometric Design Exception Justification
Within this section please justify the design exceptions (if any) noted in the Critical Design Elements table above. Refer to Section 2-6.01.01 of the MnDOT Road Design Manual for additional guidance on Geometric Design Exceptions.

Geometric Design Exception approved by:

____

Robert J. McPartlin, P.E.
Project Development Engineer   Date

FIGURE E-5 Minnesota content and format guidance exhibit.

DUAL

CHAPTER II
PRELIMINARY DESIGN

C. Give reasons for requesting design exceptions for each design element.

Request for Design Exceptions:

(NOTE: Include only for consultant designed projects.)

By: ______________________ Date: ______________________
Consultant Project Manager

____
Name of Consulting Firm

By: ______________________ Date: ______________________
MoDOT Project Manager

Approved: (Include only applicable signatures.)

By: ______________________ Date: ______________________
Division Engineer, Design

By: ______________________ Date: ______________________
Division Engineer, Bridge

By: ______________________ Date: ______________________
FHWA

Design Exception Information Form

FIGURE E-6 Missouri content and format guidance exhibit.

NCDOT DESIGN EXCEPTION REQUEST
(Project does not require FHWA design approval)

F.A. Project No.: State Project No.:

TIP No.: County:

Design Exception Requested for: (design speed, bridge width, land or shoulder width, structural capacity, horizontal or vertical clearance, stopping sight distance, horizontal or vertical alignment, grades, cross slopes, superelevation)

Location of Design Feature in Question:

PROJECT DATA

Current ADT (Year): Design ADT (Year):

% Trucks: Design Speed: Posted Speed:

Functional Classification:

Minimum AASHTO Dimensions: Dimensions Proposed:

Total Estimated Cost of Project:

Additional Cost to Meet Minimum AASHTO Requirements:

BASIS FOR EXCEPTION

1. Describe how the accident history relates to the proposed design exception. See current 3-year accident history, attached (number, type, rates, severity, cause, comparison to statewide average, etc.).

2. Describe any future plans for upgrading this roadway either at or in the vicinity of this project.

FIGURE E-7 North Carolina content and format guidance exhibit.

Project Identification Information

____ County	____ Urban or Rural Area
____ SR	____ Exempt or Non-Exempt
____ Section	____ Funding Classification
____ Project Length	____ Federal Project Number
____ Beginning & Ending Segments/Offsets	____ Construction Year
____ Functional Classification	____ STRAHNET route or STRAHNET connector

Design Criteria and Proposed Work

____ DM-2 Criteria (Urban, Rural, 3R, PM, Bridge)	
____ Lane Width	____ Bridge Work Proposed
____ Shoulder Width	____ Bridge Type
____ Superelevation Rate	____ Bridge Width
____ Number of Lanes	____ Bridge Length
____ Median Width	____ Bridge Lane Width
____ Swale Geometry	____ Bridge Water Table Width
____ Clear Zone Width	____ Bridge Sufficiency Rating
____ Guide Rail/Barrier Type	____ Bridge Vertical Clearance

Traffic Information

____ ADT (Current and Design Year)	____ Design Speed
____ Percent Trucks	____ Posted Speed
____ Design DHV	____ Running Speed
____ Level of Service	____ Truck Design Size

Project Cost Information

____ Programmed Project Cost
____ Current Estimated Cost with the Design Exception
____ Current Estimated Cost without the Design Exception

Traffic Crash History

____ 3 year traffic crash history
____ Collision diagram of existing conditions (3 year crash data)
____ Collision diagram showing proposed crash remediation
____ Listing of any crash cluster
____ Comparisons of existing accident data to statewide averages
____ Narrative description which describes aspects of the safety review study

FIGURE E-8 Pennsylvania content and format guidance exhibit.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
NASHVILLE, TENNESSEE 37243-0350

DESIGN EXCEPTION REQUEST AND JUSTIFICATION FORM

TO:______________________, Division Administrator, FHWA
(Director, Design Division, TDOT)

FROM:______________________, Director, Design Division, TDOT (C. E. Manager 1 or Transportation Manager 1, Design Office)

DATE:______________________

SUBJECT: Design Exception Request
Project. No.______________________
Project Description:______________________

DESIGN DATA:

Highway Functional Classification:______________________

Appropriate Standards for the Above Classification:______________________

Traffic Data:	ADT (19_____):	__________	D:__________
	ADT (20_____):	__________	T:__________
	DHV:	__________	V:__________

Existing Posted Speed:____________ Proposed Posted Speed:____________

Type of Terrain:______________ Rural or Urban Area:______________

FIGURE E-9 Tennessee content and format guidance exhibit.

Utah Department of Transportation
Request for Design Exception Project Information

Project No.: ______________________________

Project Description: ______________________________

____

____

____

Type of Project and Character of Work: ______________________________

____

____

____

Project Design Life: ______________________________

Traffic Data:

Existing	_______	AADT_______	% Trucks_______
Projected	_______	AADT_______	% Trucks_______
Projected	_______	AADT_______	% Trucks_______

Geometric Data:

Posted Speed Limit	_______	Proposed Design Speed	_______		
No. of Lanes	_______	Type of Facility	______________		
Pavement Width	_______	Shoulder Width	_______	Shoulder Type	_________
Clear Zone	_______				
ROW width	_______				

Accident History:

	Rate	Expected
Period	______________	
Accident Rate	_______	_______
Severity	_______	_______

Remarks: ______________________________

____

____

____

FIGURE E-10 Utah content and format guidance exhibit.

DEPARTMENT OF TRANSPORTATION
INTER-DEPARTMENTAL MEMORANDUM
DESIGN EXCEPTION REQUEST

To: ______________________ Date: ______________________

From: ______________________

Subject: DESIGN EXCEPTION REQUEST

Prepared by: ______________________

State Project Number: __________ Federal Project Number: __________

County/City: __________ District: __________ Funding Source: __________

Description: ______________________ PPMS # __________

Design Exception Request For:

___ Design Speed ___ Horizontal Clearance* (other than "clear zone") ___ Vertical Clearance*

___ Bridge Width* ___ Horizontal Alignment ___ Vertical Alignment
___ Lane Width ___ Sight Distance ___ Cross Slope
___ Shoulder Width ___ Superelevation ___ Grade
___ Structural Capacity* ___ Interstate Access Control ___ Other

* These are typically requested by the Bridge designer.

Current ADT __________ Design ADT __________

% Trucks ______ Design Speed __________ Posted Speed __________

Reduced Design Speed (if applicable) __________

Functional Classification ______________________

Minimum Design Standard __________ Requested Dimensions __________

Total estimated construction cost of project: ______________________
(Based on approval of this exception)

Additional cost to meet minimum standard: ______________________

Background description of project:
(Include a description of the general characteristics of the existing highway focusing on the features relevant to the proposed exception. Provide a brief description of the adjacent highway segments, highlighting existing nonstandard features when relevant to the proposed exception.)

FIGURE E-11 Virginia content and format guidance exhibit.

NATIONAL HIGHWAY SYSTEM ROUTES

DESIGN EXCEPTION JUSTIFICATION REPORT

STATE PROJECT NUMBER ________________________ DATE __________

FEDERAL PROJECT NUMBER __________________________

COUNTY ____

PROJECT NAME ___________________________________

PROJECT DESCRIPTION _____________________________

DISCUSSION REPRESENTATIVES:

FHWA ____

WVDOH _______________________________________

AASHTO FUNCTIONAL CLASSIFICATION: ☐ INTERSTATE ☐ ARTERIAL
TERRAIN: MOUNTAINOUS ☐ ROLLING ☐ LEVEL ☐

CURRENT YEAR	FUTURE
___(YR) ADT ___	___(YR) ADT __
___(YR) DHV ___	___(YR) DHV ___

SPEED LIMIT: ☐ POSTED/ ☐ REGULATORY _______
DESIGN SPEED SELECTED: _______
AASHTO DESIGN______ POSTED SPEED LIMIT _____
ACCIDENT RATE _____ BASE ACCIDENT RATE (STATEWIDE AVERAGE)______
NATURE OF AREA _______

DESIGN CRITERIA (DOCUMENT ONLY EXCEPTIONS)

	MIN. DESIGN CRITERA	EXISTING CONDITION	PROPOSED VALUE	CRITERIA SOURCE
TRAVEL LANE WIDTH	________	________	________	________
SHOULDER WIDTH-LEFT	________	________	________	________
-RIGHT	________	________	________	________
HORIZONTAL ALIGNMENT	________	________	________	________
VERTICAL ALIGNMENT	________	________	________	________
STOPPING SIGHT DISTANCE	________	________	________	________
MAXIMUM GRADE	________	________	________	________
CROSS SLOPE	________	________	________	________
SUPERELEVATION	________	________	________	________
HORIZONTAL CLEARANCE	________	________	________	________
VERTICAL CLEARANCE	________	________	________	________
BRIDGE WIDTH	________	________	________	________
BRIDGE STRUCTURAL CAPACITY	________	________	________	________

FIGURE E-12 West Virginia content and format guidance exhibit.

INFORMATION FOR EXCEPTION TO THE MINIMUM DESIGN STANDARDS

PROJECT: FRA-71-30.722

P.I.D.: 11898

F.A. SYSTEM : NON-FEDERAL

FUNCTIONAL CLASSIFICATION: PRINCIPAL ARTERIAL (URBAN)

****

1.) EXISTING FACILITY:

The bridge project is located in the city of Columbus in Franklin and Clinton Townships in Franklin County approximately 3 kilometers north of Interstate 70. Fifth Avenue is a Principal Urban Arterial not on the Federal Aid System. It has a current (1997) ADT of 25,390 vehicles per day with 7% truck traffic. The current legal speed is 25 mph (40 km/h). At this location, Interstate 71, which consists of four lanes in each direction, is classified as an Urban Interstate. It has a current (1998) ADT of 175,900 vehicles per day with 7% truck traffic. The current legal speed for this section of I-71 is 65 mph (105 km/h).

The existing structure, constructed in 1960, is a four-span steel beam bridge with a reinforced concrete deck and substructures. The bridge width is 17.07 meters measured from face to face of curb with 1.83-foot wide sidewalks. The bridge is 72.62 meters long. It carries two lanes of traffic in each direction with a left turn lane in the westbound direction. The bridge is on a tangent horizontal alignment. The vertical alignment of the existing roadway consists of a 1.40% grade at the rear approach to the structure and a 0.46% grade at the forward approach connected by two short crest vertical curves at each approach and a 60.96-meter crest vertical curve across the structure. The existing vertical clearance over I-71 is 4.512 meters over the southbound lanes and 4.673 meters over the northbound lanes.

2.) PROPOSED FACILITY:

The proposed project is to replace the existing reinforced concrete deck, curbs, sidewalks, parapets, approach slabs and expansion joints and to paint the existing structural steel, which will remain in place. The existing vandal protection fence will be removed and reattached to the new parapets. The proposed design speed for Fifth Avenue is 60 km/h. The projected ADT for the year 2017 is 26,660 vehicles per day with 7% truck traffic. The proposed project length is 95 meters.

FIGURE E-13 Ohio example no. 1.

INFORMATION FOR EXCEPTION TO THE MINIMUM DESIGN STANDARDS

PROJECT: COS-60-2.040

P.I.D.: 13266

STATE JOB NO.: 54380

FEDERAL PROJECT NUMBER: STP

FUNCTIONAL CLASSIFICATION: MAJOR COLLECTOR (RURAL)

****

EXISTING FACILITY:

This project is located in Washington Township of southeastern Coshocton County. State Route 60 is a two-lane rural major collector not on the Federal Aid System. The terrain in the area is rolling. Current Average Daily Traffic (ADT) on this route is 1,030 with 4% truck traffic. The legal speed for this facility is 55 mph (89 km/h).

Existing conditions include an asphalt concrete pavement in widths varying from 6.6 meters to 7.0 meters and gravel shoulders that are 0.6 meter wide. The existing horizontal alignment on the south approach consists of two reverse curves with the first curve radius being 75.928 meters and the second being 87.319 meters. The P.T. station of the second curve is located in the rear approach slab. The two curves are separated by a 15.871-meter long tangent section. The existing vertical alignment consists of a series of grade breaks, without the use of vertical curves. The superelevation in the area is irregular, with the maximum superelevation never extending beyond the crown removal point.

This existing structure, built in 1947 over Sand Fork of Little Wakatomika Creek, is a simple span steel beam bridge with a 3"x6" creosote wood strip deck and a retrofitted H-pile pier. The roadway has a face-to-face guardrail clearance of 7772 mm with a 76-mm asphalt concrete wearing surface, and no approach slab. The alignment is tangent with a 0° skew. The bridge has a sufficiency rating of 38.5 and a loading scheme of S-12.47.

PROPOSED FACILITY:

The proposed project involves horizontal realignment of 75 meters, and vertical realignment of 127 meters of existing roadway; widening and paving the shoulders; and placing a new 3-span continuously reinforced concrete slab bridge on capped pile abutments and piers. The proposed design speed is 90 km/h with exceptions. The projected design year ADT is 1,630 with 4% truck traffic.

FIGURE E-14 Ohio example no. 2.

Abbreviations used without definition in TRB Publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
U.S.DOT	United States Department of Transportation