Arizona Department of Transportation

ROADWAY ENGINEERING GROUP

MEMORANDUM

To: Roadway Group Personnel, ADOT And Consultants	**Date:** December 14, 2009
From: Mary Viparina Assistant State Engineer Roadway Engineering Group	**Subject:** **2009 Guide for Review of The AASHTO Controlling Design Criteria on Existing ADOT Roadways**

The 2009 "Guide for Review of the AASHTO Controlling Design Criteria on Existing ADOT Roadways" (AASHTO Review Guide) was developed as a direct result of the FHWA requirement that projects located on the National Highway System conform to the design parameters of the 2004 (Fifth Edition) AASHTO "Policy on Geometric Design of Highways and Streets" or formal design exceptions must be approved. This "AASHTO Review Guide" is an update from the May 1997 document to reflect the changes in the AASHTO "A Policy on Geometric Design of Highways and Streets" through the years.

The AASHTO Review Guide shall be applied to existing roadways located on the National Highway System (NHS). All design exceptions for projects located on the NHS shall be approved by the Federal Highway Administration. The design speed for review of the "AASHTO Criteria" shall be the posted speed of the roadway. New Horizontal Curve (HCA 6.1) and Vertical Curve (VCA 6.0) programs are provided in addition to templates and examples to assist the user with the new formats.

The attached AASHTO Review Guide is also available on the Predesign Web Page noted by the following Link:

http://www.azdot.gov/highways/Roadway_Engineering/Roadway_Predesign/AASHTO_Guide/PDF/AASHTO_Guide.pdf

Please forward this memorandum to design engineers and project managers in your respective Groups and encourage them to become familiar with the new guidelines. The new guidelines shall be implemented in the Scoping Phase at the earliest timeframe determined practical by the scoping Project Manager. During the Design Stage of an ongoing project, the new guidelines shall be implemented for all new design exception requests.

Please contact the Roadway Predesign Section for any questions or discussion on the AASHTO Review Guide.

GUIDE FOR REVIEW OF THE AASHTO CONTROLLING DESIGN CRITERIA ON EXISTING ADOT ROADWAYS

ARIZONA DEPARTMENT OF TRANSPORTATION

ROADWAY ENGINEERING GROUP

NOVEMBER 2009

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GUIDE FOR REVIEW OF THE AASHTO DESIGN CONTROLLING CRITERIA ON EXISTING ADOT ROADWAYS

INTRODUCTION

The "Guide for Review of the AASHTO Controlling Design Criteria on Existing ADOT Roadways" (AASHTO Review Guide) was developed as a direct result of the FHWA requirement that federally funded projects conform to the design parameters of the 2004 (Fifth Edition) AASHTO "Policy on Geometric Design of Highways and Streets" or formal design exceptions must be approved. This “AASHTO Review Guide” is an update from the May 1997 document because of the changes in the AASHTO “A Policy on Geometric Design of Highways and Streets” through the years.

A review of AASHTO Controlling Design Criteria (“AASHTO Criteria”) became necessary when the Federal definition of "construction" was expanded to include "resurfacing, restoration, and rehabilitation" (3R) by the Federal-Aid Highway Act of 1976. Before that time, the Federal-Aid Highway Program was almost totally focused on new construction and/or total reconstruction, and virtually all projects complied fully with AASHTO design criteria -- exceptions were rare. With the change, the Federal-Aid Highway Program became involved in projects aimed at preserving and prolonging the service life of existing highways, many of which did not meet current AASHTO criteria.

Implementation of this change prompted stiff criticism and opposition by highway safety advocacy groups, who feared that significant portions of the Federal-Aid highway funds would be expended on 3R projects that resurfaced existing highways, with little or no regard for existing safety conditions or significant deviations from “AASHTO Criteria”. Attempts by both AASHTO and FHWA to adopt specific criteria more appropriate to the 3R-type projects met even stiffer criticism and opposition by the safety advocacy groups, as well as considerable controversy within AASHTO, its member State highway agencies and FHWA.

After extensive study and discussion, FHWA adopted a regulation which allowed States the option to either (1) develop and submit special criteria for 3R projects to FHWA for approval, or (2) continue to apply “AASHTO Criteria” to 3R projects and request exceptions for any deviations left in place after completion of the 3R project. In a direct response to this regulatory action and at the prompting of the highway safety advocacy groups, Congress, in 1982, further modified the Federal definition of construction by adding the phrase "enhance highway safety". This modification effectively required all Federally-funded 3R projects to include at least some form of safety improvement, and demonstrated the continuing concern that existing conditions not meeting current standards, not be perpetuated without adequate evaluation and justification.

Arizona elected to follow the second option -- to continue using AASHTO criteria for 3R projects, and request design exceptions for appropriate, justified deviations. To facilitate and simplify the identification of these deviations, FHWA established a national policy requirement for review of 13 controlling criteria.

In addition to complying with the Federal Regulation and Policy, as noted above, the process of reviewing the controlling AASHTO criteria has the added benefit of identifying and analyzing the anticipated consequences of retaining or perpetuating conditions not meeting current standards.

The "AASHTO Review Guide" is the procedure by which ADOT will identify various project design elements to determine whether or not they meet the 2004 (Fifth Edition) AASHTO Green Book guidelines. Subsequent to this determination, decisions will be made on whether or not it is in the best interests of the Department and the traveling public to upgrade existing features that do not meet current AASHTO Guidelines.

In the case of pavement preservation and 3R/4R projects, decisions may become extremely difficult since the AASHTO Green Book is directed toward designs for new roadways, and in most cases, the 3R/4R type projects apply to older sections of highways that were designed to standards of the time and not designed or constructed to meet current AASHTO guidelines. It should be noted that older roadway sections not meeting the 2004 AASHTO Green Book are not inherently unsafe. Achieving AASHTO shoulder widths and vertical alignment in many cases would require reconstruction of entire sections.

The following section will discuss the types of projects to which the "AASHTO Review Guide" will be applied.

PROJECT APPLICATION

Projects Applying AASHTO Controlling Design Criteria Review

The "AASHTO Review Guide" will always apply to projects on existing roadways on the National Highway System (NHS). The Guide may also apply to roadways not on the NHS when the project team identifies a need to further evaluate the AASHTO controlling criteria as related to possible traffic operational issues. The current NHS maps are available at the following ADOT website:

http://tpd.azdot.gov/gis/maps/pdf/NHS.pdf

GUIDE FOR REVIEW OF THE AASHTO DESIGN CONTROLLING CRITERIA ON EXISTING ADOT ROADWAYS

The "AASHTO Review Guide" will be applied to the following types of projects as shown on the Design Exception and Design Variance Process Guide Table and determined by the ADOT Roadway Group Predesign Section Manager:

1. Conversion of an existing roadway to a new divided highway. The "AASHTO Review Guide" will apply to the existing roadway to remain.
2. Partial Reconstruction of Existing Roadway. The "AASHTO Review Guide" will apply to the existing roadway to remain.
3. Widening to provide an additional lane or increase the shoulder width. When widening an existing urban access controlled highway to add an auxiliary lane, HOV lane or general-purpose lane, the ADOT Roadway Design Guidelines (RDG) design criteria will be applied only to the new widened portion. When determined beneficial by Roadway Predesign, the "AASHTO Criteria" may be reviewed for the existing roadway. Widening of an existing roadway to provide for a passing lane or climbing lane shall be in accordance with the Roadway Engineering Group "A Policy on the Design of Passing Lanes and Climbing Lanes".
4. Intersection Modifications (turn lane additions). The "AASHTO Review Guide" will apply to the AASHTO criteria being affected by the proposed modification.
5. Pavement Preservation. Applies to an overlay project greater than one-inch in thickness and a mill and replace project greater than one-inch in depth. (See note below).

It should be noted that new construction and full reconstruction projects will not require review of the "AASHTO Criteria" since the ADOT Roadway RDG applies per the "Design Exception and Design Variance Process Guide".

An AASHTO Controlling Design Criteria Report may be prepared on an existing roadway, which is being replaced by a new roadway or totally reconstructed in order to better define the purpose and need for the new or reconstructed roadway. This decision will be made by Roadway Predesign during the scoping phase.

Note: The review of the "AASHTO Criteria" will not be utilized on existing interchanges and/or Grade Separations for resurfacing type projects. However, if the scope is significant, such as total pavement replacement, extensive widening or reconfiguration, a review is necessary. Otherwise, the accident patterns or operational problems identified by Traffic, District or the Project Team will be utilized to determine the need to review the criteria for the interchanges. The structures of the interchanges will be reviewed if they are part of the mainline (overpasses), however, if the structure is part of the crossroad, it will not be reviewed unless the entire interchange is reviewed (crossroad and ramps).

Projects Not Applying AASHTO Controlling Design Criteria Review

The following types of projects will not generally apply the "AASHTO Criteria". These projects are normally singular in scope, are maintenance type, or are spot improvement projects:

1. Seal Coats – AR-ACFC, ACFC's, chip seals, and overlays one-inch or less in thickness or mill and replace one-inch or less
2. Guardrail or other barriers, crash attenuators
3. Structure Extensions - pipe and box culvert
4. Signing and/or Striping, Channelization
5. Signalization
6. Fencing, Cattle Guards
7. Railroad Crossings
8. State Parks
9. Rest Areas
10. Landscaping and Irrigation
11. Bridge Maintenance, Bridge Replacement
12. Drainage Improvement – (except changes in profile require a review of the vertical alignment)
13. PCCP Rehabilitation (Slab Replacement, Grinding, Joint Repair) - FHWA may require written exceptions depending upon degree of involvement in other work items.
14. Spot Improvements
15. Climbing/Passing Lanes (See Roadway Design "A Policy on the Design of Passing Lanes and Climbing Lanes.")

PROCEDURES

A determination of the need to apply the "AASHTO Criteria" to any project must be accomplished before the initial scoping document is started. The engineer preparing the scoping document should confer with the Roadway Predesign representative prior to preparing the AASHTO Controlling Design Criteria Report.

Using the Project Application section previously outlined, Roadway Predesign Section will determine which projects will apply the "AASHTO Criteria". On projects where it may be unclear as to whether the "AASHTO Criteria" should be applied, the Assistant State Engineer, Roadway Engineering Group has the authority to make this determination.

Roadway Predesign Section monitors the preparation of Project Assessment Reports, Design Concept Reports and Combined Location and Design Concept Reports for projects involving New Construction or Reconstruction of Existing Roadways. These reports will determine the application of the AASHTO Controlling Design Criteria and will state any design exceptions required.

Roadway Predesign will technically review Scoping Reports prepared by others that describe design features of a project and formulate project costs. The Scoping Reports include analysis and recommendations as to the disposition of the “AASHTO Criteria” and any required design exceptions.

The AASHTO Controlling Design Criteria Report will provide the evaluations and recommendations for incorporating design features which may not meet the guidelines established in the 2004 AASHTO Green Book as described herein. This report will be utilized primarily in obtaining formal design exceptions on NHS projects.

OVERVIEW

The purpose of this “AASHTO Review Guide” is to provide a systematic approach to the review of existing roadways prior to implementing improvements to those roadways. Existing design related data can be gathered from various sources and then compared to the "AASHTO Criteria" designated by "A Policy on Geometric Design of Highways and Streets," 2004 Fifth Edition, commonly referred to as the "AASHTO Green Book".

With this procedure, differences between existing features and the AASHTO Controlling Design Criteria features can be determined. The differences can then be evaluated so that recommendations can be made as to whether or not additional work should be undertaken.

It is not the intent of this guide to describe a complete evaluation process. The overall evaluation will require good engineering judgment. The degree and depth of the evaluation will be dependent upon the individual project and the judgment of the engineer. Factors such as economics, anticipated growth, accident history, program schedules, and time and manpower requirements should be given consideration prior to final determination.

AASHTO CONTROLLING DESIGN CRITERIA REPORT

There are thirteen "AASHTO Criteria":

1. Design Speed
2. Lane Width
3. Shoulder Width
4. Bridge Width
5. Horizontal Alignment
6. Superelevation
7. Vertical Alignment
8. Grade
9. Stopping Sight Distance *
10. Cross Slope
11. Vertical Clearance
12. Horizontal Clearance
13. Structural Capacity/Bridge Barrier

* Note: There are three aspects of stopping sight distance that are reviewed: Vertical curve stopping sight distance, horizontal curve stopping sight distance and intersection stopping sight distance.

AASHTO policies and guides provide values for these "AASHTO Criteria". Design exceptions are required if these criteria do not conform to the values as set forth in the standards of the following publications:

1. A Policy on Geometric Design of Highways and Streets, 2004
2. A Policy on Design Standards – Interstate System, 2005

The "AASHTO Controlling Design Criteria Report" provides the means of documenting the design criteria of an existing roadway, and thereby determining if design exceptions are required. Once it has been decided that a report is required for the project, determine the functional classification and the design speed of the roadway. The design speed for review of the "AASHTO Criteria" shall be the posted speed of the roadway. These will determine the various geometric design features of the roadway from the above referenced publications. Projected traffic volumes are also required to determine some of the geometric design features of the roadway. The evaluation of the structure criteria for the report is the responsibility of the Bridge Management Section. A "Bridge Evaluation Request" form must be transmitted to the Bridge Management Engineer for the evaluation of all the structures on the project. (See Appendix B for the Bridge Evaluation Request form. A two-week return period is normally needed). Once the functional classification, design speed and traffic volumes have been determined, the controlling criteria can be evaluated. (The "AASHTO Criteria" are presented in summary form as shown in Appendix A). The Summary of "AASHTO Criteria" will then establish if design exceptions are required and a determination will be made if these design exceptions will be requested or not. If no design exceptions are required, the "AASHTO Controlling Design Criteria Report" is completed and filed. If a determination is made that design exceptions are required, the "AASHTO Controlling Design Criteria Report" is forwarded to Traffic Design Section for a "Crash Analysis for Design Exception Report", Traffic Engineering, PGP 251. (See Appendix C and D for the listing of design exceptions and example for the AASHTO report). The "Crash Analysis" is provided by Traffic Design for further disposition by the team. If the analysis indicates that there are no crash patterns that are attributed to existing geometric elements being evaluated, a "Design Exception Letter" can be prepared. If the analysis indicates there are crash patterns that may be attributable to existing geometric elements, further analysis is required to determine if mitigation measures should be undertaken or if a design exception is justified.

DESIGN TRAFFIC VOLUMES

Construction year* and design year* traffic volumes (AADT) are needed for utilization of the AASHTO values for Lane and Shoulder Widths, Bridge Width and Structural Capacity. The design year selected will be 20 years from construction date. A 10-year design is utilized for pavement preservation projects.

Construction year and projected design year traffic volumes along with traffic factors (peak hour factor, % trucks, directional distribution) can be obtained by request from Multimodal Planning Division Traffic Data Section except for the MAG and PAG areas, for those areas the request is made directly to the MAG and PAG representatives.

The AASHTO guidelines on Design Traffic Volume for the various roadway classifications are:

AASHTO Functional Classification	2004 Green Book Reference
A. Local Rural Roads	p. 380
B. Rural Collector Roads	p. 420
C. Rural Arterial Highways	p. 444
D. Rural Freeways	p. 504
E. Local Urban Streets	p. 390
F. Urban Collector Streets	p. 430
G. Urban Arterial Streets	p. 470
H. Urban Freeways	p. 504

Note: Use construction year from 5-Year Program if shown. If not listed in the 5-Year Program, use construction year if shown in the scoping request. If no construction year is known, estimate construction year as follows: Construction Year = Current fiscal year + Project Development (Scoping plus Design time). Project Development time ranges from 2 to 5 years depending on the type of project.

Design Year = Construction Year + Construction Time + Life Cycle;

Construction Time typically ranges from 1 to 3 years. Life cycle depends on the type of project. Pavement preservation projects have a 10-year life cycle and all other types of projects have a 20-year life cycle.

FUNCTIONAL CLASSIFICATION

To determine the functional classification of the roadway that is being considered for review, utilize the Functional Classification Maps prepared by the Multimodal Planning Division. The maps are available at the following ADOT website:

http://mpd.azdot.gov/mpd/gis/index.asp

The following correlations exist between ADOT and AASHTO's classification terminology:

ADOT	AASHTO
Rural Principle	Interstate Rural Interstate
Rural Principle	Other Rural Arterial
Rural Minor Arterial	Rural Arterial
Rural Major Collector	Rural Collector
Rural Minor Collector	Rural Collector
Urban Principle Interstate	Urban Interstate
Urban Principle Other Frwy/Expwy	Urban Freeway
Urban Principle Other	Urban Arterial
Urban Minor Arterial	Urban Arterial
Urban Collector	Urban Collector

Rural frontage roads are either rural locals or rural collectors dependent on the traffic movement. Urban frontage roads are classified urban collectors.

AASHTO CONTROLLING DESIGN CRITERIA

DESIGN SPEED

The design speed for review of the "AASHTO Criteria" shall be the posted speed of the roadway. An inventory of the existing posted speed limits within the project limits should be obtained for the AASHTO evaluation. The posted speeds for the State Highway System can be reviewed at the ADOTNet Information Data Warehouse on the Speed Limit Report. In addition to reviewing on-site, posted speed may be reviewed on the Photo Log Viewer (date shown). If there is a discrepancy between the posted speed log and the signage in the field, the posted speed signage in the field shall govern.

Note: Consultants may not have access to the posted speed log, therefore, the ADOT project manager will need to obtain this information and provide it to the consultant.

Ramp design speed shall either be the posted speed or the design speed as determined by the "AASHTO Green Book". (See Traffic Interchange Criteria, Ramps, Design Speed for ramp speed discussion).

LANE WIDTH AND SHOULDER WIDTH

Lane width and shoulder width on an existing roadway can be determined by researching the as-built plans. The State Highway Log is also a useful tool for ready reference. Lane and shoulder widths should be verified by actual field measurements.

Upon determination as to whether lane and shoulder widths meet the minimum AASHTO criteria, evaluation will be required to determine what, if any, modifications should be recommended for implementation. The lane and shoulder width shall be as shown on the typical section. If there is no typical section available, then the width of the lane shall be 12 ft if there is at least 24 ft of pavement available and the remainder of the pavement shall be the

shoulder width without respect to the striping of the roadway. If there is less than 24 ft of pavement, then the width of the lane shall be as measured in the field with respect to the shoulder stripe.

Local Rural Roads, Collectors and Arterials (2-lane undivided) have traveled way as the criterion for lane width. Traveled way pertains to the two traffic lanes.

The minimum AASHTO lane and shoulder widths are summarized in the following tables for the various functional classifications of roadways:

AASHTO Functional Classification	2004 Green Book Reference
A. Local Rural Roads	p. 384
B. Rural Collector Roads	p. 425
C. 1. Rural Arterial Highways (2-lane)	p. 448
2. Rural Divided Arterial	p. 455
3. Rural Multilane Undivided Arterial*	pp. 453-454
D. Rural Freeways**	pp. 504-505
E. Local Urban Streets ***	p. 393
F. Urban Collector Streets	pp. 433-434
G. Urban Arterial Streets***	pp. 472-473
H. Urban Freeways**	pp. 504-505

* Note: The rural elements of design apply to Multilane Undivided Arterial; therefore, use Exhibit 7-3, except divide the traveled way by two to obtain the lane width.

** Note: For the Interstate System, see "A Policy on Design Standards-Interstate System", 2005.

*** Note: Local Urban Streets and Urban Arterials have no criterion for shoulders.

BRIDGE WIDTH

BRIDGE WIDTH is defined as the minimum clear roadway width on the bridge as listed under the column heading "Curb to Curb" of the Bridge Record. This information can also be obtained from the Bridge Management Engineer by submitting a Bridge Evaluation Request Form (See Appendix B).

For all existing bridges contained within the project limits the Bridge Width shall be compared with the AASHTO guidelines as contained in the 2004 Green Book. The AASHTO Bridge Width criteria is referenced below for the various Functional Classifications of roadways:

AASHTO Functional Classification	2004 Green Book Reference
A. Local Rural Roads	pp. 385-386
B. Rural Collector Roads	pp. 426-427
C. Rural Arterial Highways	p. 447
D. Rural Freeways *	p. 506
E. Local Urban Streets**	pp. 386,399
F. Urban Collector Streets	pp. 427,436
G. Urban Arterial Streets**	p. 481
H. Urban Freeways *	p. 506

* Note: For Interstate System, see "A Policy on Design Standards - Interstate System", 2005. Rural and Urban freeways have no specific criteria; therefore use the approach roadway width.

** Note: There are no specific criteria for bridges to remain. Therefore the criteria for local urban bridges should be used per Exhibit 5-7, page 386. For urban arterials use approach roadway width.

HORIZONTAL ALIGNMENT, SUPERELEVATION AND STOPPING SIGHT DISTANCE

The existing horizontal alignment with corresponding curve data and superelevation can be obtained utilizing the as-built plans. While the degree of curvature shown on as-built plans is generally very reliable, the superelevation data cannot be relied upon because revisions to superelevation during construction have not been well documented in the past. Also, subsequent overlay projects and maintenance work may have changed the original superelevation.

Exhibits 3-25 through 3-29 (pp. 167-174) in the 2004 AASHTO Green Book can be utilized as the desired standards for curvature for rural highways and high-speed urban streets. As in the case of vertical alignments, the posted and advisory speed limits throughout the alignment will provide information for helping to determine if modifications are needed.

If superelevation data is not available or may have been changed, other means of reviewing superelevation may be required.

ADOT has adopted maximum rates for superelevation (See RDG Table 202.1A) as follows:

1. Rural Highways (controlled and non-controlled access)
   Above elevation 6000 ft - 0.060 ft/ft
   Between elevation 4000 ft & 6000 ft - 0.080 ft/ft
   Below elevation 4000 ft - 0.100 ft/ft

2. Urban Highways
   Controlled access – 0.060 ft/ft
   Non-controlled access – 0.040 ft/ft

For a given design speed there are five methods for sustaining centripetal acceleration on curves by the use of “e” or “f” or both. See pp. 140 to 143 of the 2004 Green Book for further discussion.

Method 5 (p. 140) for distribution of “e” and “f” is utilized to compute the minimum superelevation required for a given design speed or posted speed. Method 2 (p. 140) for distribution of “e” and “f” is utilized to compute the speed of the existing curve based upon the existing superelevation and the existing degree of curve. The Method 2 speed is compared to the posted speed in order to access the need to improve the superelevation of the existing curve when the existing superelevation is less than the Method 5 e minimum. The output from the computer program (HCA 60) shows both of these values.

Superelevation on low-speed urban streets (posted speed is 45 mph or less) is not required. Horizontal curves are frequently designed without superelevation, counteracting the centrifugal force solely with side friction. However, the minimum radius as per Exhibit 3-16 (p. 151) should not be exceeded.

For a full discussion of design for low-speed urban streets see Chapter 3 of the 2004 AASHTO Green Book on pp. 148 - 152.

Stopping sight distance on horizontal curves is also an important feature that should be closely observed during the field review. During the drive through the project, features that would appear to restrict horizontal sight distance such as narrow cut ditches, trees, bushes, outcroppings, etc. should be observed. Exhibit 3-53 (p. 226) or equation 3-38 (p.227) of the 2004 AASHTO Green Book should be utilized to determine the desired sight distance. The required sight distance is obtained from Exhibit 3-2 (p. 115) or Equations (3-2) (p. 113) and (3-3) (p. 114). The computer program (HCA 6.1) can also be utilized to obtain the horizontal sight distance. Measurements can be taken during the field review to determine if sight distance obstructions exist or additional data can be requested and evaluated as needed.

Roadway Predesign has software (HCA 6.1), which is designed for inputting of existing horizontal curve data and outputs minimum superelevation, speed of existing curve, existing and required horizontal SS_D for a specific design speed. (See Appendix D for computer output format).

Note: When utilizing the HCA 6.1 software to determine horizontal stopping sight distance the following inputs are required: 1) Input the grade with respect to traffic utilizing the inside travel lane of the horizontal curve, 2) choose the largest negative grade or the smallest positive grade if there are multiple grades within the horizontal curve and 3) HSO is the horizontal sightline offset which is typically measured in the field. If the horizontal stopping sight distance is not to be calculated leave the HSO column, the Grade column and the Horizontal Stopping Sight Distance column blank.

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

As-built plans are normally the best source of data available for evaluation of existing profile alignments. In some instances, hard-copy maps or other survey information may be available in the absence of as-built plans.

Once the existing alignment has been determined, the 2004 AASHTO Green Book (pp. 265-276) can be utilized to determine the theoretical adequacy of the existing profile.

1. Utilize equation (3-43) or (3-44) (pp. 268) to calculate the existing sight distance for crest vertical curves; utilize equation (3-48) or (3-50) (p. 273) to calculate the existing sight (light beam distance) for sag vertical curves. The calculated sight distances should be compared to Exhibit 3-2 (p. 115) and/or Equations (3-2) (p. 113) and (3-3) (p. 114) for the required stopping sight distance.

2. Utilize Exhibit 3-71 (p. 271) to input the length of the existing crest vertical curve and the algebraic difference of the existing grades to determine the existing speed (V_E).

3. Utilize Exhibit 3-74 (p. 275) to input the length of the existing sag vertical curve and the algebraic difference of the existing grades to determine the existing speed (V_E).

V_E will provide an indication of the theoretical design speed that the existing vertical curve will provide and can then be compared to the design speed selected for the given section of highway in evaluating the need for any modification to the existing vertical alignment.

Roadway Predesign Section has software (VCA 6.0), which is designed to evaluate existing vertical alignments and determine existing speeds, existing and required stopping sight distance on crest vertical curves and headlight distance for sag vertical curves.

Note: When inputting the approach and departure grades into the program, the user needs to open the HELP file and under HELP TOPICS read the discussion concerning "Approach and Departure Grade Fields". This will assure the approach and departure grade fields are filled out correctly.

GRADE

The mainline profile on a route can be determined by a review of the as-built plans. The review of the vertical alignment and stopping sight distance will provide some indication of grades that may need further evaluation. In general, AASHTO has established guidelines for suggested maximum grades for various roadway classifications as follows:

AASHTO Functional Classification	2004 Green Book Reference
A. Local Rural Roads	p. 382
B. Rural Collector Roads	p. 423
C. Rural Arterial Highways	p. 446
D. Rural Freeways *	p. 506
E. Local Urban Streets	p. 391
F. Urban Collector Streets	p. 432
G. Urban Arterial Streets	p. 472
H. Urban Freeways *	p. 506

* Note: For Interstate System, see "A Policy on Design Standards – Interstate System", 2005

STOPPING SIGHT DISTANCE FOR INTERSECTIONS

The at-grade intersections of the through facility with public roads should be observed for adequacy of intersection sight distance during the initial field review for the project. If there appears to be a potential restriction with intersection sight distance, additional data may need to be gathered. Check with the Regional Traffic Engineer if there are sight distance operational issues on public roads. Consideration should be given to modifications to sight distance obstructions that occur within the sight triangles or other mitigation measures should be considered.

A full discussion of intersection sight distance is contained in Chapter 9 of the 2004 AASHTO Green Book beginning on p. 650.

CROSS SLOPE

The primary consideration on cross slope is to provide adequate pavement drainage. In addition to a review of the as-built plans, this item should be addressed by visual observation during the Field Review. Also, District representatives should be asked to provide any historical information in regard to problems with cross slope, ponding on the pavement, or irregular shape of the cross section.

In some instances, the existing pavement cross section may have become distorted due to several overlays and/or maintenance treatment. If this is the case, the new pavement design should consider alternatives such as additional removal, milling, or total reconstruction of the pavement section. This should be coordinated closely with ADOT Materials Group and should be addressed in their pavement evaluation process.

AASHTO has established guidelines for ranges of cross slopes for various roadway classifications as follows:

AASHTO Functional Classification	2004 Green Book Reference
A. Local Rural Roads	p. 383
B. Rural Collector Roads	p. 421
C. Rural Arterial Highways	pp. 446-447
D. Rural Freeways *	p. 504
E. Local Urban Streets	p. 392
F. Urban Collector Streets	p. 431
G. Urban Arterial Streets	p. 472
H. Urban Freeways *	p. 504

* Note: For Interstate System, see "A Policy on Design Standards – Interstate System", 2005.

VERTICAL CLEARANCE

Underpass clearances at bridge structures should be verified through a review of the Bridge Inspection Maintenance Reports** which are available in ADOT Bridge Group and are also shown on the Bridge Evaluation Request Form (See Appendix B). Existing clearances*** can then be compared with the AASHTO recommended clearances.

Whenever a change in the existing profile grade on an existing route is being contemplated, the vertical clearances at existing structures should be reviewed to determine how the proposed changes in profile (overlay, mill, etc.) might affect the clearance.

The AASHTO recommended vertical clearance for each classification of roadways is as follows:

AASHTO Functional Classification	2004 Green Book Reference
A. Local Rural Roads	p. 385
B. Rural Collector Roads	p. 427
C. Rural Arterial Highways	p. 447
D. Rural Freeways *	pp. 506-507
E. Local Urban Streets	p. 399
F. Urban Collector Streets	p. 436
G. Urban Arterial Streets	p. 472
H. Urban Freeways *	pp. 506-507

* Note: For Interstate System, see "A Policy on Design Standards - Interstate System", 2005.

** Note: Always compare the date on the bridge maintenance record to the date on the as-builts to assure that the roadway was not overlaid after the bridge inspection.

*** Note: Existing vertical clearances to be utilized are obtained from the Bridge Evaluation Request Form or the Bridge Inspection Maintenance Report.

HORIZONTAL CLEARANCE

This element is also often referred to as lateral offset to obstructions. The consideration for Urban Arterial Streets, Urban Collector Streets and Local Urban Streets where curbs are utilized is to maintain a minimum lateral offset distance from the face of curb to a fixed object. The consideration for all other roadways is to maintain a clear lateral clearance which equals the approach roadway width.

The AASHTO Horizontal Clearance criteria is referenced below for the various Functional Classifications of roadways:

AASHTO Functional Classification	2004 Green Book Reference
A. Local Rural Roads	p. 387
B. Rural Collector Roads	p. 427
C. Rural Arterial Highways	p. 448
D. Rural Freeways *	p. 507
E. Local Urban Streets	p. 399
F. Urban Collector Streets	p. 437
G. Urban Arterial Streets	p. 481
H. Urban Freeways *	p. 507

* Note: For Interstate System, see “A Policy on Design Standards – Interstate System”, 2005

STRUCTURAL CAPACITY

It is ADOT policy to design all new and reconstructed bridges for HS 20 design loading regardless of the functional classification of the roadway. All bridges on the project will be evaluated by the Bridge Management Engineer when a Bridge Evaluation Request Form (See Appendix B) is submitted.

The AASHTO Structural Capacity criteria is referenced below for the various Functional Classifications of roadways:

AASHTO Functional Classification	2004 Green Book Reference
A. Local Rural Roads	p. 386
B. Rural Collector Roads	p. 427
C. Rural Arterial Highways	p. 447
D. Rural Freeways *	p. 506
E. Local Urban Streets**	p. 386
F. Urban Collector Streets**	pp. 427, 436
G. Urban Arterial Streets**	p. 481
H. Urban Freeways *	p. 506

* Note: For Interstate System, see "A Policy on Design Standards - Interstate System", 2005. Rural and urban freeways (including Interstates) have no criteria for bridges to remain, therefore use HS 20.

** Note: Urban Locals, Collectors and Arterials have no criteria for bridges to remain. Therefore for Locals use Exhibit 5-7, page 386; for Collectors use Exhibit 6-7, page 427; and for Arterials use HS 20.

BRIDGE BARRIER

The bridge barrier type for State-owned bridges is listed in the Arizona State Highway System Bridge Record and for all other bridges is listed in the Arizona City Streets and County Roads Bridge Record. This information can also be obtained from the Bridge Management Engineer by submitting a Bridge Evaluation Request Form (See Appendix B).

Evaluation of the bridge barrier for replacement is the responsibility of the Bridge Management Engineer and will be shown on the Bridge Evaluation Request Form.

For information regarding bridge barrier and off-bridge transition features such as barrier curbs, walkways and roadside barriers refer to the 2004 AASHTO Green Book Sections on Curbs, p. 319, Sidewalks, pp. 427,761-763; and Bridge Railings, p. 764.

TRAFFIC INTERCHANGE CRITERIA

RAMPS

1. Design Traffic Volume
   See "Design Traffic Volumes".

2. Design Speed
   Design speed shall be posted speed of ramp. If the posted speed is unknown, then the design speed recommended by the 2004 AASHTO Green Book is referenced in Exhibit 10-56 on p. 826. (Use the posted speed of the mainline for the Highway design speed and the middle range as the ramp design speed.) The minimum design speed for freeways and expressway diagonal exit ramps is 50 mph; this is usually for the ramp proper. This speed does not pertain to the ramp terminals that should be properly transitioned and provided with speed-change facilities adequate for the highway speed involved.

   Loop ramp (where the net angular change in direction exceeds 180 degrees) design speed preferably should not be less than 25 mph (150 ft radius).

   For a directional ramp, the minimum design speed is 40 mph and for a semi-directional ramp, a design speed of less than 30 mph should not be used. (See p. 825.)

3. Lane widths and shoulder widths
   Ramp pavement widths of an existing TI can be determined by researching the as-built plans. During the Predesign Field Reviews, pavement widths should be observed and verified as necessary to determine how the existing widths compare with the guidelines in the 2004 AASHTO Green Book.

Design widths of ramp pavements for various conditions are discussed on p. 838 and widths for turning roadways is given in Exhibit 10-67, p. 839. (Also, see the revised (1/2009) FHWA Memo of 09/28/88 for additional instructions; however, there is no maximum width for ramps, only a maximum width for both shoulders for one-way operation.)

Case II with design traffic condition C is to be utilized for all ramps except if the current volume is under 100 vpd, then Case II, condition B may be utilized for a single-lane ramp.

Upon determination as to whether pavement width meets the minimum AASHTO criteria, evaluation will be required to determine what, if any, modification should be recommended for implementation.

Design vehicle turning templates using the computer program may be used to evaluate adequacy of existing ramps.

4. Vertical alignment and stopping sight distance
   See "Vertical alignment and stopping sight distance".

5. Horizontal alignment, superelevation and stopping sight distance
   See "Horizontal alignment, superelevation and stopping sight distance".

6. Grades
   Profile grades on a ramp can be determined by a review of the as-built plans. In general, AASHTO has established guidelines for suggested maximum grades on pp. 828 to 829 of the 2004 AASHTO Green Book. The ascending and descending grades should be limited to 3-5%. However, with proper ramp terminal facilities, short upgrades of 8% permit safe operation without unduly slowing down passenger cars. On one-way down ramps, gradients up to 8% do not cause hazard due to excessive acceleration. Therefore the 8% grades are to be utilized as the maximum grades.

7. Cross Slope
   The cross slope on portions of ramps on tangent normally are sloped one-way at a practical rate that may range from 1.5 to 2.0 percent for high-type pavement. See p. 829 of the 2004 Green Book.

8. Vertical Clearances
   Underpass clearances at bridge structures should be verified through review of the Bridge Inspection Maintenance Reports that are available in ADOT Bridge Group. The existing clearance is also available when submitting a Bridge Evaluation Request form to the Bridge Management Section. Existing clearances can then be compared with the AASHTO recommended clearance.

Interstate and freeway routes shall have a minimum vertical clearance of 16 feet. For sign trusses and pedestrian overpasses the clearance shall be 17 ft. All other roadways shall have a minimum clearance of 14 feet.

9. Bridge Widths
Information on existing State-owned bridges is listed in the Arizona State Highway System Bridge Record published by the Bridge Group. BRIDGE WIDTH is defined as the minimum clear roadway width on the bridge as listed under the column heading "Curb-to-Curb" of the Bridge Record. The bridge width can also be obtained from the Bridge Management Engineer by submitting a Bridge Evaluation Request Form. Information obtained from the Bridge Record should be verified with the Bridge Management Section. Details for the bridge deck and the attendant bridge rail, curbs and sidewalk may be obtained from the bridge inspection files and from available as-built plans.

Clear width on bridges shall be as wide as the approach roadway. See p. 506 of the 2004 AASHTO Green Book.

10. Structural Capacity
There are no AASHTO criteria for bridges to remain; therefore HS 20 should be used.

11. Bridge Barrier
The evaluation of the bridge barrier is the responsibility of the Bridge Management Engineer. Barrier will be evaluated both for structural and geometric criteria.

CROSSROAD

Determine the functional classification of the crossroad utilizing either the map prepared by Multimodal Planning Division (Functional Classification for the Arizona State Highway System) if the crossroad is a State route, or the section containing the definitions and characteristics of highway facilities (pp. 7-13) of the 2004 Green Book.

Once the classification has been established, then utilize the “AASHTO Review Guide” for means to identify and evaluate the AASHTO recommended design criteria.

* Note: Except in very unusual circumstances, the crossroad will always have the same terrain classification as the mainline.

APPENDIX A

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA

RURAL COLLECTOR

(PAVEMENT PRESERVATION PROJECT)

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAINLINE SUMMARY (UNDIVIDED)

PROJECT NUMBER:	080 CH 386 H 6580 01C	**ROUTE:**	SR 80
PROJECT LOCATION:	SR 80; EAST OF DOUGLAS	**BEGINNING MP:**	368.40
HIGHWAY SECTION:	DOUGLAS - RODEO HIGHWAY	**ENDING MP:**	373.50
FUNCTIONAL CLASSIFICATION:	RURAL COLLECTOR		

TRAFFIC VOLUMES AND FACTORS:

CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
2007	2017	**K=** 14%
AADT (VPD)	**AADT (VPD)**	**D=** 51%
3,261	4,200	**T=** 14%

THE POSTED SPEED LIMIT IS: 65 MPH[1] **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 4400 FT

LANE AND SHOULDER WIDTH:

	EXISTING (FT)	AASHTO RECOMMENDED MINIMUM (FT)
WIDTH OF TRAVELED WAY:	24	24 [1]
SHOULDER WIDTH:	5*	8 [1]

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

VPI STATION	MILEPOST BEGIN	MILEPOST END	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FT)	STOPPING SIGHT DISTANCE EXISTING (FT)	STOPPING SIGHT DISTANCE REQUIRED (FT)	EXISTING SPEED (MPH)	POSTED SPEED (MPH)

SEE ATTACHMENT #1

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

HPI STATION	MILEPOST BEGIN	MILEPOST END	SUPERELEVATION RDG MAX (FT/FT)	SUPERELEVATION EXISTING (FT/FT)	SUPERELEVATION MINIMUM (FT/FT)	EXISTING SPEED (MPH)	POSTED SPEED (MPH)	EXISTING DEGREE OF CURVE	MAXIMUM DEGREE OF CURVE	EXISTING HSO (FT)	EXISTING GRADE (%)	HORIZONTAL SSD EXISTING (FT)	HORIZONTAL SSD REQUIRED (FT)
122+99.94			0.08	0.020	-0.012	71	65	2° 00' 00"	3° 52'	NA			
398+37.50			0.08	0.020	-0.012	71	65	2° 00' 00"	3° 52'	NA			

REMARKS:

* DESIGN EXCEPTION REQUIRED

NOTE 1: RURAL COLLECTOR DOES NOT HAVE DESIGN CRITERION OVER 60 MPH, THEREFORE 60 MPH WAS USED AS THE CRITERION.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAINLINE SUMMARY (UNDIVIDED)
(CONTINUED)

GRADES:

EXISTING MAXIMUM GRADE IS: 3.3333%
AASHTO MAXIMUM GRADE IS: 5% [1]

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 2.0%
AASHTO RANGE IS: 1.5 - 2.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM CLEARANCE
			NONE	

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
BRIDGE #64	371.98	52'-0"	39.7'	28'-0"	Yes	Yes	HS 20	HS 15
BRIDGE #54	372.65	44'-0"	39.7'	28'-0"	Yes	Yes	HS 12.22 *	HS 15
RCB 3-10'x8' (#44)	373.11	32'-0"	38.0'	N/A	Yes	Yes	HS 20	HS 15

NOTE: DO NOT LIST BOX CULVERTS WHICH ARE NOT AT GRADE.

REMARKS:

* DESIGN EXCEPTION REQUIRED

NOTE 1: RURAL COLLECTOR DOES NOT HAVE DESIGN CRITERION OVER 60 MPH, THEREFORE 60 MPH WAS USED AS THE CRITERION.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAINLINE SUMMARY (UNDIVIDED)

PROJECT NUMBER:	080 CH 386 H 6580 01C	**ROUTE:**	SR 80
PROJECT LOCATION:	SR 80; EAST OF DOUGLAS	**BEGINNING MP:**	373.50
HIGHWAY SECTION:	DOUGLAS - RODEO HIGHWAY	**ENDING MP:**	378.50
FUNCTIONAL CLASSIFICATION:	RURAL COLLECTOR		

TRAFFIC VOLUMES AND FACTORS:

CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
2007	2017	**K=** 14%
AADT (VPD)	**AADT (VPD)**	**D=** 51%
3,261	4,200	**T=** 14%

THE POSTED SPEED LIMIT IS: 60 MPH **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 4400 FT

NOTE: PREPARE A "SUMMARY" FOR EACH POSTED SPEED LIMIT WITHIN THE PROJECT LIMITS.

LANE AND SHOULDER WIDTH:

	EXISTING (FT)	AASHTO RECOMMENDED MINIMUM (FT)
WIDTH OF TRAVELED WAY:	24	24
SHOULDER WIDTH:	2*	8

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

VPI STATION	MILEPOST BEGIN	MILEPOST END	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FT)	STOPPING SIGHT DISTANCE EXISTING (FT)	STOPPING SIGHT DISTANCE REQUIRED (FT)	EXISTING SPEED (MPH)	POSTED SPEED (MPH)
510+00.00			1.0000	-1.5000	400	632	434	63	60

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

HPI STATION	MILEPOST BEGIN	MILEPOST END	SUPERELEVATION RDG MAX (FT/FT)	SUPERELEVATION EXISTING (FT/FT)	SUPERELEVATION MINIMUM (FT/FT)	EXISTING SPEED (MPH)	POSTED SPEED (MPH)	EXISTING DEGREE OF CURVE	MAXIMUM DEGREE OF CURVE	EXISTING HSO (FT)	EXISTING GRADE (%)	HORIZONTAL SSD EXISTING (FT)	HORIZONTAL SSD REQUIRED (FT)
512+48			0.08	0.020	-0.024	58	60	2° 00' 00"	4° 46'	NA			

REMARKS:

* DESIGN EXCEPTION REQUIRED

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAINLINE SUMMARY (UNDIVIDED)
(CONTINUED)

GRADES:

EXISTING MAXIMUM GRADE IS: 3.333%
AASHTO MAXIMUM GRADE IS: 5%

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 1.5%
AASHTO RANGE IS: 1.5 - 2.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM CLEARANCE
			NONE	

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
Bridge #55	373.9	44'	39.7'	28'	No **	No **	HS 12.22 *	HS 15
Bridge #65	376.81	32'	39.8'	28'	Yes	Yes	HS 20+	HS 15

NOTE: DO NOT LIST BOX CULVERTS WHICH ARE NOT AT GRADE.

REMARKS:

* DESIGN EXCEPTION REQUIRED

** DESIGN EXCEPTION WILL NOT BE REQUESTED BECAUSE BRIDGE BARRIER WILL BE UPGRADED UNDER THIS PROJECT.

URBAN ARTERIAL

(MAJOR WIDENING PROJECT)

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAINLINE SUMMARY (UNDIVIDED)

PROJECT NUMBER: 77 PM 82 H 6694 01C
PROJECT LOCATION: TANGERINE ROAD - PINAL COUNTY LINE
HIGHWAY SECTION: TUCSON - ORACLE JC - GLOBE HIGHWAY
FUNCTIONAL CLASSIFICATION: URBAN ARTERIAL

ROUTE: SR 77
BEGINNING MP: 82.00
ENDING MP: 85.60

TRAFFIC VOLUMES AND FACTORS:

CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
2008	2030	**K=** 6%
AADT (VPD)	**AADT (VPD)**	**D=** 50%
28,000	65,000	**T=** 9%

THE POSTED SPEED LIMIT IS: 55 MPH **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 2900 FT

LANE AND SHOULDER WIDTH:

	EXISTING (FT)	PROPOSED (FT)	AASHTO RECOMMENDED MINIMUM (FT)
TRAVEL LANE WIDTH:	4-(VARIES) 12 -14	4-12	10
CONTINUOUS TWO-WAY LEFT TURN:	0	12	10
SHOULDER WIDTH:	10	10	8

NOTE: ADD TURN LANES AND/OR PARKING LANES IF THEY ARE PRESENT.

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

	MILEPOST		APPROACH GRADE	DEPARTURE GRADE	LENGTH OF CURVE	STOPPING SIGHT DISTANCE		EXISTING SPEED	POSTED SPEED
VPI STATION	BEGIN	END	(%)	(%)	(FT)	EXISTING (FT)	REQUIRED (FT)	(MPH)	(MPH)
749+50			0.5286	3.8182	800	985	608	80	55
753+50			3.8182	0.5000	1400	954	608	79	55
774+50			0.5000	1.9543	1000	+9999	586	+100	55
792+00	82.97	83.12	1.9543	-5.6995	1000	531*	539	54	55
802+00			5.6995	0.5098	1000	645	539	61	55

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

	MILEPOST		SUPERELEVATION			EXISTING SPEED	POSTED SPEED	EXISTING DEGREE OF CURVE	MAXIMUM DEGREE OF CURVE	EXISTING HSO	EXISTING GRADE	HORIZONTAL SSD	
HPI STATION	BEGIN	END	RDG MAX (FT/FT)	EXISTING (FT/FT)	MINIMUM (FT/FT)	(MPH)	(MPH)			(FT)	(%)	EXISTING (FT)	REQUIRED (FT)
732+72			0.06	0.015	-0.104	94	55	0^{o} 45'	5^{o} 24'	NA			

REMARKS:

* DESIGN EXCEPTION REQUIRED

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAINLINE SUMMARY (UNDIVIDED)
(CONTINUED)

GRADES:

EXISTING MAXIMUM GRADE IS: 5.6995 *
AASHTO MAXIMUM GRADE IS: 5%

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 2.0 %
AASHTO RANGE IS: 1.5 - 3.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM CLEARANCE
			NONE	

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
DEAD MAN WASH	83.53	136'	56.0 **	80.0	No **	No **	HS 15 *	HS 20

NOTE: DO NOT LIST BOX CULVERTS WHICH ARE NOT AT GRADE.

REMARKS:

* DESIGN EXCEPTION REQUIRED

** DESIGN EXCEPTION WILL NOT BE REQUESTED BECAUSE BRIDGE WIDTH AND BARRIER WILL BE UPGRADED UNDER THIS PROJECT.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAINLINE SUMMARY (UNDIVIDED)

PROJECT NUMBER:	77 PM 82 H 6694 01C	**ROUTE:**	SR 77
PROJECT LOCATION:	TANGERINE ROAD - PINAL COUNTY LINE	**BEGINNING MP:**	85.60
HIGHWAY SECTION:	TUCSON - ORACLE JC - GLOBE HIGHWAY	**ENDING MP:**	89.50
FUNCTIONAL CLASSIFICATION:	URBAN ARTERIAL		

TRAFFIC VOLUMES AND FACTORS:

CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
2008	2030	**K=** 6%
AADT (VPD)	**AADT (VPD)**	**D=** 50%
28,000	65,000	**T=** 9%

THE POSTED SPEED LIMIT IS: 45 MPH **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 2900 FT

LANE AND SHOULDER WIDTH:

	EXISTING (FT)	PROPOSED (FT)	AASHTO RECOMMENDED MINIMUM (FT)
LANE WIDTH:	4-(VARIES) 12 -14	4-12	10
CONTINUOUS TWO-WAY LEFT TURN:	0	12	10
SHOULDER WIDTH:	10	10	8

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

	MILEPOST		APPROACH GRADE	DEPARTURE GRADE	LENGTH OF CURVE	STOPPING SIGHT DISTANCE		EXISTING SPEED	POSTED SPEED
VPI STATION	BEGIN	END	(%)	(%)	(FT)	EXISTING (FT)	REQUIRED (FT)	(MPH)	(MPH)
827+00			0.5098	1.1658	800	+9999	366	+100	45
846+00			1.1658	2.6200	800	+9999	375	+100	45
857+00			2.6200	0.7200	1400	1261	375	94	45
868+00			0.7200	2.1500	800	+9999	372	+100	45

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

	MILEPOST		SUPERELEVATION			EXISTING SPEED	POSTED SPEED	EXISTING DEGREE OF CURVE	MAXIMUM DEGREE OF CURVE	EXISTING HSO	EXISTING GRADE	HORIZONTAL SSD	
HPI STATION	BEGIN	END	RDG MAX (FT/FT)	EXISTING (FT/FT)	MINIMUM (FT/FT)	(MPH)	(MPH)			(FT)	(%)	EXISTING (FT)	REQUIRED (FT)

SEE ATTACHMENT No. 2

REMARKS:

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAINLINE SUMMARY (UNDIVIDED)
(CONTINUED)

GRADES:

EXISTING MAXIMUM GRADE IS: 2.9200 %
AASHTO MAXIMUM GRADE IS: 6%

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 2.0 %
AASHTO RANGE IS: 1.5 - 3.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM CLEARANCE
			NONE	

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
					NONE			

NOTE: DO NOT LIST BOX CULVERTS WHICH ARE NOT AT GRADE.

REMARKS:

RURAL INTERSTATE

(PAVEMENT PRESERVATION PROJECT)

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAINLINE SUMMARY (DIVIDED)

PROJECT NUMBER: 40 CN 152 H3262 01 C
PROJECT LOCATION: WELCH RD TI - DEVIL DOG TI
HIGHWAY SECTION: ASHFORK - FLAGSTAFF HIGHWAY
FUNCTIONAL CLASSIFICATION: RURAL INTERSTATE

ROUTE: I-40 EB & WB
BEGINNING MP: 150.00
ENDING MP: 160.00

NOTE: THE "SUMMARY" FOR A DIVIDED ROADWAY CAN EITHER BE COMBINED AS SHOWN OR EACH DIRECTION OF TRAFFIC CAN HAVE ITS OWN "SUMMARY":.

TRAFFIC VOLUMES AND FACTORS:

CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
1993	2003	
		K= 10%
AADT (VPD)	AADT (VPD)	D= NA
6,800	10,000	T= 9%

THE POSTED SPEED LIMIT IS: 65 MPH **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 5500 FT

LANE AND SHOULDER WIDTH:

	EXISTING (FEET)	AASHTO RECOMMENDED MINIMUM (FEET)
LANE WIDTH:	2-12	2-12
INSIDE SHOULDER WIDTH:	3 *(WB), 4 (EB)	4
OUTSIDE SHOULDER WIDTH:	10	10

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

VPI STATION	MILEPOST BEGIN	MILEPOST END	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FT)	STOPPING SIGHT DISTANCE EXISTING (FT)	STOPPING SIGHT DISTANCE REQUIRED (FT)	EXISTING SPEED (MPH)	POSTED SPEED (MPH)

SEE ATTACHMENT #1

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

HPI STATION	MILEPOST BEGIN	MILEPOST END	SUPERELEVATION RDG MAX (FT/FT)	SUPERELEVATION EXISTING (FT/FT)	SUPERELEVATION MINIMUM (FT/FT)	EXISTING SPEED (MPH)	POSTED SPEED (MPH)	EXISTING DEGREE OF CURVE	MAXIMUM DEGREE OF CURVE	EXISTING HSO (FT)	EXISTING GRADE (%)	HORIZONTAL SSD EXISTING (FT)	HORIZONTAL SSD REQUIRED (FT)

SEE ATTACHMENT #2

REMARKS:

* DESIGN EXCEPTION REQUIRED

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAINLINE SUMMARY (DIVIDED)
(CONTINUED)

GRADES:

EXISTING MAXIMUM GRADE IS: 3.9978% *
AASHTO MAXIMUM GRADE IS: 3%

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 2.0%
AASHTO RANGE IS: 1.5 - 2.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM ALLOWABLE CLEARANCE
Palo Parado UP EB (#3421)	157	16' - 0"	15' - 10" *	16' - 0"
Palo Parado UP WB (#3422)	157	16' - 2"	16' - 0"	16' - 0"
Deadman UP EB GS (#3444)	159	16' - 0"	15' - 10" *	16' - 0"
Deadman UP WB GS (#3445)	159	16' - 2"	16' - 0"	16' - 0"

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
Creator Wash Bridge EB (#2123)	157	105'	36.0' *	37.5'	No *	No *	HS 15 *	HS 20
Creator Wash Bridge WB (#2124)	157	105'	37.5'	37.5'	Yes	Yes	HS 15 *	HS 20
Ashfork RR OP EB (#3241)	159	125'	35.5' *	37.5'	No *	No *	HS 20	HS 20
Ashfork RR OP WB (#3242)	159	125'	37.5'	37.5'	Yes	Yes	HS 20	HS 20

NOTE: DO NOT LIST BOX CULVERTS WHICH ARE NOT AT GRADE.

REMARKS:

* DESIGN EXCEPTION REQUIRED

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
CROSSROAD

PROJECT NUMBER: 40 CN 152 H3262 01 C
PROJECT LOCATION: WELCH RD TI - DEVIL DOG TI
HIGHWAY SECTION: ASHFORK - FLAGSTAFF HIGHWAY **MAINLINE MILEPOST:** 157.00
CROSSROAD: PALO PARADO TI CROSSROAD
FUNCTIONAL CLASSIFICATION: RURAL COLLECTOR

TRAFFIC VOLUMES AND FACTORS:

CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
1993	2003	
		K= 10%
AADT (VPD)	AADT (VPD)	D= 51%
950	1,000	T= 9%

THE POSTED SPEED LIMIT IS: 50 MPH **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 5500 FT

LANE AND SHOULDER WIDTH:

	EXISTING (FT)	AASHTO RECOMMENDED MINIMUM (FT)
WIDTH OF TRAVELED WAY:	24	22
SHOULDER WIDTH:	2*	5

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

	MILEPOST		APPROACH GRADE	DEPARTURE GRADE	LENGTH OF CURVE	STOPPING SIGHT DISTANCE		EXISTING SPEED	POSTED SPEED
VPI STATION	BEGIN	END	(%)	(%)	(FT)	EXISTING (FT)	REQUIRED (FT)	(MPH)	(MPH)
510+00.00			1.0000	-1.5000	400	632	434	63	50

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

	MILEPOST		SUPERELEVATION			EXISTING SPEED	POSTED SPEED	EXISTING DEGREE OF	MAXIMUM DEGREE OF	EXISTING HSO	EXISTING GRADE	HORIZONTAL SSD	
			RDG MAX	EXISTING	MINIMUM							EXISTING	REQUIRED
HPI STATION	BEGIN	END	(FT/FT)	(FT/FT)	(FT/FT)	(MPH)	(MPH)	CURVE	CURVE	(FT)	(%)	(FT)	(FT)
512+48			0.08	0.020	-0.024	58	50	4° 00' 00"	7° 34'	NA			

REMARKS:

* DESIGN EXCEPTION REQUIRED

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
CROSSROAD
(CONTINUED)

GRADES:

EXISTING MAXIMUM GRADE IS: 3.333%
AASHTO MAXIMUM GRADE IS: 6%

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 1.5%
AASHTO RANGE IS: 1.5 - 2.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM CLEARANCE
			NONE	

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
Palo Parado TI UP EB (#3421)	157	105'	30'	22'	No **	No **	HS 15	HS 15
Palo Parado TI UP WB (#3422)	157	105'	30'	22'	Yes	Yes	HS 15	HS 15

NOTE: DO NOT LIST BOX CULVERTS WHICH ARE NOT AT GRADE.

REMARKS:

** DESIGN EXCEPTION WILL NOT BE REQUESTED BECAUSE BRIDGE BARRIER WILL BE UPGRADED UNDER THIS PROJECT.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
RAMP 157A

PROJECT NUMBER: 40 CN 152 H3262 01 C
PROJECT LOCATION: WELCH RD TI - DEVIL DOG TI
HIGHWAY SECTION: ASHFORK - FLAGSTAFF HIGHWAY **MAINLINE MILEPOST:** 157.00
FUNCTIONAL CLASSIFICATION: DIAGONAL
DESCRIPTION: WB EXIT RAMP

TRAFFIC VOLUMES AND FACTORS:

CURRENT YEAR	CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
1990	1993	2003	**K=** 12%
AADT (VPD)	**AADT (VPD)**	**AADT (VPD)**	**D=** NA
250	390	520	**T=** 2%

THE POSTED SPEED LIMIT IS: UNKNOWN, USE 50 MPH **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 5500 FT

RAMP WIDTH:

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITION (A OR B OR C): C

MINIMUM RADIUS (FT)	TOTAL PAVED WIDTH (FT)	2-C WIDTH (FT)	2-C WIDTH EXCLUDING SHOULDERS (FT)	TRAVELED-WAY WIDTH EXISTING WIDTH (FT)	TRAVELED-WAY WIDTH MINIMUM 1-C (FT)	EXISTING LEFT SHOULDER (FT)	EXISTING RIGHT SHOULDER (FT)	EXISTING LEFT & RIGHT SHOULDER (FT)	AASHTO MAXIMUM SHOULDERS (FT)
2291	22	20	12	14	14	2	6	8	12

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

VPI STATION	MILEPOST BEGIN	MILEPOST END	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FT)	STOPPING SIGHT DISTANCE EXISTING (FT)	STOPPING SIGHT DISTANCE REQUIRED (FT)	EXISTING SPEED (MPH)	POSTED SPEED (MPH)
6+25			3.0000	-3.0000	600	465	446	51	50
12+25			-3.0000	1.0000	600	622	446	61	50

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

HPI STATION	MILEPOST BEGIN	MILEPOST END	SUPERELEVATION RDG MAX (FT/FT)	SUPERELEVATION EXISTING (FT/FT)	SUPERELEVATION MINIMUM (FT/FT)	EXISTING SPEED (MPH)	POSTED SPEED (MPH)	EXISTING DEGREE OF CURVE	MAXIMUM DEGREE OF CURVE	EXISTING HSO (FT)	EXISTING GRADE (%)	HORIZONTAL SSD EXISTING (FT)	HORIZONTAL SSD REQUIRED (FT)
11+25			0.08	0.035	-0.053	65	50	3° 00' 00"	7° 34'	NA			

REMARKS:

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
RAMP 157A
(CONTINUED)

GRADES:

EXISTING MAXIMUM ASCENDING	EXISTING MAXIMUM DESCENDING	AASHTO MAXIMUM ASCENDING	AASHTO MAXIMUM DESCENDING
3%	-3%	8%	8%

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 1.5%
AASHTO RANGE IS: 1.5 - 2.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM CLEARANCE
			NONE	

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
					NONE			

NOTE: DO NOT LIST BOX CULVERTS WHICH ARE NOT AT GRADE.

REMARKS:

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
RAMP 157F

PROJECT NUMBER: 40 CN 152 H3262 01 C
PROJECT LOCATION: WELCH RD TI - DEVIL DOG TI
HIGHWAY SECTION: ASHFORK - FLAGSTAFF HIGHWAY **MAINLINE MILEPOST:** 157.00
FUNCTIONAL CLASSIFICATION: LOOP
DESCRIPTION: EB EXIT RAMP

TRAFFIC VOLUMES AND FACTORS:

CURRENT YEAR	CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
1990	1993	2003	**K=** 12%
AADT (VPD)	**AADT (VPD)**	**AADT (VPD)**	**D=** NA
250	390	520	**T=** 2%

THE POSTED SPEED LIMIT IS: UNKNOWN, USE 25 MPH **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 5500 FT

RAMP WIDTH: **CASE (1 OR 2 OR 3):** 2
TRAFFIC CONDITION (A OR B OR C): C

EXISTING MINIMUM RADIUS (FT)	AASHTO MINIMUM RADIUS (FT)	EXISTING TOTAL PAVED WIDTH (FT)	2-C WIDTH (FT)	2-C EXCLUDING SHOULDERS (FT)	TRAVELED-WAY WIDTH EXISTING WIDTH (FT)	TRAVELED-WAY WIDTH MINIMUM 1-C (FT)	EXISTING LEFT SHOULDER (FT)	EXISTING RIGHT SHOULDER (FT)	EXISTING LEFT & RIGHT SHOULDER (FT)	AASHTO MAXIMUM SHOULDERS (FT)
180	150	28	22	14	20	16	2	6	8	12

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

VPI STATION	MILEPOST BEGIN	MILEPOST END	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FT)	STOPPING SIGHT DISTANCE EXISTING (FT)	STOPPING SIGHT DISTANCE REQUIRED (FT)	EXISTING SPEED (MPH)	POSTED SPEED (MPH)
6+25			-5.0000	-3.0000	600	3200	162	>100	25
12+25			-3.0000	1.0000	600	622	157	61	25

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

HPI STATION	MILEPOST BEGIN	MILEPOST END	SUPERELEVATION RDG MAX (FT/FT)	SUPERELEVATION EXISTING (FT/FT)	SUPERELEVATION MINIMUM (FT/FT)	EXISTING SPEED (MPH)	POSTED SPEED (MPH)	EXISTING DEGREE OF CURVE	MAXIMUM DEGREE OF CURVE	EXISTING HSO (FT)	EXISTING GRADE (%)	HORIZONTAL SSD EXISTING (FT)	HORIZONTAL SSD REQUIRED (FT)
3+25			0.08	0.080	-0.005	26	25	31° 00' 00"	42° 38'	NA			
9+75			0.08	0.060	-0.121	35	25	15° 00' 00"	42° 38'	NA			

REMARKS:

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
RAMP 157F
(CONTINUED)

GRADES:

EXISTING MAXIMUM ASCENDING	EXISTING MAXIMUM DESCENDING	AASHTO MAXIMUM ASCENDING	AASHTO MAXIMUM DESCENDING
1%	-5%	8%	8%

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 1.5%

AASHTO RANGE IS: 1.5 - 2.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM CLEARANCE
			NONE	

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
					NONE			

NOTE: DO NOT LIST BOX CULVERTS WHICH ARE NOT AT GRADE.

REMARKS:

APPENDIX B

BRIDGE EVALUATION REQUEST FORM

DATE:

TO: **Peng Chen**
BRIDGE GROUP
BRIDGE MANAGEMENT SECTION, MD 635E

FEDERAL REFERENCE NO: _____ TRACS NO: _____
HIGHWAY: _____
LOCATION: _____
MP LIMITS: _____ TO: _____
PROJECT DESCRIPTION: _____

FROM: _____

SUBJECT: **BRIDGE EVALUATION REQUEST**

Please evaluate the following structures per AASHTO guidelines:

ROUTE NO.	MILEPOST	STR. NO. AND NAME	BRIDGE LENGTH	BRIDGE ROADWAY WIDTH	BRIDGE RAIL / BARRIER			AC OVERLAY			VERTICAL CLEARANCE (MINIMUM)		BRIDGE LOAD RATING	BRIDGE SUFFICIENCY RATING
					TYPE	GEOM. OK	STRUC OK	THICKNESS (EXISTING)	REMOVE (MINIMUM)	REPLACE/NEW (MAXIMUM)	NB/EB	SB/WB		
			Comments:											
			Comments:											
			Comments:											
			Comments:											
			Comments:											

Evaluation Completed by: _____ Date: _____

APPENDIX C

INSTRUCTION GUIDE FOR THE LIST OF

EXISTING FEATURES REQUIRING DESIGN EXCEPTIONS

In order to facilitate document reviews and to establish continuity among AASHTO Controlling Design Criteria Reports, the following outline for listing design exception and example for an Interstate project has been prepared. Please note order in which the mainline, crossroad, ramps and design exceptions are listed. Design exceptions will be listed in the direction of travel for ramps and divided roadways (i.e. uni-directional roadways; one-way traffic). The examples show the standard sentences and numbering sequence used to introduce each design exception and a description of the design exception.

Please list the mainline roadways, crossroad, and ramps in the following order:

MAINLINE

ROUTE NB (or EB)

Design Exception(s)

ROUTE SB (or WB)

Design Exception(s)

T.I. NAME

CROSSROAD NAME

Design Exception(s)

RAMP DESIGNATION (use the NB entrance or WB exit ramp)

Design Exception(s)

RAMP DESIGNATION (use the NB exit or EB entrance ramp)

Design Exception(s)

RAMP DESIGNATION (use the SB entrance or EB exit ramp)

Design Exception(s)

RAMP DESIGNATION (use the SB exit or WB entrance ramp)

(The RAMP DESIGNATION will be the ramp number as shown on the Control-of-Access photograph of the traffic interchange, or as marked at the Traffic Interchange ramps in the field. If not available, use the description of the ramp with respect to traffic movement, such as SB Exit or WB Entrance Ramp.)

(The Ramp Functional Classification refers to the type of ramp under review, such as diagonal, loop, direct etc.; see p. 823 of the 2004 Green Book)

Please list the applicable design exceptions in the following order:

1. Design Speed

2. Travel Lane/ Traveled Way/ Ramp Pavement Width

3. Shoulder Width

4. Existing Bridge Width

5. Horizontal Alignment
    a. Existing degree of curve exceeding maximum
    b. Horizontal Curve Stopping Sight Distance

6. Superelevation

7. Vertical Alignment
    a. Vertical Curve Stopping Sight Distance

8. Grade

9. Intersection Stopping Sight Distance

10. Cross Slope

11. Vertical Clearance
    a. Existing
    b. Post Construction

12. Horizontal Clearance

13. Structural Capacity
    a. Bridge Barrier
        1. Geometry
        2. Structural Criteria

NOTE: The information shown on the following asterisk table is used to demarcate on the "Summary of Controlling Design Criteria" sheets.

* Design Exception Required
** Design Exception Required, but will not be requested because….
*** Not Calculated because…..
**** For special circumstances
If none of the above conditions apply, the "Remarks" block remains blank.

PROJECT 40 CN 152 H3262 01 C

-40-3(77)A

WELCH ROAD TI – DEVIL DOG TI

ASH FORK – FLAGSTAFF HIGHWAY

I-40

AASHTO CONTROLLING DESIGN CRITERIA REPORT

July 2006

ARIZONA DEPARTMENT OF TRANSPORTATION

INTERMODEL TRANSPORTATION DIVISION

ROADWAY ENGINEERING GROUP

ROADWAY PREDESIGN

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LIST OF EXISTING FEATURES REQUIRING DESIGN EXCEPTIONS

The following is a list of the existing design features requiring design exceptions based upon A Policy on Geometric Design of Highways and Streets 2004 and A Policy on Design Standards – Interstate System 2005.

I-40 EB

The existing shoulder width is less than the recommended 4 ft (inside) shoulder as follows:

1. MP 150.05 to MP 160.00 – 1 ft less than recommended.

The existing bridge width is less than the recommended 37.5 ft as follows:

1. MP 151.03 Crater Wash Bridge (#2123) – 1.5 ft less than recommended.
2. MP 153.50 Ashfork RR OP (#3241) – 2.0 ft less than recommended.

The existing degree of curve exceeds the recommended maximum of 3^{o} 52' as follows:

1. Beginning MP 151.00 (HPI Sta 980+34.10) – 0^{o} 38' greater than the maximum.
2. Beginning MP 153.00 (HPI Sta 990+50.00) – 1^{o} 38' greater than the maximum.

The superelevation rate is less than the recommended minimum for a posted speed of XX mph as follows:

1. Beginning MP 156.50 (HPI Sta 1097+67.30)
   e existing = X.XXX ft/ft (X.XXX ft/ft less than the recommended of X.XXX ft/ft)
   e minimum Method 2 = -X.XXX ft/ft Method 2 Speed = XX mph
2. Beginning MP 157.00 (HPI Sta 1109+21.10)
   e existing = X.XXX ft/ft (X.XXX ft/ft less than the recommended of X.XXX ft/ft)
   e minimum Method 2 = -X.XXX ft/ft Method 2 Speed = XX mph

The vertical curve stopping sight distance is less than the recommended as follows:

1. Beginning MP 152.33 (VPI Sta 997+00.00) – Existing Speed = XX mph
   58 ft less than the recommended XXX ft.
2. Beginning MP 154.02 (VPI Sta 1050+50.00) – Existing Speed = XX mph
   325 ft less than the recommended XXX ft.
3. Beginning MP 156.23 (VPI Sta 1690+50.00) – Existing Speed = XX mph
   85 ft less than the recommended XXX ft.

The existing grade exceeds the recommended maximum of 3% as follows:

3. MP 154.99 to MP 155.83 – 0.9997% greater than the recommended.

The post construction vertical clearance is less than the recommended 16"-0" as follows:

1. MP 157.00 Palo Parado Bridge (#3421) – 0'- 2" less than the recommended.
2. MP 159.00 Deadman UP GS (#3444) – 0' 2" less than the recommended.

The bridge structural capacity is less than the recommended HS 20 as follows:

1. MP 151.03 Crater Wash Bridge (#2123) – HS 18.5.

The geometry and/or structural criteria of the bridge barrier does not meet AASHTO recommendations as follows:

1. MP 151.03 Crater Wash Bridge (#2123) – bridge barrier and 18" curb.
2. MP 153.50 Ashfork RR OP (#3241) – bridge barrier.

I-40 WB

The horizontal curve stopping sight distance is less than recommended as follows:

1. Beginning MP 156.80 (HPI Sta 1097+67.30) – Existing Speed = XX mph
   253 ft less than the recommended XXX ft.

The superelevation rate is less than the recommended minimum for a posted speed of XX mph as follows:

1. Beginning MP 157.50 (HPI Sta 1109+21.10)
   e existing = X.XXX ft/ft (X.XXX ft/ft less than the recommended of X.XXX ft/ft)
   e minimum Method 2 = -X.XXX ft/ft Method 2 Speed = XX mph
2. Beginning MP 156.80 (HPI Sta 1097+67.30)
   e existing = X.XXX ft/ft (X.XXX ft/ft less than the recommended of X.XXX ft/ft)
   e minimum Method 2 = -X.XXX ft/ft Method 2 Speed = XX mph
3. Beginning MP 153.21 (HPI Sta 990+50.00)
   e existing = X.XXX ft/ft (X.XXX ft/ft less than the recommended of X.XXX ft/ft)
   e minimum Method 2 = -X.XXX ft/ft Method 2 Speed = XX mph

The vertical curve stopping sight distance is less than the recommended as follows:

1. Beginning MP 156.34 (VPI Sta 1690+50.00) – Existing Speed = XX mph
   58 ft less than the recommended XXX ft.
2. Beginning MP 154.14 (VPI Sta 1050+50.00) – Existing Speed = XX mph
   325 ft less than the recommended XXX ft.
3. Beginning MP 152.44 (VPI Sta 997+00.00) – Existing Speed = XX mph
   85 ft less than the recommended XXX ft.

The existing grade exceeds the recommended maximum of 3% as follows:

1. MP 154.99 to MP 155.83 – 0.997% greater than the maximum.

The bridge structural capacity is less than the recommended HS 20 loading as follows:

1. MP 151.03 Crater Wash Bridge (#2124) – HS 15.

Palo Parado T.I.
Crossroad

The existing shoulder width is less than the recommended 6 ft as follows:

1. Sta 575+34.12 to Sta 582+00.23 – 2 ft less than recommended.
2. Sta 582+00.23 to Sta 583+01.24 – 1 ft less than recommended.

The superelevation rate exceeds the recommended maximum of 0.08 ft/ft for a posted speed of XX mph as follows:

1. HPI Sta 562+48.54
   e existing = X.XXX ft/ft (X.XXX ft/ft less than the recommended of X.XXX ft/ft)
   e minimum Method 2 = -X.XXX ft/ft Method 2 Speed = XX mph
2. HPI Sta 577+51.24
   e existing = X.XXX ft/ft (X.XXX ft/ft less than the recommended of X.XXX ft/ft)
   e minimum Method 2 = -X.XXX ft/ft Method 2 Speed = XX mph

Ramp 157A

The ramp pavement width is less than the recommended 14 ft as follows:

1. Sta 19+25.56 to Sta 10+23.04 – 1 ft less than recommended.

The existing degree of curve exceeds the recommended maximum of 7^{o} 34' as follows:

1. HPI Sta 11+25.89 – 0^{o} 11' greater than the maximum.

Ramp 157F

The superelevation rate is less than the recommended minimum for (see Note #1) as follows:

1. HPI Sta 10+24.11
   e existing = X.XXX ft/ft (X.XXX ft/ft less than the recommended of X.XXX ft/ft)
   e minimum Method 2 = -X.XXX ft/ft Method 2 Speed = XX mph

Note #1

- If the ramp is signed with a posted speed, use "a posted speed of 50 mph."
- If the ramp does not have a signed posted speed, use "as assumed design speed of XX mph."
- See 2009 AASHTO Guide: Traffic Interchange Criteria; Ramps; Design Speed discussion.

The vertical curve stopping sight distance is less than the recommended as follows:

1. VPI Sta 597+00.00 – Existing Speed = XX mph
   103 ft less than the recommended XXX ft.
2. VPI Sta 650+50.00 – Existing Speed = XX mph
   49 ft less than the recommended XXX ft.
3. VPI Sta 691+50.00 – Existing Speed = XX mph
   104 ft less than the recommended XXX ft.

Ramp 157D

The ramp shoulder width exceeds the recommended maximum 12 ft as follows:

1. Sta 14+27.56 to Sta 6+23.04 – 1 ft more than the recommended.

Ramp 157J

The vertical curve stopping sight distance is less than the recommended as follows:

1. VPI Sta 9+75.00 – Existing Speed = XX mph
   21 ft less than the recommended XXX ft.

APPENDIX D

AASHTO REPORT EXAMPLE

PROJECT 040 CN 239 H 6570 01C

-40-D-( )A

I-40; DENNISON – COUNTY LINE

FLAGSTAFF – HOLBROOK HIGHWAY

INTERSTATE 40

AASHTO CONTROLLING DESIGN CRITERIA REPORT

SEPTEMBER 2005

PREPARED FOR:

ARIZONA DEPARTMENT OF TRANSPORTATION

INTERMODEL TRANSPORTATION DIVISION

ROADWAY ENGINEERING GROUP

ROADWAY PREDESIGN

PREPARED BY:

AZTEC ENGINEERING
4561 E. MCDOWELL ROAD
PHOENIX, AZ 85008

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LIST OF EXISTING FEATURES REQUIRING DESIGN EXCEPTIONS

The following is a list of the existing design features requiring design exceptions based upon A Policy on Geometric Design of Highways and Streets 2004 and A Policy on Design Standards – Interstate System 2005.

I-40 EB

The superelevation rate is less than the recommended minimum for a posted speed of 75 mph as follows:

1. Beginning MP 239.96 (HPI Sta 2312+09.72)
   e existing = 0.015 ft/ft (0.050 ft/ft less than the recommended of 0.065 ft/ft)
   e minimum Method 2 = 0.025 ft/ft Method 2 Speed = 73 mph

The bridge structural capacity is less than the recommended HS 20 loading as follows:

1. MP 248.99 EB Tucker Flat Bridge #336 – HS 11.11

I-40 WB

The existing shoulder width is less than the recommended 4 ft (inside) shoulder as follows:

1. MP 250.25 to MP 239.96 – 1 ft less than recommended.

The superelevation rate is less than the recommended minimum for a posted speed of 75 mph as follows:

1. Beginning MP 241.38 (HPI Sta 2312+21.69)
   e existing = 0.015 ft/ft (0.050 ft/ft less than the recommended of 0.065 ft/ft)
   e minimum Method 2 = 0.025 ft/ft Method 2 Speed = 73 mph

The vertical curve stopping sight distance is less than the recommended as follows:

1. Beginning MP 246.99 (VPI Sta 2682+00.00) – Existing Speed = 75 mph
   3 ft less than the recommended 843 ft.

LEUPP ROAD T.I.
Crossroad
The superelevation rate is less than the recommended minimum for a posted speed of 30 mph as follows:

1. Beginning MP 245.39 (HPI Sta 3+99.21)
   e existing = 0.015 ft/ft (0.027 ft/ft less than the recommended of 0.042 ft/ft)
   e minimum Method 2 = -0.137ft/ft Method 2 Speed = 48 mph

The geometry and/or structural criteria of the bridge barrier does not meet AASHTO recommendations as follows:

1. MP 245.39 Leupp TI UP (#1317) – bridge barrier

RAMP A

The existing degree of curve exceeds the recommended maximum of 5^{o} 58' as follows:

1. HPI Sta 10+41.78 – 4^{o} 2' greater than the maximum.
2. HPI Sta 3+12.34 – 0^{o} 2' greater than the maximum.

RAMP B

The existing degree of curve exceeds the recommended maximum of 5^{o} 58' as follows:

1. HPI Sta 4+50.00 – 0^{o} 2' greater than the maximum.
2. HPI Sta 12+54.03 – 4^{o} 2' greater than the maximum.

RAMP C

The vertical curve stopping sight distance is less than the recommended as follows:

1. VPI Sta 10+00.00 - Existing Speed = 44 mph
   164 ft less than the recommended 529 ft.

RAMP D

The superelevation rate is less than the recommended minimum for "(see Note #1 below)" as follows:

1. HPI Sta 6+77.20
   e existing = 0.015 ft/ft (0.030 ft/ft less than the recommended of 0.045 ft/ft)
   e minimum Method 2 = -0.059 ft/ft Method 2 Speed 70 mph

The vertical curve stopping sight distance is less than the recommended as follows:

1. VPI Sta 1+00.00 - Existing Speed = 41 mph
   203 ft less than the recommended 543 ft.

2. VPI Sta 6+00.00 - Existing Speed = 47 mph
   120 ft less than the recommended 543 ft.

Note # 1

- If the ramp is signed with a posted speed, use "a posted speed of 50 mph."
- If the ramp does not have a signed posted speed, use "an assumed design speed of XX mph."
- See 2009 AASHTO Guide: Traffic Interchange Criteria; Ramps; Design Speed discussions.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAIN LINE EB ROADWAY

PROJECT NUMBER:	40 CN 239 H6570 01 C	**ROUTE:**	I-40 EB
PROJECT LOCATION:	DENNISON - COUNTY LINE	**BEGINNING MP:**	239.96
HIGHWAY SECTION:	FLAGSTAFF - HOLBROCK HIGHWAY	**ENDING MP:**	250.25
FUNCTIONAL CLASSIFICATION:	RURAL INTERSTATE		

TRAFFIC VOLUMES AND FACTORS:

CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
2007	2017	
		K= 15%
AADT (VPD)	**AADT (VPD)**	**D=** 51%
24,375	30,976	**T=** 43%

THE POSTED SPEED LIMIT IS: 75 MPH **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 5100 FT

LANE AND SHOULDER WIDTH:

	EXISTING (FEET)	AASHTO RECOMMENDED MINIMUM (FEET)
LANE WIDTH:	2-12	2-12
INSIDE SHOULDER WIDTH:	4	4
OUTSIDE SHOULDER WIDTH:	10	10

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

	MILEPOST		APPROACH GRADE	DEPARTURE GRADE	LENGTH OF CURVE	STOPPING SIGHT DISTANCE		EXISTING SPEED	POSTED SPEED
VPI STATION	BEGIN	END	(%)	(%)	(FT)	EXISTING (FT)	REQUIRED (FT)	(MPH)	(MPH)

SEE ATTACHMENT #1

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

	MILEPOST		SUPERELEVATION			METHOD 2 SPEED	POSTED SPEED	EXISTING DEGREE OF CURVE	MAXIMUM DEGREE OF CURVE	EXISTING HSO	EXISTING GRADE	HORIZONTAL SSD	
HPI STATION	BEGIN	END	RDG MAX (FT/FT)	EXISTING (FT/FT)	MINIMUM (FT/FT)	(MPH)	(MPH)			(FT)	(%)	EXISTING (FT)	REQUIRED (FT)

SEE ATTACHMENT #2

REMARKS:

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAIN LINE EB ROADWAY
(CONTINUED)

GRADES:

EXISTING MAXIMUM GRADE IS: 1.8800%
AASHTO MAXIMUM GRADE IS: 3%

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 1.5%
AASHTO RANGE IS: 1.5 - 2.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM ALLOWABLE CLEARANCE
Leupp Road TI UP (#1317)	245.39	17' - 0"	16' - 9.5"	16' - 0"

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
Tucker Flat Bridge, EB (#336)	248.99	80'	39.6'	37.5'	Yes	NO**	HS 11.11*	HS 20

REMARKS: * DESIGN EXCEPTION REQUIRED
** DESIGN EXCEPTION WILL NOT BE REQUESTED BECAUSE BRIDGE BARRIER WILL BE UPGRADED UNDER THIS PROJECT.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAIN LINE WB ROADWAY

PROJECT NUMBER:	40 CN 239 H6570 01 C	**ROUTE:**	I-40 WB
PROJECT LOCATION:	DENNISON - COUNTY LINE	**BEGINNING MP:**	239.96
HIGHWAY SECTION:	FLAGSTAFF - HOLBROCK HIGHWAY	**ENDING MP:**	250.25
FUNCTIONAL CLASSIFICATION:	RURAL INTERSTATE		

TRAFFIC VOLUMES AND FACTORS:

CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
2007	2017	
		K= 15%
AADT (VPD)	**AADT (VPD)**	**D=** 51%
24,375	30,976	**T=** 43%

THE POSTED SPEED LIMIT IS: 75 MPH **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 5100 FT

LANE AND SHOULDER WIDTH:

	EXISTING (FEET)	AASHTO RECOMMENDED MINIMUM (FEET)
LANE WIDTH:	2-12	2-12
INSIDE SHOULDER WIDTH:	3 *	4
OUTSIDE SHOULDER WIDTH:	10	10

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

	MILEPOST		APPROACH GRADE	DEPARTURE GRADE	LENGTH OF CURVE	STOPPING SIGHT DISTANCE		EXISTING SPEED	POSTED SPEED
VPI STATION	BEGIN	END	(%)	(%)	(FT)	EXISTING (FT)	REQUIRED (FT)	(MPH)	(MPH)

SEE ATTACHMENT #1

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

	MILEPOST		SUPERELEVATION			METHOD 2 SPEED	POSTED SPEED	EXISTING DEGREE OF CURVE	MAXIMUM DEGREE OF CURVE	EXISTING HSO	EXISTING GRADE	HORIZONTAL SSD	
HPI STATION	BEGIN	END	RDG MAX (FT/FT)	EXISTING (FT/FT)	MINIMUM (FT/FT)	(MPH)	(MPH)			(FT)	(%)	EXISTING (FT)	REQUIRED (FT)

SEE ATTACHMENT #2

REMARKS: * DESIGN EXCEPTION REQUIRED

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAIN LINE WB ROADWAY
(CONTINUED)

GRADES:

EXISTING MAXIMUM GRADE IS: 1.9560%
AASHTO MAXIMUM GRADE IS: 3%

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 1.5%
AASHTO RANGE IS: 1.5 - 2.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM ALLOWABLE CLEARANCE
Leupp Road TI UP (#1317)	245.39	16' - 9"	16' - 6.5"	16' - 0"

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
Tucker Flat Bridge, WB (#1318)	248.99	81'	38.0	37.5'	Yes	No**	HS 20	HS 20

REMARKS: ** DESIGN EXCEPTION WILL NOT BE REQUESTED BECAUSE BRIDGE BARRIER WILL BE UPGRADED UNDER THIS PROJECT.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
CROSSROAD

PROJECT NUMBER: 40 CN 239 H6570 01 C
PROJECT LOCATION: DENNISON - COUNTY LINE
HIGHWAY SECTION: FLAGSTAFF - HOLBROCK HIGHWAY **MAINLINE MILEPOST:** 245.39
CROSSROAD: LEUPP ROAD TI
FUNCTIONAL CLASSIFICATION: RURAL COLLECTOR

TRAFFIC VOLUMES AND FACTORS:

CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
2007	2017	
		K= 10%
AADT (VPD)	AADT (VPD)	D= 51%
950	1,000	T= 9%

THE POSTED SPEED LIMIT IS: 30 MPH **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 5100 FT

LANE AND SHOULDER WIDTH:

	EXISTING (FEET)	AASHTO RECOMMENDED MINIMUM (FEET)
WIDTH OF TRAVELED WAY:	24	22
SHOULDER WIDTH:	5	5

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

	MILEPOST		APPROACH GRADE	DEPARTURE GRADE	LENGTH OF CURVE	STOPPING SIGHT DISTANCE EXISTING	STOPPING SIGHT DISTANCE REQUIRED	EXISTING SPEED	POSTED SPEED
VPI STATION	BEGIN	END	(%)	(%)	(FT)	(FT)	(FT)	(MPH)	(MPH)
2+01.43			-2.0000	2.7633	400	382	204	45	30
8+00.00			2.7633	-0.3645	300	495	204	54	30

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

	MILEPOST		SUPERELEVATION RDG MAX	SUPERELEVATION EXISTING	SUPERELEVATION MINIMUM	METHOD 2 SPEED	POSTED SPEED	EXISTING DEGREE OF CURVE	MAXIMUM DEGREE OF CURVE	EXISTING HSO	EXISTING GRADE	HORIZONTAL SSD EXISTING	HORIZONTAL SSD REQUIRED
HPI STATION	BEGIN	END	(FT/FT)	(FT/FT)	(FT/FT)	(MPH)	(MPH)	CURVE	CURVE	(FT)	(%)	(FT)	(FT)
3+99.21			0.08	*0.015	0.042	48	30	6^{o} 00' 00"	26^{o} 44'	NA			

REMARKS: *DESIGN EXCEPTION REQUIRED

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
CROSSROAD
(CONTINUED)

GRADES:

EXISTING MAXIMUM GRADE IS: 2.7633%
AASHTO MAXIMUM GRADE IS: 7%

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 1.5%
AASHTO RANGE IS: 1.5 - 2.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM ALLOWABLE CLEARANCE
			NONE	

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
Leupp TI UP (#1317)	245.39	238.0'	30'	22'	No *	Yes	HS 20	HS 15

REMARKS: *DESIGN EXCEPTION REQUIRED

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
RAMP A

PROJECT NUMBER: 40 CN 239 H6570 01 C
PROJECT LOCATION: DENNISON - COUNTY LINE
HIGHWAY SECTION: FLAGSTAFF - HOLBROCK HIGHWAY **MAINLINE MILEPOST:** 245.39
FUNCTIONAL CLASSIFICATION: DIAGONAL
DESCRIPTION: WB ENTRANCE RAMP

TRAFFIC VOLUMES AND FACTORS:

CURRENT YEAR	CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
2005	2007	2017	**K=** 12%
AADT (VPD)	**AADT (VPD)**	**AADT (VPD)**	**D=** NA
125	130	255	**T=** 2%

THE POSTED SPEED LIMIT IS: UNKNOWN, USE 55 MPH **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 5100 FT

RAMP WIDTH:

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITION (A OR B OR C): C

MINIMUM RADIUS (FT)	EXISTING TOTAL PAVED WIDTH (FT)	2-C WIDTH (FT)	2-C WIDTH EXCLUDING SHOULDERS (FT)	TRAVELED-WAY WIDTH EXISTING WIDTH (FT)	TRAVELED-WAY WIDTH MINIMUM 1-C (FT)	EXISTING LEFT SHOULDER (FT)	EXISTING RIGHT SHOULDER (FT)	EXISTING LEFT & RIGHT SHOULDER (FT)	AASHTO MAXIMUM SHOULDERS (FT)
572.96	22	20	12	14	14	2	6	8	12

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

VPI STATION	MILEPOST BEGIN	MILEPOST END	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FT)	STOPPING SIGHT DISTANCE EXISTING (FT)	STOPPING SIGHT DISTANCE REQUIRED (FT)	EXISTING SPEED (MPH)	POSTED SPEED (MPH)
5+00			0.7958	1.3720	200	+9999	504	+100	55
12+50			1.3720	2.7246	200	+9999	517	+100	55

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

HPI STATION	MILEPOST BEGIN	MILEPOST END	SUPERELEVATION RDG MAX (FT/FT)	SUPERELEVATION EXISTING (FT/FT)	SUPERELEVATION MINIMUM (FT/FT)	METHOD 2 SPEED (MPH)	POSTED SPEED (MPH)	EXISTING DEGREE OF CURVE	MAXIMUM DEGREE OF CURVE	EXISTING HSO (FT)	EXISTING GRADE (%)	HORIZONTAL SSD EXISTING (FT)	HORIZONTAL SSD REQUIRED (FT)
10+41.78			0.08	0.043	0.222 **	41	55	10° 00' 00" **	5° 58'	NA			
3+12.34			0.08	0.076	***	54	55	6° 00' 00" *	5° 58'	NA			

REMARKS: * DESIGN EXCEPTION REQUIRED
** DESIGN EXCEPTION NOT REQUESTED BECAUSE TRAFFIC IS APPROACHING A STOP CONDITION
*** NOT CALCULATED BECAUSE EXISTING DEGREE OF CURVE EXCEEDS MAXIMUM DEGREE OR CURVE.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
RAMP A
(CONTINUED)

GRADES:

EXISTING MAXIMUM ASCENDING	EXISTING MAXIMUM DESCENDING	AASHTO MAXIMUM ASCENDING	AASHTO MAXIMUM DESCENDING
2.7146%	NA	8%	8%

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 1.5%

AASHTO RANGE IS: 1.5 - 2.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM ALLOWABLE CLEARANCE
			NONE	

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
					NONE			

REMARKS:

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
RAMP B

PROJECT NUMBER: 40 CN 239 H6570 01 C
PROJECT LOCATION: DENNISON - COUNTY LINE
HIGHWAY SECTION: FLAGSTAFF - HOLBROCK HIGHWAY **MAINLINE MILEPOST:** 245.39
FUNCTIONAL CLASSIFICATION: DIAGONAL
DESCRIPTION: EB EXIT RAMP

TRAFFIC VOLUMES AND FACTORS:

CURRENT YEAR	CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
1990	1993	2003	K= 12%
AADT (VPD)	AADT (VPD)	AADT (VPD)	D= NA
240	390	520	T= 2%

THE POSTED SPEED LIMIT IS: UNKNOWN, USE 55 MPH **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 5100 FT

RAMP WIDTH: **CASE (1 OR 2 OR 3):** 2
TRAFFIC CONDITION (A OR B OR C): C

EXISTING MINIMUM RADIUS (FT)	EXISTING TOTAL PAVED WIDTH (FT)	2-C WIDTH (FT)	2-C EXCLUDING SHOULDERS (FT)	TRAVELED-WAY WIDTH EXISTING WIDTH (FT)	TRAVELED-WAY WIDTH MINIMUM 1-C (FT)	EXISTING LEFT SHOULDER (FT)	EXISTING RIGHT SHOULDER (FT)	EXISTING LEFT & RIGHT SHOULDER (FT)	AASHTO MAXIMUM SHOULDERS (FT)
572.96	22	20	12	14	14	2	6	8	12

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

VPI STATION	MILEPOST BEGIN	MILEPOST END	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FT)	STOPPING SIGHT DISTANCE EXISTING (FT)	STOPPING SIGHT DISTANCE REQUIRED (FT)	EXISTING SPEED (MPH)	POSTED SPEED (MPH)
2+00.00			-1.5005	0.1373	200	+9999	505	+100	55
13+00.00			0.1373	1.1300	200	+9999	502	+100	55

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

HPI STATION	MILEPOST BEGIN	MILEPOST END	SUPERELEVATION RDG MAX (FT/FT)	SUPERELEVATION EXISTING (FT/FT)	SUPERELEVATION MINIMUM (FT/FT)	METHOD 2 SPEED (MPH)	POSTED SPEED (MPH)	EXISTING DEGREE OF CURVE	MAXIMUM DEGREE OF CURVE	EXISTING HSO (FT)	EXISTING GRADE (%)	HORIZONTAL SSD EXISTING (FT)	HORIZONTAL SSD REQUIRED (FT)
4+50.00			0.08	0.076	***	54	55	6^{o} 00' 00" *	5^{o} 58'	NA			
12+54.03			0.08	0.043	0.222 **	41	55	10^{o} 00' 00" **	5^{o} 58'	NA			

REMARKS: *DESIGN EXCEPTION REQUIRED
** DESIGN EXCEPTION NOT REQUESTED BECAUSE THIS IS THE ENTRANCE TERMINI FOR THE CROSSROAD RAMP ENTRANCE
*** NOT CALCULATED BECAUSE EXISTING DEGREE OF CURVE EXCEEDS MAXIMUM DEGREE OR CURVE.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
RAMP B
(CONTINUED)

GRADES:

EXISTING MAXIMUM ASCENDING	EXISTING MAXIMUM DESCENDING	AASHTO MAXIMUM ASCENDING	AASHTO MAXIMUM DESCENDING
1.1300%	-1.5005%	8%	8%

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 1.5%
AASHTO RANGE IS: 1.5 - 2.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM ALLOWABLE CLEARANCE
			NONE	

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
					NONE			

REMARKS:

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
RAMP C

PROJECT NUMBER: 40 CN 239 H6570 01 C
PROJECT LOCATION: DENNISON - COUNTY LINE
HIGHWAY SECTION: FLAGSTAFF - HOLBROCK HIGHWAY **MAINLINE MILEPOST:** 245.39
FUNCTIONAL CLASSIFICATION: DIAGONAL
DESCRIPTION: WB EXIT RAMP

TRAFFIC VOLUMES AND FACTORS:

CURRENT YEAR	CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
1990	1993	2003	**K=** 12%
AADT (VPD)	**AADT (VPD)**	**AADT (VPD)**	**D=** NA
240	390	520	**T=** 2%

THE POSTED SPEED LIMIT IS: UNKNOWN, USE 55 MPH **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 5100 FT

RAMP WIDTH:

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITION (A OR B OR C): C

MINIMUM RADIUS (FT)	TOTAL PAVED WIDTH (FT)	2-C WIDTH (FT)	2-C WIDTH EXCLUDING SHOULDERS (FT)	TRAVELED-WAY WIDTH EXISTING WIDTH (FT)	TRAVELED-WAY WIDTH MINIMUM 1-C (FT)	EXISTING LEFT SHOULDER (FT)	EXISTING RIGHT SHOULDER (FT)	EXISTING LEFT & RIGHT SHOULDER (FT)	AASHTO MAXIMUM SHOULDERS (FT)
TANGENT	22	20	12	14	14	2	6	8	12

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

VPI STATION	MILEPOST BEGIN	MILEPOST END	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FT)	STOPPING SIGHT DISTANCE EXISTING (FT)	STOPPING SIGHT DISTANCE REQUIRED (FT)	EXISTING SPEED (MPH)	POSTED SPEED (MPH)
14+00.00			-1.0850	3.9600	400	*365	529	44	55
10+00.00			3.9600	1.4976	200	538	529	56	55

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

HPI STATION	MILEPOST BEGIN	MILEPOST END	SUPERELEVATION RDG MAX (FT/FT)	SUPERELEVATION EXISTING (FT/FT)	SUPERELEVATION MINIMUM (FT/FT)	METHOD 2 SPEED (MPH)	POSTED SPEED (MPH)	EXISTING DEGREE OF CURVE	MAXIMUM DEGREE OF CURVE	EXISTING HSO (FT)	EXISTING GRADE (%)	HORIZONTAL SSD EXISTING (FT)	HORIZONTAL SSD REQUIRED (FT)
							NONE (TANGENT)						

REMARKS: *DESIGN EXCEPTION REQUIRED

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
RAMP C
(CONTINUED)

GRADES:

EXISTING MAXIMUM ASCENDING	EXISTING MAXIMUM DESCENDING	AASHTO MAXIMUM ASCENDING	AASHTO MAXIMUM DESCENDING
3.9600%	-1.0850%	8%	8%

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 1.5%
AASHTO RANGE IS: 1.5 - 2.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM ALLOWABLE CLEARANCE
			NONE	

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
					NONE			

REMARKS:

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
RAMP D

PROJECT NUMBER: 40 CN 239 H6570 01 C
PROJECT LOCATION: DENNISON - COUNTY LINE
HIGHWAY SECTION: FLAGSTAFF - HOLBROCK HIGHWAY **MAINLINE MILEPOST:** 245.39
FUNCTIONAL CLASSIFICATION: DIAGONAL
DESCRIPTION: EB ENTRANCE RAMP

TRAFFIC VOLUMES AND FACTORS:

CURRENT YEAR	CONSTRUCTION YEAR	DESIGN YEAR	TRAFFIC FACTORS
1990	1993	2003	**K=** 12%
AADT (VPD)	**AADT (VPD)**	**AADT (VPD)**	**D=** NA
95	105	245	**T=** 2%

THE POSTED SPEED LIMIT IS: UNKNOWN, USE 55 MPH **TERRAIN IS:** LEVEL **AVERAGE ELEVATION IS:** 5100 FT

RAMP WIDTH: **CASE (1 OR 2 OR 3):** 2
TRAFFIC CONDITION (A OR B OR C): B

EXISTING MINIMUM RADIUS (FT)	EXISTING TOTAL PAVED WIDTH (FT)	2-B WIDTH (FT)	2-B EXCLUDING SHOULDERS (FT)	TRAVELED-WAY WIDTH EXISTING WIDTH (FT)	TRAVELED-WAY WIDTH MINIMUM 1-C (FT)	EXISTING LEFT SHOULDER (FT)	EXISTING RIGHT SHOULDER (FT)	EXISTING LEFT & RIGHT SHOULDER (FT)	AASHTO MAXIMUM SHOULDERS (FT)
2864.79	22	18	10	14	14	2	6	8	12

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

VPI STATION	MILEPOST BEGIN	MILEPOST END	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FT)	STOPPING SIGHT DISTANCE EXISTING (FT)	STOPPING SIGHT DISTANCE REQUIRED (FT)	EXISTING SPEED (MPH)	POSTED SPEED (MPH)
1+00.00			-1.5000	-5.2180	100	**340	543	41	55
6+00.00			-5.2180	-0.9990	400	*423	543	47	55

HORIZONTAL ALIGNMENT AND STOPPING SIGHT DISTANCE:

HPI STATION	MILEPOST BEGIN	MILEPOST END	SUPERELEVATION RDG MAX (FT/FT)	SUPERELEVATION EXISTING (FT/FT)	SUPERELEVATION MINIMUM (FT/FT)	METHOD 2 SPEED (MPH)	POSTED SPEED (MPH)	EXISTING DEGREE OF CURVE	MAXIMUM DEGREE OF CURVE	EXISTING HSO (FT)	EXISTING GRADE (%)	HORIZONTAL SSD EXISTING (FT)	HORIZONTAL SSD REQUIRED (FT)
6+77.20			0.08	*0.015	0.045	70	55	2° 00' 00"	5° 58' 00"	NA			

REMARKS: *DESIGN EXCEPTION REQUIRED
** DESIGN EXCEPTION NOT REQUEST BECAUSE THIS IS THE ENTRANCE TERMINI FOR THE THE CROSSROAD RAMP ENTRANCE

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
RAMP D
(CONTINUED)

GRADES:

EXISTING MAXIMUM ASCENDING	EXISTING MAXIMUM DESCENDING	AASHTO MAXIMUM ASCENDING	AASHTO MAXIMUM DESCENDING
NA	-5.2180%	8%	8%

CROSS SLOPE:

EXISTING CROSS SLOPE IS: 1.5%
AASHTO RANGE IS: 1.5 - 2.0%

VERTICAL CLEARANCE:

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POST CONSTRUCTION CLEARANCE	MINIMUM ALLOWABLE CLEARANCE
			NONE	

STRUCTURES:

STRUCTURE	MILEPOST	EXISTING BRIDGE LENGTH	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE BARRIER GEOMETRY ADEQUATE	BRIDGE BARRIER STRUCTURAL ADEQUATE	EXISTING STRUCTURE CAPACITY	RECOMMENDED STRUCTURE CAPACITY
					NONE			

REMARKS:

Attachment 1 - Vertical Curve Inventory

Project Name: DENNISON - COUNTY LINE (EB VERTICAL CURVES)
Project No: 40 CN 239 H6570 01C
Roadway Type: Divided Roadway (Uni-directional)

VPI Station (ft)	Milepost		Grade (%)		Curve	Curve	Stopping Sight Distance (ft)		Speed (mph)	
	Begin	End	Approach	Departure	Length (ft)	Type	Existing	Required	Existing	Posted
2282+00.00			-0.6490	0.7290	1000.00	Sag	+9999	825	+100	75
2298+50.00			0.7290	-0.4300	2200.00	Crest	2024	821	+100	75
2323+00.00			-0.4300	0.2610	1600.00	Sag	+9999	821	+100	75
2365+50.00			0.2610	-0.2200	1200.00	Crest	2843	818	+100	75
2398+50.00			-0.2200	0.0000	300.00	Sag	+9999	818	+100	75
2415+00.00			0.0000	0.7050	800.00	Sag	+9999	815	+100	75
2427+00.00			0.7050	1.7500	800.00	Sag	+9999	804	+100	75
2459+00.00			1.7500	0.2000	3000.00	Crest	2044	812	+100	75
2484+00.00			0.2000	-0.1000	800.00	Crest	3997	816	+100	75
2410+00.00			-0.1000	-1.3020	2200.00	Crest	1987	836	+100	75
2535+00.00			-1.3020	-0.9400	800.00	Sag	+9999	836	+100	75
2593+75.00			-0.9400	-0.7700	GB	GB	GB	GB	GB	75
2653+35.00			-0.7700	2.3166	1200.00	Sag	1535	827	+100	75
2681+50.00			2.3166	-1.8800	3200.00	Crest	1283	845	96	75
2702+50.00			-1.8800	-0.6200	900.00	Sag	+9999	845	+100	75
2731+00.00			-0.6200	0.0000	800.00	Sag	+9999	824	+100	75
2759+93.00			0.0000	0.9600	1000.00	Sag	+9999	815	+100	75
2810+00.00			0.9600	0.6250	800.00	Crest	3621	805	+100	75

Meaning Of Symbols:
GB = Grade Break - Stopping Sight Distance and Speed not calculated
Note:
Input grade with direction of traffic for one-way traffic

Attachment 1 - Vertical Curve Inventory

Project Name: DENNISON - COUNTY LINE (WB MAINLINE VERTICAL CURVES)
Project No: 40 CN 239 H6570 01C
Roadway Type: Divided Roadway (Uni-directional)

VPI Station (ft)	Milepost		Grade (%)		Curve	Curve	Stopping Sight Distance (ft)		Speed (mph)	
	Begin	End	Approach	Departure	Length (ft)	Type	Existing	Required	Existing	Posted
2812+00.00			-1.9560	0.2597	800.00	Sag	2333	847	+100	75
2760+00.00			0.2597	-0.3125	800.00	Crest	2286	820	+100	75
2729+00.00			-0.3125	0.1600	800.00	Sag	+9999	820	+100	75
2703+00.00			0.1600	-0.2351	800.00	Crest	3131	818	+100	75
2682+00.00			-0.2351	1.7620	1800.00	Sag	8083	818	+100	75
2653+00.00			1.7620	-0.0506	3000.00	Crest	1890	815	+100	75
2600+00.00			-0.0506	-1.2806	1200.00	Crest	1477	835	+100	75
2582+00.00			-1.2806	-1.1300	800.00	Sag	+9999	835	+100	75
2552+00.00			-1.1300	-0.9013	800.00	Sag	+9999	833	+100	75
2529+00.00			-0.9013	-1.0556	800.00	Crest	7393	832	+100	75
2511+00.00			-1.0556	-0.7272	800.00	Sag	+9999	832	+100	75
2462+00.00			-0.7272	2.5260	800.00	Sag	999	826	84	75
2418+00.00	246.99	246.72	2.5260	-1.7571	1400.00	Crest	* 840	843	75	75
2375+00.00			-1.7571	-0.6230	800.00	Sag	+9999	843	+100	75
2315+00.00			-0.6230	-0.0387	800.00	Sag	+9999	825	+100	75
2299+00.00			-0.0387	0.9500	1000.00	Sag	+9999	815	+100	75
2274+50.00			0.9500	0.6007	800.00	Crest	3489	806	+100	75

Meaning Of Symbols:
* = Existing Stopping Sight Distance less than AASHTO required value
Note:
Input grade with direction of traffic for one-way traffic

Attachment 2 - Horizontal Curve Inventory

Project Name: DENNISON - COUNTY LINE (EB MAINLINE HORIZONTAL CURVES)
Project No: 40 CN 239 H6570 01 C

HPI Station	Milepost		Superelevation (ft/ft)			Degree Of Curve		Speed (mph)		HSO	Grade	Horizontal SSD (ft)	
(ft)	Begin	End	Existing	AASHTO Min	RDG Max	Existing	AASHTO Max	Method 2	Posted	(ft)	(%)	Existing	Required
2312+09.72	239.96	241.38	*0.015	0.065	0.08	1°-45'-00"	2°-36'	73	75	NA			
2406+46.85			0.015	0.015	0.08	0°-10'-00"	2°-36'	>100	75	NA			
2512+07.13			0.015	0.015	0.08	0°-20'-00"	2°-36'	>100	75	NA			

Meaning Of Symbols:

* Requires a design exception

Note:
AASHTO Minimum superelevation derived from Method 5 to meet posted speed.
Roadway Engineering Design Guidelines (RDG) Maximum is based on elevation (See RDG Table 202.1A).
Input grade with respect to traffic for inside lane of curve; if both - & + grades within the curve, choose the negative grade; if all negative grades, choose the largest negative grade; if all positive grades, choose the smallest positive grade.
(See Help file under Help Topics/Approach Grade)
HSO = Horizontal Sightline Offset

Attachment 2 - Horizontal Curve Inventory

Project Name: DENNISON - COUNTY LINE (WB MAINLINE HORIZONTAL CURVES)
Project No: 40 CN 239 H6570 01 C

HPI Station	Milepost		Superelevation (ft/ft)			Degree Of Curve		Speed (mph)		HSO	Grade	Horizontal SSD (ft)	
(ft)	Begin	End	Existing	AASHTO Min	RDG Max	Existing	AASHTO Max	Method 2	Posted	(ft)	(%)	Existing	Required
2512+19.84			0.015	0.015	0.08	0°-20'-30"	2°-36'	>100	75	NA			
2406+42.87	241.38	239.96	*0.015	0.065	0.08	1°-45'-00"	2°-36'	73	75	NA			
2312+21.69			0.015	0.015	0.08	0°-10'-02"	2°-36'	>100	75	NA			

Meaning Of Symbols:

* Requires a design exception

Note:
AASHTO Minimum superelevation derived from Method 5 to meet posted speed.
Roadway Engineering Design Guidelines (RDG) Maximum is based on elevation (See RDG Table 202.1A).
Input grade with respect to traffic for inside lane of curve; if both - & + grades within the curve, choose the negative grade; if all negative grades, choose the largest negative grade; if all positive grades, choose the smallest positive grade.
(See Help file under Help Topics/Approach Grade)
HSO = Horizontal Sightline Offset

ROADWAY ENGINEERING GROUP
ROADWAY PREDESIGN SECTION

DATE: 2/21/2005

TO: **SUNIL ATHALYE**
BRIDGE GROUP
BRIDGE MANAGEMENT SECTION, MD 635E

FEDERAL REFERENCE NO: Not Assigned TRACS NO: 040 CN 239 H6570 01C
HIGHWAY: Flagstaff - Holbrook Highway
LOCATION: Dennison - County Line
MP LIMITS: 239.30 TO: 250.10
PROJECT DESCRIPTION: Pavement Preservation and Safety

FROM: **Aztec Engineering**
4561 E. McDowell Rd
Phoenix, AZ 85008

SUBJECT: **BRIDGE EVALUATION REQUEST**

Please evaluate the following structures per AASHTO guidelines:

ROUTE NO.	MILEPOST	STR. NO. AND NAME	BRIDGE LENGTH	BRIDGE ROADWAY WIDTH	BRIDGE RAIL / BARRIER TYPE	BRIDGE RAIL / BARRIER GEOM. OK	BRIDGE RAIL / BARRIER STRUC OK	AC OVERLAY THICKNESS (EXISTING)	AC OVERLAY REMOVE (MINIMUM)	AC OVERLAY REPLACE/NEW (MAXIMUM)	VERTICAL CLEARANCE (MINIMUM) NB/EB	VERTICAL CLEARANCE (MINIMUM) SB/WB	BRIDGE LOAD RATING	BRIDGE SUFFICIENCY RATING
I-40	**239.60**	**#1391** Meteor City TI OP EB	**102'-0"**	**38.2'**	**H-2-1**	**Yes**	**Yes**	**None**	**N/A**	**N/A**	**15.50'**	**15.60'**	**HS20+**	**XX**
		Comments:												
I-40	**239.60**	**#1392** Meteor City TI OP WB	**102'-0"**	**37.8'**	**H-2-1**	**Yes**	**Yes**	**None**	**N/A**	**N/A**	**15.70'**	**15.70'**	**HS20+**	**XX**
		Comments:												
I-40	**245.39**	**#1317** Leupp TI UP SR 99	**238'-0"**	**30'**	**H-2-1**	**No**	**Yes**	**None**	**N/A**	**N/A**	**17.0'**	**17.0'**	**HS20+**	**XX**
		Comments:												
I-40	**248.99**	**#336** Tucker Flat Br. EB	**80'-0"**	**39.6'**	**Thrie Bm** Retrofit	**Yes**	**Yes**	**2"**	**If Needed**	**If Removed**	**N/A**	**N/A**	**HS11.11**	**XX**
		Comments: This bridge is currently carrying normal traffic loads w/o significant distress, though it has been rated below HS20. The bridge rail has about 30'0" collision damage.												
I-40	**248.99**	**#1318** Tucker Flat Br. EB	**81'-0"**	**38'**	**Single Rail** w/ parapet	**Yes**	**No**	**1"**	**If Needed**	**If Removed**	**N/A**	**N/A**	**HS20+**	**XX**
		Comments:												

Evaluation Completed by: Mohammed Baki, P.E. Date: 3/1/2005