Chapter 23

Design Exceptions and Design Variations

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23.1 General

The Department's roadway design criteria and standards are contained in this volume and are usually within the desirable ranges established by AASHTO. The values given in this volume have been accepted by FHWA and govern the design process. When it becomes necessary to deviate from the Department's criteria, early documentation and approval are required. There are two approval processes used by designers: Design Exceptions and Design Variations. This chapter does not address the Utility Exception Procedure Topic No. 710-020-002 used by Utility Agencies/Owners to relieve their obligation to comply with a design requirement. When the Department's criteria are met, no Design Exception or Design Variation is required. However, when the Department's criteria are not met, a Design Exception, or Design Variation is required. This requirement applies to all entities affecting planning, design, construction and maintenance.

For projects using safety funds and developed to improve specific safety problems, only the elements identified under the scope of work for the safety improvement project are subject to these approval processes. The existing features, within the limits of the safety improvement project that do not meet design criteria do not require approval to remain (if the project does not create a nonconforming condition). The Safety Study shall identify all applicable Variations and/or Exceptions (Design or Utility) required based on the proposed scope. For these projects, all applicable Design Variations and/or Design Exceptions shall be approved prior to the beginning of design phase.

For drainage projects, only elements identified in the scope of services for the drainage project are subject to these approval processes. The existing features, within the limits of the drainage project that do not meet design criteria, do not require approval to remain (if the project does not create a nonconforming condition).

Maintenance Resurfacing, Ride Rehabilitation and Skid Hazard Projects do not require Design Exceptions or Design Variations other than for ADA curb ramp requirements. If compliance with ADA curb ramp requirements is determined to be technically infeasible, documentation as a Design Variation is required. Maintenance Resurfacing Projects can only be programmed on routes that meet the requirements identified in ***Chapter 28*** of the ***Work Program Instructions***.

For Landscape Only projects, intersection sight distance Design Variations may be processed by the Responsible Landscape Architect of Record. For design projects with landscaping, intersection sight distance Design Variations shall be processed by a Professional Engineer. In cases where intersection sight distance falls below stopping sight distance, a Design Exception for stopping sight distance shall be processed by the respective professional according to the above guidelines.

23.2 Identification

To allow time to research alternatives and begin the analysis and documentation activities, it is important that proper approval processes be identified as early in the Planning and Design as possible. This is preferably done during the PD&E process for major projects and the scope development process for minor projects. It is required that approval be obtained no later than the initial engineering phase.

Design Exceptions are required when the proposed design elements are below both the Department's governing criteria and AASHTO's new construction criteria for the 13 Controlling Design Elements.

The 13 Controlling Design Elements are:

1. Design Speed
2. Lane Widths
3. Shoulder Widths
4. Bridge Widths
5. Structural Capacity
6. Vertical Clearance
7. Grades
8. Cross Slope
9. Superelevation
10. Horizontal Alignment
11. Vertical Alignment
12. Stopping Sight Distance
13. Lateral Offset

Section 23.9 provides AASHTO's minimum requirements for the above elements.

Design Variations are required when proposed design elements are below the Department's criteria and where a Design Exception is not required.

Modification for Non-Conventional Projects:
See RFP for additional requirements.

23.3 Approval

All required approvals shall be obtained as described in this section. Approvals from multiple individuals may be required for certain issues. The Director of Design shall resolve any approval authority issues if conflicting objectives arise.

Approval is required from the Chief Engineer for the following:

- Design Exceptions for Design Speed on SIS facilities (following review by the State Transportation Planner).
- Design Variations for Design Speed on SIS facilities (following review by the State Transportation Planner).

Approval is required from the FHWA Division Administrator for the following:

- Design Exceptions on full FHWA oversight projects.
- Design Exceptions involving lateral offsets or vertical clearances for railroads not meeting the requirements of ***Rule 14-57 F.A.C.*** or the clearance criteria for the South Florida Rail Corridor (***Topic No. 000-725-003 - South Florida Rail Corridor Clearance Policy for 25 KV service***).
- All Design Exceptions to the 16-ft vertical clearance standard on rural Interstate routes or on a single Interstate route through urban areas: The District is responsible for completing an ***Interstate Vertical Clearance Exception Coordination*** form, (http://www.fhwa.dot.gov/design/090415.cfm) for Design Exceptions to vertical clearance requirements. The District will submit the form to the Surface Deployment and Distribution Command Transportation Engineering Agency (SDDCTEA) via e-mail for approval, copying the FHWA Florida Division. Allow for 10 working days after SDDCTEA receipt for action before requesting notification of disposition (via email or fax). A copy of the approval must be provided with the Design Exception. A request for coordination must take place before the District Design Engineer can recommend the Design Exception.

Approval is required from the District Design Engineer or Turnpike Design Engineer for the following:

- Design Exceptions
- Design Variations

Approval is required from the State Roadway Design Engineer for the following:

- Design Exceptions for elements other than Structural Capacity.
- Design Variations involving modifications to or elimination of required rumble strips.
- Design Variations involving the use of fencing around stormwater management facilities.
- Authority for approval of Design Exceptions and Design Variations on Florida Turnpike facilities has been delegated to the Turnpike Design Engineer by the State Roadway Design Engineer.

Approval is required from the State Structures Design Engineer for the following:

- Design Exceptions for Bridge Width, Structural Capacity of bridges, Lateral Offset and Vertical Clearance impacting Category 1 and 2 bridge structures.
- Design Variations for Bridge Width, Structural Capacity of bridges, Lateral Offset and Vertical Clearance impacting Category 2 structures.
- Design Variations for Structural Capacity due to deficient load ratings impacting both Category 1 and 2 bridge structures.
- Authority for approval of Design Exceptions and Design Variations for Bridge Width, Lateral Offset and Vertical Clearance on Florida Turnpike facilities has been delegated to the Turnpike Design Engineer by the State Structures Design Engineer.
- Design Variations for Traffic Railing impacting Category 1 and 2 bridge structures.

Approval is required from the District or Turnpike Structures Design Engineer for the following:

- Design Exceptions for Bridge Width, Structural Capacity of all structural items, Lateral Offset and Vertical Clearance impacting Category 1 and 2 bridge structures.
- Design Variations for Bridge Width, Structural Capacity of all structural items, Lateral Offset and Vertical Clearance impacting Category 1 bridge structures.

23.4 Justification for Central Office Approval

Sufficient detail and explanation must be given in order to build a strong case to those reviewing the request. The 13 Controlling Design Elements are considered safety related and the strongest case must be made to lower these requirements. At some point, this justification may be used to defend the Department's and/or the designer's design decisions. All deviations must be uniquely identified, located, and justified; no blanket approvals are given.

A strong case can be made if it can be shown that:

- The required criteria are not applicable to the site specific conditions.
- The project can be as safe by not following the criteria.
- The environmental or community needs prohibit meeting criteria.

Most often a case is made by showing the required criteria are impractical and the proposed design wisely balances all design impacts. The impacts usually compared are:

- Operational Impacts
- Impacts on Adjacent Section
- Level of Service
- Safety Impacts
- Long term effects
- Costs
- Cumulative Effects.

A case should not be made based solely on the basis that:

- The Department can save money.
- The Department can save time.
- The proposed design is similar to other designs.

23.5 Documentation for Central Office Approval

During the justification process supporting documentation will be generated which needs to accompany each submittal. This documentation includes, but is not limited to the following:

All Design Variations needing Central Office approvals and all Design Exceptions should include the following documentation:

a) ***Exhibit 23-A*** Submittal/Approval Letter Included (Cover Letter)

b) Summary description of included support documentation such as:

   1) Location map or description,

   2) Typical section,

   3) Aerial or Photo logs when they best illustrate the element issues,

   4) Crash History and analysis,

   5) Plan sheets in the area of the Design Exception/Design Variation elements,

   6) Profiles in the area of vertical alignment Design Exception/Design Variation elements,

   7) Tabulation of pole offsets for lateral offset Design Exception/Design Variation, and

   8) Any Applicable Signed and Sealed Engineering Support Documents.

c) Project description (general project information, typical section, begin/end milepost, county section number). Include Work Mix, To – From, Objectives, Obstacles and Schedule.

d) Description of the Design Exception/Design Variation element and applicable criteria (AASHTO and Department value or standard). Detailed explanation of why the criteria or standard cannot be complied with or is not applicable. Description of any proposed value for project and why it is appropriate.

e) Amount and character of traffic using the facility. Description of the anticipated impact on Operations, Adjacent Sections, Level Of Service, Safety, Long and Short Term Effects. (Is the Design Exception temporary or permanent?) Description of the anticipated Cumulative Effects.

f) A plan view or aerial photo of the Design Exception location, showing right of way lines, and property lines of adjacent property.

g) A photo of the area.

h) Typical section or cross-section of Design Exception location.

i) The milepost and station location of the Design Exception.

j) Any related work programmed or in future work plans.

k) The Project Schedule Management (PSM) Project Schedule Activities maintained by the Finance Management Office.

l) All mitigating efforts. An explanation of what if any associated existing or future limitations as a result of public or legal commitments. Description and explanation of any practical alternatives, the selected treatment and why.

m) Comments on the most recent 5-year crash history including all pertinent crash reports.

n) Description of the anticipated Cost (Social and to the Department - Benefit/Cost)

o) Summary Conclusions

For the specified conditions the following additional documentation is required:

p) For design speed on SIS, provide typical sections at mid blocks and at intersections.

q) For lane width, provide locations of alternative routes that meet criteria and a proposal for handling drainage, the proposed signing and pavement markings.

r) For shoulder width, provide a proposal for handling stalled vehicles and a proposal for handling drainage.

s) For bridge width, provide a plan view of the approaching roadways and existing bridge plans (these may be submitted electronically).

t) For a bridge with a design inventory load rating less than 1.0, a written evaluation and recommendation by the Office of Maintenance is required. Provide the load rating calculations for the affected structure.

u) For vertical clearance, provide locations of alternative routes that meet criteria.

v) For cross-slope, provide a proposal for handling drainage and details on how the cross slope impacts intersections.

w) For conditions that may adversely affect the roadway's capacity, provide the comments on compatibility of the design and operation with the adjacent sections. Effects on capacity (proposed criteria vs. AASHTO) using an acceptable capacity analysis procedure and calculate reduction for design year, level of service).

x) For superelevation, provide the side friction factors for the curve for each lane of different cross-slope at the PC of the curve, the point of maximum cross-slope, and the PT of the curve using the following equation.

$$f = \frac{V^2 - 15Re}{V^2e + 15R}$$

where
f = Side Friction Factor
V = Design Speed (mph)
R = Radius (feet)
e = Superelevation (ft/ft) at the station evaluated

y) For areas with crash histories or when a benefit to cost analysis is required, provide a time value analysis between the benefit to society quantified in dollars and the costs to society quantified in dollars over the life of the Design Exception. In general practice, the benefit to society is quantified by the reduction in crash cost foreseeable because of the proposed design and the cost due to the implementation of that change, such as construction and maintenance costs over the life of the project. The Discount (interest) rate to be utilized in benefit/cost analysis is 4%.

Both Historical (HCM) and Predictive (RSAP and HSM) methods are acceptable for performance of a benefit/cost analysis. These methods are outlined below:

1. Historical Crash Method (HCM)

This method can be used for sites with a crash history. It is basically the ratio (benefit/cost) of the estimated annual reduction in crash costs to the estimated annual increase in combined construction and maintenance costs. The annualized conversion will show whether the projected expenditure of funds for the crash benefit will exceed the direct cost for the improvement.

The HCM uses the ***Highway Safety Improvement Program Guideline (HSIPG)*** cost per crash by facility type in ***Table 23.5.1*** to estimate benefit to society, while the cost to society is estimated by the expected cost of right of way, construction, and maintenance.

Table 23.5.1 FDOT (HSIPG) Average Crash Costs by Facility Type

FACILITY TYPE	DIVIDED			UNDIVIDED		
	URBAN	SUBURBAN	RURAL	URBAN	SUBURBAN	RURAL
2-3 Lanes	$120,075	$182,466	$322,540	$135,384	$259,403	$503,562
4-5 Lanes	$131,636	$220,937	$454,956	$118,412	$228,170	$87,994
6+ Lanes	$127,800	$158,163	$639,743	n/a	n/a	n/a
Interstate	$161,634	n/a	$325,835	n/a	n/a	n/a
Turnpike	$151,512	n/a	$245,954	n/a	n/a	n/a

Roads Average Cost/Crash: **$165,424**

The above values were derived from 2009, 2010, 2011, 2012, and 2013 traffic crash and injury severity data for crashes on state roads in Florida using the formulation described in ***FHWA Technical Advisory "Motor Vehicle Accident Costs", T 7570.2, dated October 31, 1994*** and from a memorandum from USDOT, ***Revised Departmental Guidance: Treatment of the Value of Preventing Fatalities and Injuries in Preparing Economic Analyses, dated February 5, 2008*** updating the value of life saved to $5.8 million, updated from $5.8 million to $6 million on March 18, 2009, to $6.2 million on July 29, 2011, and to $9.1 million on February 28, 2013.

http://www.dot.gov/sites/dot.dev/files/docs/VSL%20Guidance%202013.pdf

When utilizing predictive methods for analysis, the accident severity level costs should be revised as follows:

Table 23.5.2 FDOT KABCO Crash Costs

Crash Severity	Comprehensive Crash Cost
Fatal (K)	$10,120,000
Severe Injury (A)	$574,080
Moderate Injury (B)	$155,480
Minor Injury (C)	$96,600
Property Damage Only (O)	$7,600

Source: Florida Department of Transportation Crash Analysis Reporting (C.A.R.) System

2. Roadside Safety Analysis Program (RSAP)

This method complements the Roadside Design Guide, dated June 2011. When hazards cannot be removed or relocated, designers need to determine if a safety device, such as a guardrail or a crash cushion, is warranted to protect motorists from the roadside obstacle. This method

can be used to perform a benefit/cost analysis comparing a potential safety treatment with the existing or baseline conditions (i.e., the do-nothing option) and/or alternative safety treatments. Based on the input of information available to the user (offsets, traffic, slopes, crash history, traffic accident severity levels, etc.), the program will offer results which can be used in comparing design alternatives.

3. Highway Safety Manual (HSM)

The AASHTO Highway Safety Manual provides analytical tools and techniques for quantifying the potential effects on crashes as a result of decisions made in planning, design, operations and maintenance. The new techniques and knowledge in the HSM reflect the evolution in safety analysis from descriptive (historical) methods to quantitative, predictive analyses. In the HSM, crash frequency is the fundamental basis for safety analysis and is used to reduce crashes and/or severities through the selection of alternative treatments.

The HSM includes Safety Performance Functions (SPFs) for many roadway segment and intersection applications. SPFs are equations used to estimate or predict the expected average crash frequency per year at a location as a function of traffic volume and roadway characteristics. The use of Highway Safety Manual (HSM) Safety Performance Functions (SPF) and Crash Modification Factors (CMF), with an Empirical Bayes (EB) adjustment, provides research based solutions for use in Benefit/Cost comparisons. Crash distributions presented in ***Table 23.5.3*** and KABCO costs as specified in ***Table 23.5.2*** should be used in determining benefits from an HSM analysis.

Table 23.5.3 HSM Crash Distribution for Florida (2009-2013)

		Rural Roadways			Urban & Suburban Arterials					Freeways			All
Facility Type		**2-lane (R2U)**	**4-lane Undivided (R4U)**	**4-lane Divided (R4D)**	**2-lane Undivided (U2U)**	**3-lane TWLTL (U32LT)**	**4-lane Undivided (U4U)**	**4-lane Divided (U4D)**	**5-lane TWLTL (U52LT)**	**Rural**	**Urban**	**Ramps**	**All Roadways & Ramps**
Fatal	**K**	0.033	0.027	0.033	0.009	N/A	0.005	0.009	N/A	0.020	0.007	0.005	0.008
Incapacitating Injury	**A**	0.131	0.121	0.123	0.069	N/A	0.040	0.060	N/A	0.092	0.048	0.044	0.055
Non-incapacitating Injury	**B**	0.202	0.210	0.212	0.173	N/A	0.134	0.167	N/A	0.169	0.140	0.133	0.150
Possible (or minor) Injury	**C**	0.200	0.228	0.202	0.224	N/A	0.213	0.244	N/A	0.187	0.228	0.233	0.230
Property Damage Only	**O**	0.434	0.414	0.430	0.525	N/A	0.607	0.520	N/A	0.532	0.577	0.585	0.556

Tools and spreadsheets for use with these analytical methods have been developed and are available on the following websites:

http://www.dot.state.fl.us/safety/11A-SafetyEngineering/TransSafEng/HighwaySafetyManual.shtm

http://www.dot.state.fl.us/rddesign/QA/Tools.shtm

23.6 Central Office Submittal and Approval

Submittals, when complete, shall contain 3 parts, and shall be compiled in the same order as addressed below.

1. Part 1 shall consist of a cover letter. The cover letter is the ***Plans Preparation Manual Volume 1***, ***Exhibit 23-A Submittal / Approval Letter*** for Design Exceptions.
2. Part 2 shall consist of the justification or report proper including all signed and sealed documents. Part 2 may contain or require more than one separately signed and sealed report. An example is a single submittal that includes a structural analysis and a roadway geometry analysis. There may also be documents or discussions that are not within the bounds of individually signed and sealed analysis.
3. Part 3 shall consist of any support documents to facilitate an understanding of Part 2. Note that Part 3 may include any supplementary documentation developed or added by the Central Office after the District submittal. This shall be considered a part of the submittal justification package and is provided only to assist the District in getting a favorable and timely review and approval. Any supplemental documents provided by the Central Office will be appended and shall not alter the Engineer of Record's or Professional of Record's (POR) analysis or design.

The report justifying and documenting a request is to be sealed by the Responsible Engineer in accordance with ***Chapter 19*** of this volume. The Responsible Engineer then attaches a Submittal/Approval Letter (***Exhibit 23–A***) to the Sealed Report and submits them to the District or Turnpike Design Engineer. The District or Turnpike Design Engineer then approves or denies the request and notifies the Responsible Engineer. When further approvals are required the District or Turnpike Design Engineer will forward the Submittal/Approval Letter and Sealed Report to the State Roadway Design Office.

The State Roadway Design Office will assign reference numbers to each request. The request will be reviewed then forwarded for approval to the Chief Engineer, the State Roadway Design Engineer, the State Structures Design Engineer, the Planning Office and/or FHWA as appropriate.

Each request will be reviewed on a case by case basis and approved on its merits. When approval is obtained the Roadway Design Office will e-mail the District or Turnpike Design Engineer the Central Office's disposition and return the signed Submittal/Approval Letter and Sealed Report. The Roadway Design Office will keep a copy filed under the assigned reference number. Additional copies will be provided upon request.

23.7 Central Office Denial and Resubmittal

When a request is denied, the State Roadway Design Office will notify the District or Turnpike Design Engineer of the Central Office's disposition.

Denied requests can be resubmitted when all deficiencies, noted in the denial notification, have been addressed. This may require only a new Submittal/Approval Letter if the Sealed Report does not need to be amended. However, if the Sealed Report requires revision, a new Sealed Report and attached Submittal/Approval Letter must be submitted.

The State Roadway Design Office will assign the resubmittal a tracking reference number. The resubmittal will be reviewed for completeness and forwarded for approval to the Chief Engineer, the State Roadway Design Engineer, the Structures Design Engineer, the Planning Office and/or FHWA as appropriate.

23.8 Design Variation Approval

Design Variations only require District approval unless identified as requiring Central Office approval in ***Section 23.3*** (see ***Exhibit 23-B***). Design Variations requiring Central Office approval from the Chief Engineer, State Roadway Design Engineer, and/or the State Structures Design Engineer (see ***Section 23.3***) follow the processes in ***Sections 23.4-23.7***. Design Variations approved solely in the District may be submitted as a formal Design Variation or as a signed and sealed Design Memorandum for approval by the District or Turnpike Enterprise Design Engineer.

A formal Design Variation is required for any design criteria impacting clear zones, sight distance, or Americans with Disabilities Act (ADA) compliance. The Responsible Engineer or Professional then attaches a Submittal Approval Letter (***Exhibit 23-A***) to the sealed report and submits them to the District or Turnpike Design Engineer. The District or Turnpike Design Engineer then approves or denies the request and notifies the Responsible Engineer or Professional.

At a minimum, all Design Variations must address the following items in the submittal:

1. Design criteria versus proposed criteria.
2. Reason the design criteria are not appropriate.
3. Justification for the proposed criteria.
4. Review and evaluation of the most recent certified 5 years of crash history for Central Office approved Design Variations, formal District Design Variations, and for any others as requested by the District.
5. Any background information which documents or justifies the request.

23.9 AASHTO Criteria for Controlling Design Elements

As an aid to the designer, the following tables may be used as a reference for determining when a Design Exception is required based on AASHTO criteria, but are in no way intended to replace Department design criteria. The page numbers referenced are to AASHTO's ***A Policy on Geometric Design of Highways and Streets 2004*** (unless otherwise noted) and are a starting point for researching project criteria. Please note that the criteria used for determining Design Exceptions on Interstate projects must be based on AASHTO's ***A Policy on Design Standards Interstate System***.

Criteria Tables Cross Reference

Table 23.9.1 AASHTO Design Speed (Minimum)

Type Facility	Other Factors	Design Speed (mph)	AASHTO
Freeways	Urban Rural	50 70	pg. 503
Urban Arterials	Major Other	30 30	pg. 72
Rural Arterials	Rolling terrain Level terrain	50 60	pg. 444
Urban Collectors		30	pg. 430
Rural Collectors	Level ADT < 400 ADT 400 - 2000 ADT > 2000 Rolling ADT < 400 ADT 400 - 2000 ADT > 2000	40 50 60 30 40 50	pg. 422, Exh. 6-2
CBD	Major or Minor	30	pg. 430
Ramps	Highway Design Speeds (mph) 30 35 40 45 50 55 60 65 70	 15 18 20 23 25 28 30 30 35	pg. 826
Loop Ramps	150 ft. radius	25	pg. 825
Connections	Direct Semi-Direct	40 30	pg. 825

Table 23.9.2 AASHTO Lane Widths (Minimum)

Type Facility	Lane Width (feet)	AASHTO
Freeways (including Auxiliary lanes)	12	pg. 504, 814, DSIS pg.3 (1)
Rural Arterials	11	pg. 448, Exh. 7-3
Urban Arterials	10	pg. 472
Urban Collectors	10	pg. 433
Rural Collectors	10	pg. 425, Exh. 6-5
Low Speed	10	pg. 312
Residential	9	pg. 312
Auxiliary (all but Freeway)	10	pp. 312, 433
Continuous TWLTL	10	pg. 312

1. DSIS = AASHTO's ***A Policy on Design Standards Interstate System*** (January 2005).

Table 23.9.3 AASHTO Shoulder Widths (Minimum)

Type Facility	Other Factors	Right (feet)	Median (feet)	AASHTO
Freeways	4 lanes	10	4	pg. 505
	≥ 6 lanes	10	10	pg. 505
Rural Arterial	ADT > 2000	8		pg. 448, Exh. 7-3
	ADT 400-2000	6		
	ADT < 400	4		
	Divided highway 4 lanes	8	4 paved	pg. 455
	Divided highway 6 lanes	8	8	pg. 456
Urban Arterial	Low Type	2		pg. 314
	High Type	10		pg. 314
Heavily Traveled	High Speed (≥ 50 mph)	10		pg. 314
Rural & Urban Collectors	ADT > 2000	8		pg. 425, Exh. 6-5
	ADT 1500-2000	6		
	ADT 400-1500	5		
	ADT < 400	2		

Table 23.9.4 AASHTO Bridge Widths (Minimum)

Type Facility	Other Factors	Bridge Widths	AASHTO
Freeways	New Bridges	Approach Roadway Width	pg. 506
Rural Arterials	New Bridges (Short)	Approach Roadway Width	pg. 447
	New Long Bridges (> 200 ft.)	Travel Lanes + 4 ft. each side	pg. 447
	Remain in Place	Travel Lanes + 2 ft. each side	pg. 447
Urban Arterials	Long (> 200 ft.), where shoulders or parking lanes are provided on the arterial	Travel Lanes + 4 ft. each side	pg. 481
	All new bridges	Curb to curb width of street	pg. 481

		Bridge Widths		
Type Facility	**Other Factors**	**New or Reconstruction**	**To Remain**	**AASHTO**
Rural and Urban Collectors	Under 400 ADT	Traveled Way + 2 ft. each side (1)	22 ft. (2)	pp. 426, 427
	ADT 400-1500	Traveled Way + 3 ft. each side (1)	22 ft. (2)	pp. 426, 427
	ADT 1500-2000	Traveled Way + 4 ft. each side(1),(3)	24 ft. (2)	pp. 426, 427
	ADT > 2000	Approach Roadway Width (1),(3)	28 ft. (2)	pp. 426, 427

1. If the approach roadway has paved shoulders, then the surfaced width shall be carried across the bridge.
2. Bridges longer than 100 ft. are to be analyzed individually.
3. For bridges > 100 ft. in length, the minimum bridge width of traveled way plus 3 ft. on each side is acceptable.

Table 23.9.5 AASHTO Structural Capacity (Minimum Loadings)

Type Facility	AASHTO
All Facilities	See ***AASHTO LRFD*** for minimum loadings.

Table 23.9.6 AASHTO Vertical Clearance (Minimum)

Type Facility		Vertical Clearance (feet) [2]	AASHTO
Freeways		16 [1],[4]	pp. 506, 507, 763, 764
Arterials:	Rural Urban	16 [1] 16 [1]	pp. 447, 763, 764 pp. 472, 763, 764
Arterials (Existing Structures):	Rural Urban	14 14	pp. 447, 763, 764 pp. 472, 763, 764
Other Highways		14	pp. 385, 507
Sign Trusses		17	pg. 507
Pedestrian Overpass		17	pg. 507
Tunnels:	Freeways Other Highways	16 14	pg. 355 pg. 355
Railroads		23 [3]	pg. 522

1. 14 feet allowed in highly developed urban areas if alternate route has 16 feet.
2. An allowance of 6 inches should be added to vertical clearance to accommodate future resurfacing.
3. Over High Speed Rail Systems: See ***Section 6.3.5*** of this volume and the latest version of ***American Railway Engineering and Maintenance-of-Way Association*** (***AREMA***) guidelines, or the design office of the high speed rail line of interest for specific guidelines and specifications. Over Electrified Railroad, the minimum vertical clearance shall be 24 feet 3 inches. (See ***Topic No. 000-725-003: South Florida Rail Corridor Clearance***.) Also see ***Section 6.3.5*** of this volume.
4. All Design Exceptions to the 16-ft vertical clearance standard on rural Interstate routes or on a single Interstate route through urban areas must be coordinated with Surface Deployment and Distribution Command Transportation Engineering Agency (SDDCTEA) as described in ***Section 23.3***.

Table 23.9.7 AASHTO Grades (Minimum and Maximum)

Maximum Grades

Type Facility	Type Terrain	Grades (%) For Design Speed (mph)									AASHTO
		30	35	40	45	50	55	60	65	70	
Freeway (1)	Level	---	---	---	---	4	4	3	3	3	pg. 506,
	Rolling	---	---	---	---	5	5	4	4	4	Exh. 8-1
Rural Arterial	Level	---	---	5	5	4	4	3	3	3	pg. 446,
	Rolling	---	---	6	6	5	5	4	4	4	Exh. 7-2
Urban Arterial:	Level	8	7	7	6	6	5	5	---	---	pg. 472,
	Rolling	9	8	8	7	7	6	6	---	---	Exh. 7-10
Rural Collector(2)	Level	7	7	7	7	6	6	5	---	---	pg. 423,
	Rolling	9	9	8	8	7	7	6	---	---	Exh. 6-4
Urban Collector(2)	Level	9	9	9	8	7	7	6	---	---	pg. 432,
	Rolling	11	10	10	9	8	8	7	---	---	Exh. 6-8

1. Grades one percent steeper than the values shown may be used for extreme cases in urban areas where development precludes the use of flatter grades and for one-way downgrades.
2. Short lengths of grade in rural and urban areas, such as grades less than 500 ft. in length, one-way downgrades, and grades on low-volume rural and urban collectors may be up to 2 percent steeper than the grades shown above.

Minimum Grades for Urban Curb & Gutter

Type Facility	Minimum %	AASHTO
Arterials	as required for adequate drainage	pg. 471
Collector Roads & Streets	0.30	pg. 431
Local Roads & Streets	0.20	pg. 391

Table 23.9.8 AASHTO Cross Slope (Minimum and Maximum)

Type Facility	Other Factors	Minimum	Maximum	AASHTO
Freeways	---	0.015	0.025 (1)	pg. 504
Arterials	Rural	0.015	0.02 (1)	pg. 446
	Urban	0.015	0.03	pg. 472
Divided Highways	---	0.015	0.02 (1)	pg. 455
Collectors	Rural	0.015	0.02 (1)	pg. 421
	Urban	0.015	0.03	pg. 431
Shoulders	Paved	0.02	0.06	pg. 316
	Gravel	0.04	0.06	pg. 316
	Turf	0.06(2)	0.08(2)	pg. 316

1. Values given are for up to two lanes in one direction. Additional outside lanes may have cross slopes of 0.03.
2. Shoulder cross slopes which meet FDOT criteria do not require a Design Exception.

Table 23.9.9 AASHTO Superelevation (Maximum)

Type Facility	Superelevation Rate	AASHTO
Highways (Rural)	0.12	pg. 144
Urban	0.06	pg. 145
Low Speed Urban w/severe constraints	None	pg. 145
Ramps and Turning Roadways at Intersections	0.10	pg. 639

Table 23.9.10 AASHTO Horizontal Alignment

Minimum Radius (feet) with Superelevation (page 147, Exh. 3-15)

Type Facility	Super-elevation e-max	Minimum Curve Radius (feet) for Design Speed (mph)											
		15	20	25	30	35	40	45	50	55	60	65	70
Rural Highways and High Speed Urban Streets	0.04	42	86	154	250	371	533	711	926	1190	1500	---	---
	0.06	39	81	144	231	340	485	643	833	1060	1330	1660	2040
	0.08	38	76	134	214	314	444	587	758	960	1200	1480	1810
	0.10	36	72	126	200	292	410	540	694	877	1090	1340	1630
	0.12	34	68	119	188	272	381	500	641	807	1000	1220	1480

Minimum Radius (feet) for Section with Normal Cross Slope (***2001 AASHTO***, page 168, Exh. 3-26)

Type Facility	Minimum Curve Radius (feet) for Design Speed (mph)											
	15	20	25	30	35	40	45	50	55	60	65	70
All	960	1700	2460	3350	4390	5570	6880	8350	9960	11720	13180	14730

Minimum Radius (feet) for Intersection Curves (***2001 AASHTO***, page 201, Exh. 3-43)

Design Speed (MPH)	10	15	20	25	30	35	40	45
Minimum Radius (feet)	25	50	90	150	230	310	430	540
Assumed Minimum Superelevation Rate	0.02	0.02	0.02	0.04	0.06	0.08	0.09	0.10

Minimum Passing Sight Distance (feet) (page 124, Exh. 3-7)

Design Speed (mph)	20	25	30	35	40	45	50	55	60	65	70
Passing Sight Distance	710	900	1090	1280	1470	1625	1835	1985	2135	2285	2480

Table 23.9.11 AASHTO Vertical Alignment

(Taken from page 272 Exh. 3-72, page 277 Exh. 3-75, and page 422 Exh. 6-2)

Design Speed (mph)	K Value (1) for Vertical Curves Rounded for Design	
	Crest	Sag
15	3	10
20	7	17
25	12	26
30	19	37
35	29	49
40	44	64
45	61	79
50	84	96
55	114	115
60	151	136
65	193	157
70	247	181

1. Rate of vertical curvature, K, is the length of curve per percent algebraic difference in the intersecting grades.

Table 23.9.12 AASHTO Stopping Sight Distance

(Taken from page 112, Exh. 3-1)

Design Speed (mph)	Stopping Sight Distance (feet) Computed for Design
15	80
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645
70	730

Table 23.9.13 AASHTO Lateral Offset (Minimum)

Feature	Clearance			AASHTO
Bridges	See ***Table 23.9.4***			---
Tunnels	2.5 ft. from edge of traffic lane			pg. 354, Exh. 4-17
Underpasses	2-lane:	Normal shoulder width (to edge of barrier) (1)		pg. 762, Exh. 10-6
	Divided Roadway:	Normal shoulder (outside or median) width (to edge of barrier) (1)		
Barrier Wall & Guardrail	Normal shoulder width			pg. 762, Exh. 10-6
Light Poles	Rural:	Outside clear zone (if non-breakaway)		pg. 291
	Urban:	1.5 ft. from face of curb		pg. 319
Trees greater than 4 inches in diameter measured 6 inches above the ground	Rural	Arterials:	Outside clear zone	pg. 399, 481
		Collectors ≤ 45 mph:	10 ft. from traveled way	pg. 427
		Collectors > 45 mph:	Outside clear zone	pg. 427
	Urban:		1.5 ft. from face of curb	pg. 399, 437, 481
	Freeways (Rural and Urban):		Outside clear zone	pg. 507
Sign supports	Outside clear zone (if non-breakaway)			pg. 294
Utility Poles	Rural:	Outside clear zone		pg. 294
	Urban:	1.5 ft. from face of curb		pp. 293, 319
Building Line	15 feet from elevated roadway (wall)			pg. 522
Signal Pole and Controller Cabinets	Rural:	As far from the roadway as practicable		pg. 4-13 (2)
	Urban:	1.5 ft. from face of curb		pg. 319

1. For metal guardrail, add deflection distance.
2. ***2011 AASHTO Roadside Design Guide***.

Exhibit 23-A Submittal/Approval Letter

To: _____ Date: _____
District or Turnpike Design Engineer

Financial Project ID: _____ New Const. ( ) RRR ( )
Federal Aid Number:_____
Project Name: _____
State Road Number: _____ Co./Sec./Sub. _____
Begin Project MP: _____ End Project MP: _____
Full Federal Oversight: Yes ( ) No ( )
Request for: Design Exception ( ), Design Variation ( )
Community Aesthetic Feature: Conceptual ( ), Final ( )
(For Design Exception or Design Variations Requiring Central Office Approval)
Re-submittal: Yes ( ) No ( ) Original Ref# _____ - ____ - _____

Requested for the following element(s):

( ) Design Speed	( ) Lane Widths	( ) Shoulder Widths	( ) Bridge Widths
( ) Structural Capacity	( ) Vertical Clearance	( ) Grades	( ) Cross Slope
( ) Superelevation	( ) Horizontal Alignment	( ) Vertical Alignment	( ) Stopping Sight Distance
( ) Lateral Offset	( ) Other _____		

1. **Include a brief statement here describing the project and the Design Exception, Design Variation or Community Aesthetic Feature requested.**

2. **Attach the Signed and Sealed Report including applicable documentation as per Section 23.5.**

Recommended by:

_____Date _____
Responsible Professional Engineer or Landscape Architect (Landscape-Only Projects)

Approvals:

_____Date _____
District or Turnpike Design Engineer

_____Date _____
District Structures Design Engineer

_____Date _____
State Roadway Design Engineer

_____Date _____
State Structures Design Engineer

_____Date _____
Chief Engineer

_____Date _____
FHWA Division Administrator

Exhibit 23-B Central Office Approvals- Design Exceptions and Design Variations

Design Element	State Roadway Design Engineer	State Structures Design Engineer	State Transportation Planner	Chief Engineer	FHWA Division Admin.*
	Approval	Approval	Review	Approval	
Design Speed Exception	X				
-FIHS/SIS	X		X	X	
Design Speed Variation			X	X	
-FIHS/SIS					
Lane Width Exception	X				
Shoulder Width Exception	X				
Bridge Width Exception	X	X			
Bridge Width Variation (Category 2 Structures)		X			
Structural Capacity of Bridge Exception		X			
Structural Capacity of Bridge Variation					
-Category 2 Structures		X			
-Deficient Load Ratings (Category 1 and 2 Structures)		X			
-Traffic Railing (Category 1 and 2 Structures)		X			
Vertical Clearance Exception	X				
-16' for rural Interstate routes or single urban Interstate route	X				X
-All Category 1 and 2 Structures	X	X			
Vertical Clearance Variation (Category 2 Structures)		X			
Grades Exception	X				
Cross Slope Exception	X				
Superelevation Exception	X				

Exhibit 23-B Central Office Approvals- Design Exceptions and Design Variations (continued)

Design Element	State Roadway Design Engineer	State Structures Design Engineer	State Transportation Planner	Chief Engineer	FHWA Division Admin.*
	Approval	Approval	Review	Approval	
Horizontal Alignment Exception	X				
Vertical Alignment Exception	X				
Stopping Sight Distance Exception	X				
Lateral Offset Exception	X				
-RR-South Fla Rail Corridor	X				
-Category 1 and 2 Structures	X	X			
Lateral Offset Variation (Category 2 Structure)		X			
Design Variation: Rumble strip requirements	X				
Design Variation: Crossovers on Limited Access Facilities	X				X
Design Variation: Patterned Pavement Technical Special Provisions	X				
Design Variation: Use of fencing around stormwater management facilities	X				
Roundabout Designs-All	X				
Colored Bike Lane Assessments (The first 3 years after installation)	X				
Design Variation: Community Structures Non-Interstate	X				
Design Variation: Community Structures Interstate	X				X
Lump Sum Contracts (Non-Typical)	X				

*Design Exceptions on full FHWA oversight projects

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