

CENTRAL FEDERAL LANDS HIGHWAY DIVISION HIGHWAY DESIGN STANDARDS

Project Number and Name: UT PFH 112-1(1) 4R Example Road

Location: North Fork Blue River Road MP 3.6 to 11.2. Located east of Dakota, UT between Van Gordon and Alameda off of State Route 199

Type of Project: New Construction Reconstruction RRR Other (describe)

Description of Work: Spot improvements: Grading, drainage, aggregate base, asphalt pavement, MSE walls, soil nail walls, and bridge construction

System:

<input type="checkbox"/> National Park Service <input checked="" type="checkbox"/> Forest Service <input type="checkbox"/> Bureau of Land Management <input type="checkbox"/> Bureau of Indian Affairs	<input type="checkbox"/> National Highway System (NHS) <input type="checkbox"/> Non NHS <input checked="" type="checkbox"/> Off system (county road) <input type="checkbox"/> Other (describe)
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Functional Classification: Rural collector

Owner Agency: Jefferson County

Terrain: Mountainous

Design Vehicle: MH

		ADT – MP 3.6 to 13.6			PERCENT TRUCKS	D
TRAFFIC	YEAR	AVERAGE	SEASONAL	DHV		
Current	2008	211		21	1	50
Design	2028	314				

Design Standards: AASHTO 2004 NPS State Other (describe)

GEOMETRIC AND BRIDGE CRITERIA – MP 3.6 to 13.6 (Spot Improvements)			
GEOMETRIC AND BRIDGE CRITERIA	STANDARD	AS DESIGNED	EXCEPTION
1. Design Speed	Minimum = 20 MPH Design Speed should equal or exceed Posted or Regulatory Speed of completed facility	35 MPH Posted or Regulatory = 35 MPH	No
2. Traveled Way Width	10 ft	11 ft	No
3. Shoulder Width	2 ft	1 ft	Yes - see (1) below
4. Crown	2%	2%	No
5. Horizontal Curvature	340 ft	110 ft	Yes - see (2) below
6. Superelevation	e(max) = 6% Δ = 0.62%	e(max) = 6% Δ = 0.98%	Yes - see (3) below
7. Grades	14%	8.2%	No
8. Vertical Curvature	K (crest) = 29 K (sag) = 49	K (crest) = 46 K (sag) = 31	K(crest) - No K (sag) - Yes - see (4) below

9. Stopping Sight Distance	250 ft	257 ft	No
10. Horizontal Clearance to Structure (not clear zone)	N/A	N/A	N/A
11. Vertical Clearance to Structure	N/A	N/A	N/A
12. Bridge Width	28 ft	32 ft	No
13. Bridge Loading	HL 93	HL 93	No

4R EXAMPLE

Descriptions of and reasons for exceptions to standards:

(1) Shoulder width

The lane width was increased from the standard of 10 ft to 11 ft to better accommodate off-tracking and eliminate the need for curve widening. The shoulder width was then reduced to 1 ft.

(2) Horizontal curvature

-Site C, Station 504+75 to 506+50, R=110 ft. Major alignment corrections were not included in the scope of this project. The design speed of a 110 ft radius curve is 20 MPH, so there is a 15 MPH reduction in speed on this curve (35 MPH project design speed - 20 MPH design speed for this curve). This is undesired, but necessary on this project due to environmental and cost constraints. To correct this curve, a retaining wall would have to be constructed exceeding 50 feet in height. The 110 ft radius curve matches existing and is necessary to tie into the existing roadway.

-Site C, 518+32 to 519+50, R = 205 ft. Major alignment corrections were not included in the scope of this project. The design speed of a 205 ft radius curve is 25 MPH, so there is a 10 MPH reduction in speed on this curve (35 MPH project design speed - 25 MPH design speed for this curve). This is undesired, but necessary on this project due to environmental and cost constraints. Steep terrain limits the amount of centerline shift. The 205 ft radius matches the existing alignment.

-Rock Creek Bridge: 211+96 to 213+40, R=250 ft. The 250 ft radius curve matches existing and is necessary to tie into the existing roadway. A larger radius curve would extend the length of the project and increase embankment and excavation limits. The 250 ft radius curve is used to limit project length and keep environmental impacts to a minimum.

(3) Maximum relative gradient

There is insufficient superelevation runoff on Site A at Station 111+05.70 and Site C at Station 518+20. Curve radii as large as possible were used to minimize short tangents and to match the reversing horizontal curves in the existing alignment. This keeps the roadway close to the existing alignment and minimizes impacts outside of the existing roadway bench.

(4) Sag vertical curvature

-Rock Creek Bridge: 210+30 to 211+95, symmetrical vertical curve, L=165 ft, k(sag)=31. The lower K value of the sag vertical curve is necessary to match the bridge grade with the driveways accessing private property. The bridge grade was set based on keeping the bottom edge of the girders above the water surface elevation for Q50. The lower k value provides stopping sight distance on the bridge to meet an inferred design speed of 25 MPH.

-Boulder Creek Bridge: 409+27 to 411+67, asymmetrical vertical curve, L1=115 ft, k(sag)=40; L2=125 ft, k(sag)=47. The bridge grade was set based on keeping the bottom edge of the girders above the water surface elevation for Q100. The lower k value is necessary to keep vertical curves off the bridge and to maintain access to driveways.

Analysis of risks and design features proposed to mitigate exceptions:

(1) Shoulder width

The total roadway width (11 ft travel way + 1 ft shoulder) meets the overall standard (10 ft travel way + 2 ft shoulder). The existing roadway is widened approximately 3 ft to a consistent width. Delineation is improved with new pavement markings.

(2) Horizontal curvature

-Site C, 504+75 to 506+50, R=110 ft. The 110 ft curve radius matches existing alignment. An advance curve warning with speed advisory sign will be added.

-Site C, 518+32 to 519+50, R = 205 ft. An advance curve warning with speed advisory sign will be added. Sight distance will be improved around both the inside and outside of this curve.

-Rock Creek Bridge: 211+96 to 213+40, R=250 ft. The 250 ft radius curve is consistent with the existing alignment geometry for the route. Curve widening will be applied to the inside of the curve at the bridge. An advance curve warning with speed advisory sign will be added.

(3) Maximum relative gradient

An advance curve warning with speed advisory sign will be added to reduce speeds at Sites A and C.

(4) Sag vertical curvature:

-Rock Creek Bridge and Boulder Creek Bridge: Curve widening will be added to both bridges, allowing vehicles more room to maneuver and improving sight distance. Very little traffic travels on the roadway at night.

No crash data was available; neither Jefferson County nor the California State Patrol had any documented crash history along the route. No evidence of undocumented crashes (e.g. skid marks or broken vehicle mirrors) was noted in the field.

The above exceptions are consistent with features of the existing corridor outside the project limits. The proposed roadway is expected to perform at an acceptable level of substantive safety. Risks associated with these design exceptions were determined to be low considering the low traffic volumes, the low vehicle speeds, the high percentage of local traffic, and consistency of the existing route corridor.

FLH SUPPLEMENTAL STANDARDS – MP 3.6 to 13.6			
DESIGN CRITERIA	STANDARD	AS DESIGNED	EXCEPTION
1. Clear Zone	7-10 ft	4-10 ft	Yes - see (1) below
2. Barrier Crashworthiness	NCHRP 350 TL-2	NCHRP 350 TL-2 and TL-3	No
3. Design Flood	FLH Project Development and Design Manual Exhibit 7.1-A		Yes - see (2) below
4. Pavement Design Service Life	25-year	25-year	No

Descriptions of and reasons for exceptions to FLH standards:

(1) Clear Zone

The AASHTO 'Roadside Design Guide' recommends a clear zone width of 7-10 ft. Project constraints, including steep terrain, limited right of way, and sensitive environment, limit clear zone widths to edge of subgrade (typically 4 ft) and to bottom of ditch (typically 10 ft). Additional clear zone widths are obtained when available.

Guardrail is provided at all bridge abutments and at embankment retaining wall locations. A tangent guardrail terminal section is used when width is not available to use a flared guardrail terminal section at Station 404+20 left. Bridge railing will meet TL-3 criteria. Transition railing will meet TL-2 criteria. By using a lower speed crash tested railing, the length of railing can be reduced, therefore reducing impacts to private driveways and side roads adjacent to Rock and Boulder Creek Bridges. All other guardrail along the route (e.g. along the MSE walls) will meet TL-3.

(2) Rock Creek Bridge. The FLH Standard Practice for hydraulic design of bridges is to use a 50-year design flood for capacity design and a 100-year design flood for stability design. For this bridge the 50-year design flood for the South Fork of the Smith River was used in the design instead of the design floods for Rock Creek. The 50-yr event in the South Fork of the Smith River controls the water surface elevation at the bridge, regardless of the flow in Rock Creek. When water surface elevations are controlled by high tailwater in the Smith River, the velocities through the bridge during high flows are relatively low (5-6 ft/s). The low chord elevation of the proposed bridge design is more than 3 ft below the 50-yr water surface

elevation of 403.8 ft. The proposed bridge is 4 ft higher than existing. Since there are several private driveways and sensitive wetlands adjacent to the bridge, the elevation of Rock Creek Bridge is constrained by right of way, cost, and environmental impacts.

Analysis of risks and design features proposed to mitigate exceptions:

(1) Clear Zone

The as-designed clear zone width of 4-10 ft is as wide as practical, considering the steep mountainous terrain, limited right of way, and sensitive riparian area along the route. These clear zone widths are consistent along the entire roadway corridor. Since documentable site-specific safety problems do not exist, it is unlikely that any roadside improvement would provide substantial safety benefits.

(2) Rock Creek Bridge

The durability, operational, and maintenance risks are considered to be minimal. Capacity and stability risks are considered to be low: during high flows debris may temporarily get caught by the bridge, but should pass once the flows recede. There is minimal risk for property loss and hazard to life during the service life of the bridge.

APPROVAL:

- There are no exceptions to applicable standards.
- The exceptions to the design standards as noted and their related risks have been reviewed with the appropriate agencies and parties and are considered acceptable for this project.

PREPARED BY:

Lead Designer Signature
Lead Designer

April 27, 2007
Date

APPROVAL IS RECOMMENDED:

Highway Design Manager Signature
Highway Design Manager

April 27, 2007
Date

Project Manager Signature
Project Manager

April 27, 2007
Date

Project Management Engineer Signature
Project Management Engineer

April 27, 2007
Date

PM Engineer Comments: Discussed design exceptions at Management Board (MB) meeting on March 12, 2007. MB recommendations have been incorporated into HDS form.

I CONCUR WITH THE ABOVE RECOMMENDATIONS:

USFS Signature
Four Rivers National Forest, USFS

April 30, 2007
Date

County Signature
Jefferson County

April 30, 2007
Date

THE ABOVE RECOMMENDATIONS ARE APPROVED:

Project Delivery Director Signature
Director, Project Delivery

September 18, 2008
Date

After all signatures have been obtained:

cc: Ed Hammontree, Project Management Engineer
T. Samuel Holder, Project Development Engineer
Bob Welch, Technical Services Engineer
Mark Taylor, FLH Design Discipline Leader
Christine Black, Senior Highway Designer
Ed Demming, Safety Engineer
 , Project Manager
 , Highway Design Manager
 , Lead Designer

Name, Four Rivers National Forest, USFS
Name, Jefferson County

4R EXAMPLE

CENTRAL FEDERAL LANDS HIGHWAY DIVISION HIGHWAY DESIGN STANDARDS

Project Number and Name: CO PRA BICA 123(1) 3R Example Road

Location: Eleven miles east of Cortez, CO. South of main entrance station.

Type of Project: New Construction Reconstruction RRR Other (describe)

Description of Work: This project will provide resurfacing, restoration, and rehabilitation to the 10.5 miles of the main entrance road from the Park Entrance to Park Point. Pulverizing and a 3.0" surfacing will be used to improve the surface and ride of the existing roadway.

System:

<input checked="" type="checkbox"/> National Park Service <input type="checkbox"/> Forest Service <input type="checkbox"/> Bureau of Land Management <input type="checkbox"/> Bureau of Indian Affairs	<input type="checkbox"/> National Highway System (NHS) <input checked="" type="checkbox"/> Non NHS <input type="checkbox"/> Off system (county road) <input type="checkbox"/> Other (describe)
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Functional Classification: NPS Class 1: Principal Park Road/Rural Parkway

Owner Agency: National Park Service

Terrain: Mountainous

Design Vehicle: SU

		ADT – 1+00 to 556+22			PERCENT TRUCKS	D
TRAFFIC	YEAR	AVERAGE	SEASONAL	DHV		
Current	2008	1600		20	1	50
Design	2028	1953				

Design Standards: AASHTO 2004 NPS State Other (describe)

GEOMETRIC AND BRIDGE CRITERIA – 1+00 to 216+54 and 335+75 to 556+22			
GEOMETRIC AND BRIDGE CRITERIA	STANDARD	AS DESIGNED	EXCEPTION
1. Design Speed	Minimum = 20 MPH Design Speed should equal or exceed Posted or Regulatory Speed of completed facility	35 MPH Posted or Regulatory = 35 MPH	No
2. Traveled Way Width	11 ft	11 ft	No
3. Shoulder Width	3 ft	1 ft	Yes - See (1) below
4. Crown	1% -3%	~2%	No
5. Horizontal Curvature	340 ft	180 ft	Yes - See (2) below
6. Superelevation	e(max) = 6% Δ = 0.62%	e(max) = ~6% Δ = *	*See (3) below
7. Grades	13%	<13%	No
8. Vertical Curvature	K (crest) = 40 K (sag) = 50	K (crest) = * K (sag) = *	*See (4) below

9. Stopping Sight Distance	225 ft	>225 ft	No
10. Horizontal Clearance to Structure (not clear zone)	N/A	N/A	N/A
11. Vertical Clearance to Structure	N/A	N/A	N/A
12. Bridge Width	28 ft	32 ft	No
13. Bridge Loading	HL 93	HL 93	No

GEOMETRIC AND BRIDGE CRITERIA – 216+54 to 335+75			
GEOMETRIC AND BRIDGE CRITERIA	STANDARD	AS DESIGNED	EXCEPTION
1. Design Speed	Minimum = 20 MPH Posted or Regulatory = 45 MPH	45 MPH	No
2. Traveled Way Width	11 ft	11 ft	No
3. Shoulder Width	3 ft	1 ft	Yes - See (1) below
4. Crown	1% -3%	~2%	No
5. Horizontal Curvature	643 ft	200 ft	Yes - See (2) below
6. Superelevation	e(max) = 6% Δ = 0.62%	e(max) = ~6% Δ = *	*See (3) below
7. Grades	13%	<13%	No
8. Vertical Curvature	K (crest) = 80 K (sag) = 70	K (crest) = * K (sag) = *	*See (4) below
9. Stopping Sight Distance	325 ft	>325 ft	No
10. Horizontal Clearance to Structure (not clear zone)	N/A	N/A	N/A
11. Vertical Clearance to Structure	N/A	N/A	N/A
12. Bridge Width	N/A	N/A	N/A
13. Bridge Loading	N/A	N/A	N/A

Descriptions of and reasons for exceptions to standards:

Note: design speed, traveled way, and shoulder width were selected from the NPS Park Road Standards. All other values selected from the AASHTO 2004 Green Book.

*The scope of the project is to resurface, restore, and rehabilitate the existing deteriorating pavement within available funding limits. Improving the roadway to meet all current standards is not part of the scope of this 3R project. No design adjustments to the vertical or horizontal alignment, grade, or typical section are in the scope of the project.

(1) Shoulders: The NPS standards recommend 3.0 feet wide paved shoulders. To minimize impacts to Park resources, many of which are buried artifacts, the proposed design maintains

existing shoulder width. Due to impacts and budget constraints, shoulder widening was not included in this project. There are paved ditches throughout the roadway which, although not intended for use as a shoulder, can be used as a place of refuge for vehicles in emergency situations.

(2) Horizontal curves: To minimize impacts to Park resources, many of which are buried artifacts, and to traverse the switchback topography to climb Main Entrance Road, 46 existing curves have a centerline radius below the required 340 feet for a 35 mph design speed and 2 existing curves below the required 643 feet for a 45 mph design speed and require a design exception. The 35 mph design exception curves are located approximately at stations: 62+50, 78+40, 82+60, 88+20, 92+90, 100+85, 107+13, 120+25, 122+20, 128+95, 131+60, 135+15, 136+55, 158+35, 162+35, 178+53, 192+73, 337+22, 356+95, 363+75, 366+85, 374+98, 380+60, 384+30, 388+50, 393+96, 403+71, 420+50, 430+38, 433+73, 439+15, 453+02, 453+40, 456+41, 4559+76, 466+13, 483+53, 495+20, 502+48, 505+76, 510+96, 518+99, 527+03, 532+26, 545+13, 549+28. The 45 mph design exception curves are located approximately at stations: 217+62, 222+30. These curves will be signed with advance curve warning signs, W1-11, W1-1, W1-3, or W1-5, with 15-25 mph advisory speed plaques, W13-1, as necessary.

(3) Superelevation: NPS maintenance staff indicated that some of the superelevation has been reduced over the years during the numerous patching and overlay projects. The relative gradient of the horizontal curves matches existing. Specific values for existing relative gradient are unknown but after driving the roadway and discussions with the Maintenance staff, no problem areas were identified.

(4) Vertical Curves/Stopping Sight Distance: Vertical curves have been evaluated using the as built drawings and visidata (video of the roadway). Based on available information, it has been determined that stopping sight distance is adequate.

Analysis of risks and design features proposed to mitigate exceptions:

The NPS provided crash data for the route; there are no documented safety issues related to any engineering features of the roadway. NPS maintenance and park ranger staff also stated that there were very few known accidents within the limits of the project. There is no evidence of unreported crashes (e.g. no areas with skid marks or scarred trees).

The project is consistent with adjacent roadway segments, maintaining consistency in geometric design features and speed along the route.

Of the 48 existing curves with radii less than the AASHTO standard, 6 curves have radii more than 15 mph below the design speed. Refer to the Design Technical Memorandum for more details on the analysis of existing curves. These 6 curves are switchbacks with adequate superelevation and advance signing. Reconstructing these 6 curves to meet AASHTO standards will not provide cost-effective safety benefits.

The proposed roadway is expected to perform at an acceptable level of substantive safety. Risks associated with these design exceptions were determined to be low considering the lack of site-specific safety issues, low vehicle speeds, and consistency of the existing roadway corridor.

New regulatory and warning signs will be installed on the project including speed limit, advanced curve, and grade warning signs. Pavement markings will be improved.

FLH SUPPLEMENTAL STANDARDS – MP 3.6 to 13.6			
DESIGN CRITERIA	STANDARD	AS DESIGNED	EXCEPTION
1. Clear Zone	See (1) below	6-10 ft	Yes - See (1) below
2. Barrier Crashworthiness	NCHRP 350 TL-3	NCHRP 350 TL-3	No
3. Design Flood	FLH Project Development and Design Manual Exhibit 7.1-A		* - See (2) below
4. Pavement Design Service Life	20-year	20-year	No

Descriptions of and reasons for exceptions to FLH standards:

(1) Clear Zone

According to the 2002 AASHTO Roadside Design Guide, for roadways with ADT between 1500 and 6000 and a design speed of 35 mph, the recommended clear zone distances are as follows: for a 1:4 foreslope: 14 ft; and for 1:3 backslope: 12 ft and for 45 mph, 1:4 foreslope: 20 ft; and for 1:3 backslope: 12 ft.

The 2004 AASHTO Green Book, p.319, indicates that the minimum clear zone of 10 ft for local rural roads should be provided. The project generally meets the 10 ft guideline. However, the clear zone for some of the sections with paved ditches are less than 10 ft.

Achieving the minimum clear zone distance of 10 feet would require extensive reconstruction of existing cut slopes. Adjacent sections of roadway have a similar cross section and there is no significant run-off-the-road crash history on the roadway. Due to funding and environmental constraints, cut slope reconstruction is not part of the scope of this project.

The existing guardrail varies in condition along the length of the project. This project is proposing to replace all the existing guardrail due to the increase in roadway surface elevation.

(2) Design Flood

No hydraulic improvements are included in the scope of the project. Existing drainage patterns, including culverts, will be maintained.

Analysis of risks and design features proposed to mitigate exceptions:

(1) Clear Zone

Since there are very few known accidents along this project route and no evidence of unreported crashes (e.g. no areas with skid marks or scarred trees), the safety performance indicates that the existing roadway is considered substantively safe. No new substandard features will be created, or existing ones made worse.

(2) Design Flood

There is no visual evidence of hydraulic problems along Main Entrance Road. NPS Maintenance Staff are unaware of any hydraulic issues. Risk is considered minimal since no documentable site-specific hydraulic issues exist for Main Entrance Road.

APPROVAL:

There are no exceptions to applicable standards.

The exceptions to the design standards as noted and their related risks have been reviewed with the appropriate agencies and parties and are considered acceptable for this project.

PREPARED BY:

Lead Designer Signature
Lead Designer

April 27, 2007
Date

APPROVAL IS RECOMMENDED:

Highway Design Manager Signature
Highway Design Manager

April 27, 2007
Date

Project Manager Signature
Project Manager

April 27, 2007
Date

Project Management Engineer Signature
Project Management Engineer

April 27, 2007
Date

PM Engineer Comments: Discussed design exceptions at Management Board (MB) meeting on March 12, 2007. MB recommends approval.

I CONCUR WITH THE ABOVE RECOMMENDATIONS:

NPS Signature
Big Canyon National Park, NPS

April 30, 2007
Date

Maintaining Agency, if different from above (i.e. County)

Date
Date

THE ABOVE RECOMMENDATIONS ARE APPROVED:

Project Delivery Director Signature
Director, Project Delivery

September 18, 2008
Date

After all signatures have been obtained:

cc: Ed Hammontree, Project Management Engineer
T. Samuel Holder, Project Development Engineer
Bob Welch, Technical Services Engineer
Mark Taylor, FLH Design Discipline Leader
Christine Black, Senior Highway Designer
Ed Demming, Safety Engineer
 , Project Manager
 , Highway Design Manager
 , Lead Designer

Name, Four Rivers National Forest, USFS
Name, Jefferson County

3R EXAMPLE

CENTRAL FEDERAL LANDS HIGHWAY DIVISION HIGHWAY DESIGN STANDARDS

Project Number and Name: CA ERFO 123(1) ERFO Example

Location: Blue County, Green National Forest, ninety miles west of Eureka, CA

Type of Project: New Construction Reconstruction RRR Other (ERFO)

Description of Work: This project consists of 4 locations damaged during storm events within the last year. In general, the work consists of restoring the sites to their pre-disaster condition. Specific items of work include grading, drainage, MSE wall, Gabion wall, and paving. The 4 locations are Routes 5N07 MP 1.1, 6N02 MP 1.0 and MP 1.8, and 7N25 MP2.8.

System:

<input type="checkbox"/> National Park Service <input checked="" type="checkbox"/> Forest Service <input type="checkbox"/> Bureau of Land Management <input type="checkbox"/> Bureau of Indian Affairs	<input type="checkbox"/> National Highway System (NHS) <input checked="" type="checkbox"/> Non NHS <input type="checkbox"/> Off system (county road) <input type="checkbox"/> Other (describe)
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Functional Classification: Local Road / Rural Recreational and Scenic Road

Owner Agency: Cheney County

Terrain: Mountainous

Design Vehicle: SU

		ADT – Routes 5N07, 6N02, and 7N25			PERCENT TRUCKS	D
TRAFFIC	YEAR	AVERAGE	SEASONAL	DHV		
Current	2008	<100			0	
Design	2028	<100				

Design Standards: AASHTO 2004 NPS State AASHTO Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤400) (VLVLR)

GEOMETRIC AND BRIDGE CRITERIA – Routes 5N07, 6N02, and 7N25			
GEOMETRIC AND BRIDGE CRITERIA	STANDARD	AS DESIGNED	EXCEPTION
1. Design Speed	Minimum = 20 MPH Design Speed must equal or exceed Posted or Regulatory Speed of completed facility	25 MPH Posted or Regulatory = 25 MPH	No
2. Traveled Way Width	18 ft	24 ft	No
3. Shoulder Width	Included in 18 ft width above	Included in 24 ft width above	No
4. Crown	1% - 3%	2%	No
5. Horizontal Curvature	81 ft	70 ft	Yes - See (1) below
6. Superelevation	e(max) = 6% Δ = 0.74%	e(max) = 6% Δ = 0.74%	No
7. Grades	13%	8%	No

8. Vertical Curvature	K (crest) = 7 K (sag) = 50	K (crest) = 10 K (sag) = 100	No
9. Stopping Sight Distance	115 ft	200 ft	No
10. Horizontal Clearance to Structure (not clear zone)	N/A	N/A	N/A
11. Vertical Clearance to Structure	N/A	N/A	N/A
12. Bridge Width	N/A	N/A	N/A
13. Bridge Loading	N/A	N/A	N/A

Descriptions of and reasons for exceptions to standards:

Note: Design criteria selected from the AASHTO 2004 Green Book include: design speed, crown, superelevation, grades, and k(sag). Design criteria selected from the VLVLRL include: roadway width, horizontal curvature, k(crest), and stopping sight distance. Due to the constrained location and ADT less than 100, Exhibit 5 of the VLVLRL was used to select the minimum horizontal curve radius.

(1) Horizontal curve

At MP 2.8 on Forest Road 7N25, a horizontal curve radius of 70 ft is used to tie into the existing alignment on the west end of the site. Using the AASHTO recommended radius of 81 ft would require a significant (over 60 ft tall) cut or fill. The 70 ft radius curve keeps the roadway on the existing bench, minimizing environmental and cost impacts while restoring the roadway to approximate pre-disaster condition.

Analysis of risks and design features proposed to mitigate exceptions:

(1) Horizontal curve

The 70 ft radius curve maintains consistency of geometric features and speed characteristics along the roadway corridor. There are no documented safety issues at this location. No indications of undocumented crashes (e.g. skid marks or roadside damage) were found at the site. Improving the curve radius would provide little or no safety benefit. The existing road performs at an acceptable level of substantive safety, so the risk of this design exception is considered minimal. Curve delineation is improved with new pavement markings.

FLH SUPPLEMENTAL STANDARDS – MP 3.6 to 13.6			
DESIGN CRITERIA	STANDARD	AS DESIGNED	EXCEPTION
1. Clear Zone	0 - 6 ft	2 ft	No
2. Barrier Crashworthiness	NCHRP 350 TL-3	NCHRP 350 TL-3	No
3. Design Flood	FLH Project Development and Design Manual Exhibit 7.1-A		No
4. Pavement Design Service Life	20-year	20-year	No

Descriptions of and reasons for exceptions to FLH standards:

None

Analysis of risks and design features proposed to mitigate exceptions:

N/A

APPROVAL:

- There are no exceptions to applicable standards.
- The exceptions to the design standards as noted and their related risks have been reviewed with the appropriate agencies and parties and are considered acceptable for this project.

ERFEO EXAMPLE

PREPARED BY:

Lead Designer Signature
Lead Designer

April 27, 2007
Date

APPROVAL IS RECOMMENDED:

Highway Design Manager Signature
Highway Design Manager

April 27, 2007
Date

Project Manager Signature
Project Manager

April 27, 2007
Date

Project Management Engineer Signature
Project Management Engineer
PM Engineer Comments: None.

April 27, 2007
Date

I CONCUR WITH THE ABOVE RECOMMENDATIONS:

USFS Signature
Green National Forest, USFS

April 30, 2007
Date

County Signature
Blue County

April 30, 2007
Date

THE ABOVE RECOMMENDATIONS ARE APPROVED:

Project Delivery Director Signature
Director, Project Delivery

September 18, 2008
Date

After all signatures have been obtained:

cc: Ed Hammontree, Project Management Engineer
T. Samuel Holder, Project Development Engineer
Bob Welch, Technical Services Engineer
Mark Taylor, FLH Design Discipline Leader
Christine Black, Senior Highway Designer
Ed Demming, Safety Engineer
 , Project Manager
 , Highway Design Manager
 , Lead Designer

Name, Green National Forest, USFS
Name, Blue County

ERFEO EXAMPLE