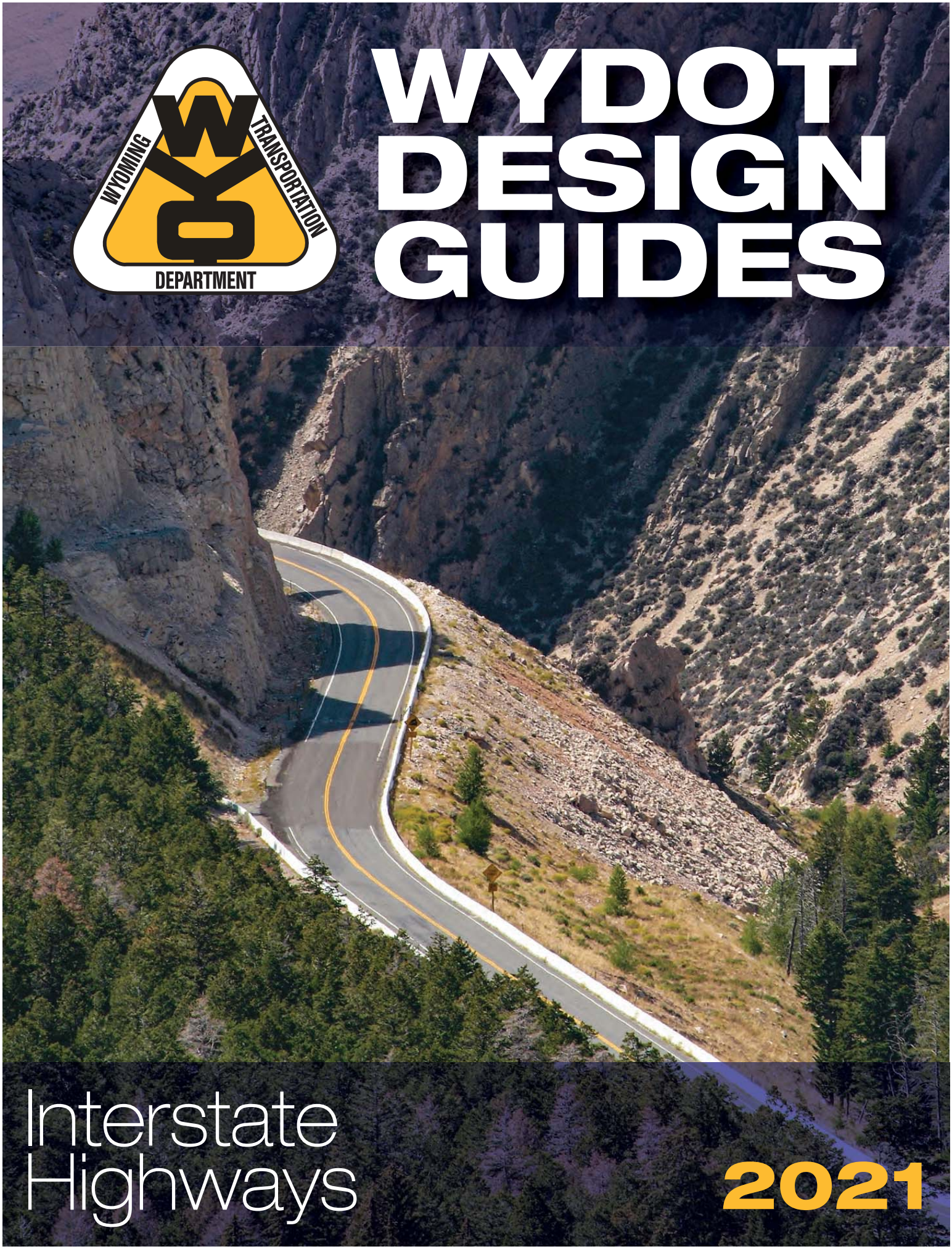
WYOMING TRANSPORTATION DEPARTMENT
WYDOT DESIGN GUIDES
Interstate Highways
2021

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GUIDE FOR INTERSTATE HIGHWAYS

PRESERVATION – REHABILITATION – RECONSTRUCTION

INTRODUCTION

This Guide is directed to developing transportation projects on the Wyoming Interstate Highway System, functionally classified as Principal Arterials. The Guide outlines project development criteria and procedures, within three project types – Preservation, Rehabilitation, and Reconstruction – to address major Program areas. These Program areas are: Highway Pavements, Highway and Roadside Geometrics, Highway Structures, Highway and Roadside Safety, Highway Capacity, Highway Interchanges and Intersections, and Highway Corridor Evaluations.

PROJECT AND PROGRAM DIRECTION

Developing each transportation project, from early scoping through design and construction, must recognize that the Department continues to operate with increasing transportation needs, higher construction costs, and limited funding. As a result, project scopes and designs should be developed with an understanding of those objectives that best meet the Department's goals to take care of all physical aspects of the State Transportation System and to exercise good stewardship of resources.

Every project scope and design must be specifically directed to the highway corridor proposed for improvement, rather than applying historical standards or practices based on the highway system. Preservation projects should first review the highway corridor to identify existing deficiencies in pavements, bridge structures, safety, capacity, and highway operations including interchanges and intersections; Rehabilitation and Reconstruction projects should evaluate the highway corridor to identify existing deficiencies in pavements, bridge structures, safety, capacity, and highway operations including interchanges and intersections. Early consideration of the existing physical condition of the highway/roadside, and the safety, operational, and maintenance history of the corridor should be used to establish a needs-based justification for any proposed improvement, included in the project scope. Project scopes would then guide development of cost-effective designs.

To further support the above goals and objectives directed to narrowly defined project scopes and cost-effective designs, the criteria and procedures presented in this Guide are developed as recommended practice. The criteria and procedures may be modified, as needed, to meet an individual project or location-specific situation. As a result, the use of words such as 'may or should' versus 'shall, will, or must' is intended to support presentation of the criteria, and is not intended to present a permissive condition versus a required condition.

GENERAL DEFINITIONS

1. Functional Classification: Classification of the system of public highways by the character of service they provide. The Interstate Highway System is functionally classified as Principal Arterial – Freeways as this System provides for the highest level of mobility and access control.
2. Controlling Design Criteria: Controlling design criteria are Design Speed (DS), Lane Width, Shoulder Width, Horizontal Curve Radius, Cross Slope, Superelevation Rate, Maximum Grades, Stopping Sight Distance, Structure Vertical Clearance, and Bridge Structure Capacity (loading). Design values for each of the Controlling Design Criteria are developed by the American Association of State Highway and Transportation Officials (AASHTO).

   A definition of Controlling Design Criteria often includes addressing Design Exceptions. Design Exceptions may be used, on Reconstruction projects, where it is not reasonable to achieve full compliance with AASHTO minimum design values for any of the controlling design criteria. The process for evaluating, justifying, and documenting Design Exceptions is presented in the WYDOT *Road Design Manual*.
3. Highway Design, Highway and Roadside Safety, and Bridge Structure Design Criteria and Values: The criteria and values current with development of this Guide are listed as References. All References used in this Guide are to the most current adopted editions.
4. Highway Capacity Analysis: This analysis, applicable to Reconstruction projects and to those Rehabilitation projects with bridge replacement, will be completed for a 20-year design life using procedures from the Transportation Research Board (TRB) *Highway Capacity Manual*. A Level-of-Service (LOS) C has been selected as the appropriate LOS to warrant capacity improvements for Interstate mainline sections; a Level-of-Service (LOS) D has been selected as the appropriate LOS to warrant capacity improvements for Interstate interchange ramps and intersecting roads.
5. Project Scope and Funding: Project scopes will be determined at an early planning stage using established management systems for Pavements, Bridges, and Safety. Early project scoping will develop the project purpose, project type, project limits, and location-specific major elements.

   Projects meeting the criteria presented in this Guide are eligible for State and Federal funding categories (NHPP, STP, HSIP, TAP, State Construction, State Safety).

6. Preservation Project Type: Preservation of the highway corridor to allow for the construction of a) a range of pavement design strategies that extend the service life or serviceability of the roadway pavement structure as identified in the Pavement Management System, b) bridge structure preservation or maintenance strategies identified in the Bridge Management System, and c) selected location-specific roadway and roadside safety improvements supported by the Safety Management System and including location-specific roadway geometric improvements. This project type may also address corridor needs for (a) operational improvements including auxiliary lanes and intersections improvements, (b) roadway traffic control device upgrades including signs, signals, and markings and (c) areas of isolated reconstruction or rehabilitation to meet identified highway needs.
7. Rehabilitation Project Type: Rehabilitation of existing highways to allow for the construction of selected improvements including (a) pavement design strategies identified in the Pavement Management System, (b) highway geometric upgrades, (c) bridge structure replacement or rehabilitation strategies identified in the Bridge Management System, (d) roadway and roadside safety improvements supported by the Safety Management System, (e) operational improvements including auxiliary lanes, modifications to existing interchanges and intersections, and upgrades to roadway traffic control devices including signs, signals, and markings. This project type could include isolated areas of reconstruction to meet identified highway needs.
8. Reconstruction Project Type: New construction or reconstruction of existing highways to provide for (a) the full range of pavement design strategies identified in the Pavement Management System, (b) highway geometric criteria upgrades, (c) bridge structure replacement or rehabilitation strategies identified in the Bridge Management System, (d) a full range of roadway and roadside safety improvements supported by the Safety Management System, (e) added capacity for design year traffic including additional travel lanes and auxiliary lanes, new interchanges and modifications to existing interchanges and intersections, and (f) roadway traffic control devices.

APPLICATION CRITERIA – INTERSTATE PRESERVATION PROJECTS

Project Direction

These application criteria, as stated in the Introduction, are directed to each Preservation project scope and design. Each project should first review the highway corridor (defined as the project limits) to identify existing deficiencies in pavements, bridge structures, safety, capacity, and highway operations including interchanges and intersections. Early consideration of the existing physical condition of the highway/roadside, and the safety, operational, and maintenance history of the corridor should be used to establish a needs-based justification for any proposed improvement, included in the project scope. Project scopes would then guide development of cost-effective designs.

Highway Pavements

Interstate Preservation projects provide for a range of pavement design strategies to extend the service life of existing plant-mix asphalt pavements and Portland cement concrete pavements. Strategies for plant-mix asphalt pavements include, but are not limited to, surface preparations (mill, level, full-depth reclamation, other), overlays, wearing surfaces, chip seals, micro-surfacing, and seal coats. Strategies for Portland cement concrete pavements include, but are not limited to, isolated slab replacement, dowel bar retrofit, grind and texture, and joint seals. Preservation projects will construct these strategies or other pavement treatment types as identified in the Pavement Management System and further outlined in the Pavement Condition and Project Candidates manual developed and administered through the Materials Program. This project type could include isolated areas of reconstruction or rehabilitation to meet identified pavement structure needs.

Highway and Roadside Geometrics

Interstate Preservation projects are not intended to improve mainline Interstate geometric design or roadside elements; these would typically be evaluated as part of a Rehabilitation or Reconstruction type project. Auxiliary lanes, including acceleration/deceleration lanes, can be constructed with a Preservation project, when justified.

Highway Structures

Interstate Preservation projects will provide for the preservation or maintenance of existing bridge structures, consistent with improvements identified in the Bridge Management System.

All highway structures, within the project limits, will be reviewed to determine if 16-foot vertical clearance has been provided or maintained on rural Interstate and/or if 16-foot vertical clearance has been provided or maintained on an urban Interstate, single routing. Any project that does not provide or maintain a minimum 16-foot vertical clearance for all highway structures will be coordinated with the FHWA and the Surface Deployment and Distribution Command Transportation Engineering Agency (SDDCTEA) of the Department of Defense.

Highway and Roadside Safety

Project planning for Interstate Preservation will require a highway safety screening to determine the safety improvements/countermeasures recommended on each project. By entering the project limits into the Safety Management System (SMS) administered by the Highway Safety Program, a Highway Safety (HWS) Segment Report is generated. The HWS Segment Report will show the Safety Index (SI) rating for the project limits.

The use of the SMS to obtain an SI rating constitutes a highway safety screening and supports the Department's effort to reduce the frequency and severity of highway crashes, and directs attention and funding to 1) those highway sections that have a history of more severe or frequent crashes and 2) those highway sections where construction of safety improvements/countermeasures have the potential to significantly reduce the crash frequency and/or severity.

Highway sections with an SI Rating of 1 or 2 do not have a history of frequent or severe crashes. Although safety improvements/countermeasures may be constructed on these highway sections, the highway safety screening does not require any additional safety work to be added to preservation projects.

Highway sections with an SI Rating of 3 or 4 show a history of frequent or severe crashes and requires the project planning team to evaluate the need to add safety improvements/ countermeasures to the project. This evaluation will reveal the potential to reduce the frequency or severity of specific crash types/locations, and is the joint responsibility of Highway Safety, Planning, Traffic, District, and Highway Development.

The safety evaluation will consist of adding multiple safety treatments to the road sections within the SMS prior to the recon or kick-off meeting. At the recon or kick-off meeting, the design team will review all of the treatments suggested, review the benefit to cost ratios, and determine what safety treatments should be added to the project. Proposed safety improvements will be available for inclusion in the project scope.

Preservation projects do not require additional safety improvements to be added to the project. If no safety improvements are recommended for the project after the design team evaluation has been completed, a note will be placed in the project file by the lead designer stating why safety improvements were not added to the project.

Safety improvements, if selected for inclusion in the project scope, will meet applicable geometric and safety design criteria and design values as presented in this Guide for Interstate Rehabilitation Projects, WYDOT *Road Design Manual*, AASHTO *Roadside Design Guide* (RDG), AASHTO *Manual for Assessing Safety Hardware* (MASH), NCHRP *Report 350 Recommended Procedures for the Safety Performance of Highway Features, and* FHWA *Manual on Uniform Traffic Control Devices* (MUTCD).

Highway Capacity

Interstate Preservation projects are not intended to provide for additional Interstate travel lanes; future year Interstate System capacity needs would typically be evaluated as part of a Reconstruction type project. Auxiliary lanes, including truck climbing lanes, and acceleration/ deceleration lanes can be constructed with a Preservation project, when justified.

Highway Interchanges and Intersections

Interstate Preservation projects are not intended to improve ramp or crossroad geometric design or roadside elements; these would typically be evaluated as part of a Rehabilitation or Reconstruction type project. Auxiliary lanes, including turn lanes, can be constructed with a Preservation project, when justified.

Highway Corridor Reviews and Evaluations

Interstate Preservation projects should review all physical aspects of the highway corridor to identify existing deficiencies and/or other highway and roadside elements that may require continued maintenance. For this Interstate project type, the highway corridor to be reviewed is the project limits.

This project type may include an operational evaluation of all roadside hardware, including bridge curb and rail, guardrail barriers and terminals, bridge rail to guardrail connections, sign support breakaway hardware, sign legend and retroreflection, and highway and interchange lighting. These installations may be upgraded, if needed, to meet design standards according to the AASHTO *Manual for Assessing Safety Hardware* (MASH), NCHRP *Report 350 Recommended Procedures for the Safety Performance of Highway Features*, FHWA *Manual on Uniform Traffic Control Devices* (MUTCD), and WYDOT *Operating Policy 25-1 Traffic Control and Roadway Lighting Devices*. Roadside safety hardware upgrades need to be reviewed per the Department's MASH implementation plan.

All Preservation project designs should avoid right-of-way acquisitions and/or construction easements; these projects should also avoid or minimize environmental impacts and resultant cost of mitigation.

The Design Phase should evaluate alternative contracting including, but not limited to, Lane Rental, and Incentive/Disincentive provisions.

APPLICATION CRITERIA – INTERSTATE REHABILITATION PROJECTS

Project Direction

These application criteria, as stated in the Introduction, are directed to each Rehabilitation project scope and design. Each project should first evaluate the highway corridor (defined as the project limits for roadside elements and both the project limits and adjacent sections for highway (roadway) geometric elements) to identify existing deficiencies in pavements, bridge structures, safety, capacity, and highway operations including interchanges and intersections. Early consideration of the existing physical condition of the highway/roadside, and the safety, operational, and maintenance history of the corridor should be used to establish a needs-based justification for any proposed improvement, included in the project scope. Project scopes would then guide development of cost-effective designs.

Highway Pavements

Interstate Rehabilitation projects provide for a broad range of pavement design strategies. Strategies for plant-mix asphalt pavements include, but are not limited to, removal and replacement, widening, surface preparations (mill, level, full-depth reclamation, other), overlays and seal coats. Strategies for Portland cement concrete pavements include, but are not limited to, crack and seat, grind (level), overlay and seal coats. Rehabilitation projects will construct these strategies or other pavement treatment types as identified in the Pavement Management System and further outlined in the Pavement Condition and Project Candidates manual developed and administered through the Materials Program. This project type could include isolated areas of reconstruction to meet identified pavement structure needs.

Interstates will be designed to meet the following criteria for the paved width of travel lanes, shoulders, and auxiliary lanes. The right lane and shoulder will be designed to a full-depth pavement structure for 14 feet (12 feet of outside travel lane plus 2 feet of right shoulder). The remaining right shoulder width will be evaluated for a reduced-depth pavement structure, typically a minimum 4-inch plant-mix asphalt for the remaining full width. The full width of the left lane (or all other travel lanes) will be designed to a full-depth pavement structure, and the full left shoulder will be evaluated for a reduced-depth pavement structure, typically a minimum 4-inch plant-mix asphalt.

Auxiliary lanes, including passing, climbing, and continuous acceleration/deceleration lanes, will be evaluated for a reduced-depth pavement structure as they carry a differing volume and mix of traffic.

Highway and Roadside Geometrics

Project planning for Interstate Rehabilitation projects will include an evaluation of existing highway elements against design values for Controlling Design Criteria and selected non-controlling design criteria that are below Tolerable Controls. Tolerable Controls are generally defined as the design values for highway elements in effect at the time of original construction of the Interstate highway section proposed for improvement, or the design values for existing highways elements if the highway section has been improved since original construction. The evaluation will be used to select the highway elements that will be improved and included in the Rehabilitation project scope.

Table 1 presents the minimum design values for Tolerable Controls for the Controlling Design Criteria relating to highway design. Design values for Tolerable Controls for the Controlling Design Criteria relating to bridge structures are presented in Table 2 located in a following section, Highway Structures. These minimum design values are applicable to mainline Interstate sections and are not intended to control the design of auxiliary lanes and interchange ramps.

For Interstate Rehabilitation projects, highway and bridge structure designs for proposed improvements will be based on the minimum design values for Tolerable Controls as presented in this Guide. The use of higher values, up to the AASHTO minimum design values from Table 3, are available for use when justified due to higher traffic volumes, higher truck traffic volumes, identified safety concerns including higher frequency or more severe crash types, or other identified highway needs.

Table 1. Interstate - Rehabilitation Project Type: Controlling Design Criteria and Tolerable Controls (Design Values)

Controlling Design Criteria	Rural Design Values 80 MPH Posted Speed		Rural Design Values 75 MPH Posted Speed		Urban[1] Design Values	
Design Speed (DS)	70 MPH		65 MPH		50 MPH	
Lane Width	12 Feet		12 Feet		12 Feet	
Shoulder Width	Left	Right	Left	Right	Left	Right
4-Lane Roadway	2 Feet	8 Feet	2 Feet	8 Feet	2 Feet	8 Feet
Horizontal Curve Radius	70 MPH DS		65 MPH DS		50 MPH DS	
Cross Slope	1.5%		1.5%		1.5%	
Superelevation Rate	Superelevation Tables e_{max} = 8%		Superelevation Tables e_{max} = 8%		Superelevation Tables e_{max} = 8%	
Maximum Grade						
Flat Terrain	Existing		Existing		Existing	
Rolling Terrain	Existing		Existing		Existing	
Mountainous Terrain	Existing		Existing		Existing	
Stopping Sight Distance	730 Feet		645 Feet		425 Feet	

[1] Urban design values are applied to those sections of Interstate which have posted speeds below 75 MPH and are located in or near urban areas with adjacent urban-type development/land use.

As noted above, project planning for Interstate Rehabilitation projects will include an evaluation of existing highway elements against design values for selected non-controlling design criteria. Selected criteria and design values are presented in Table 1a for non-controlling design criteria relating to highway and roadside geometric design.

Table 1a. Interstate - Rehabilitation Project Type:
Non-Controlling Design Criteria and Tolerable Controls (Design Values)

Non-Controlling Design Criteria	Rural and Urban Design Values		Footnote
Fore Slope Rate	1V:4H to 1V:6H, including Surfacing Taper		1
Clear Zone Width	Existing Paved Shoulder Width		
Slope Rate – beyond Clear Zone	See Road Design Manual		1
Median Width	Existing		
Sag Vertical Curve – Headlight Sight Distance	Rural	Urban	2
	730 Feet, 70 MPH DS 645 Feet, 65 MPH DS	425 Feet	
Lateral Offset to Obstruction	Existing Paved Shoulder Width		

Footnote 1 – Selection of slope rates should avoid right-of-way acquisitions and/or construction easements; should also consider avoidance or minimization of environmental impacts and resultant cost of mitigation.

Footnote 2 - Sag vertical curves are normally designed to not restrict the distance of roadway illuminated by vehicle headlights, which would reduce stopping sight distance at night.

Highway Structures

Project planning for Interstate Rehabilitation projects will evaluate existing bridge structure elements against design values for Controlling Design Criteria. This evaluation will assist in selecting those bridge structure elements, related to controlling design criteria that are below Tolerable Controls, which will be improved as part of the Rehabilitation project scope. Tolerable Controls are generally defined as the design values for bridge structure elements in effect at the time of original construction of the Interstate bridge structure proposed for improvement, or the design values for existing bridge structure elements if the bridge structure has been improved since original construction.

Interstate Rehabilitation projects will also evaluate bridge structures to determine elements in an advanced state of deterioration. Work needed to extend the functional life of the structure, including structure replacement, widening, or reconstruction of any element, may be addressed with a Rehabilitation project. Any bridge structure replaced or proposed for rehabilitation of major elements will be evaluated for structure type, length, and width requirements, with a highway capacity analysis based on a minimum 20-year design life. The location of abutments and piers will consider design values for Lateral Offset to Obstructions, which may vary by highway system crossed (Interstate, NHS Arterial, Non-NHS State Highway, Public Highway).

Table 2 presents the minimum design values for Tolerable Controls for the two Controlling Design Criteria relating to bridge structure design. These minimum design values are applicable to mainline Interstate bridge structure and are not intended to control the design of structures serving auxiliary lanes including interchange ramps.

For Interstate Rehabilitation projects, bridge structure designs for rehabilitation of an existing structure will be based on the minimum design values for Tolerable Controls as presented in this Guide. The use of higher values, up to the AASHTO minimum design values from Table 4, are available for use when justified due to higher traffic volumes, higher truck traffic volumes, identified safety concerns including higher frequency or more severe crash types, or other identified highway needs.

For Interstate Rehabilitation projects, bridge structure design for replacement of an existing structure will be based on the minimum AASHTO design values identified in Table 2, Table 3, and Table 4. Long structures, defined as length in excess of 200 feet, may have a lesser roadway width to accommodate the traveled way plus 4 feet offsets (left and right side) to curb barrier or rail.

**Table 2. Interstate - Rehabilitation Project Type:
Structure Controlling Design Criteria and Tolerable
Controls (Design Values)**

Controlling Design Criteria	Rural and Urban Design Values REHABILITATE BRIDGE	Rural and Urban Design Values REPLACE BRIDGE	Footnote
Vertical Clearance – Highway Structures			1, 2
Structure over Interstate Highway	15 Feet	16 Feet	
Structure over NHS Arterial	14 Feet	16 Feet	
Structure over Non-NHS Arterial	14 Feet	16 Feet	
Structure over Non-NHS Collector	Existing	14 Feet	
Structure over Non-NHS Local	Existing	14 Feet	
Vertical Clearance – Sign Structures			
All Highway Systems	Existing	19 Feet	
Structural Capacity	HS-20, Inventory Rating ≥ 0.8	HL-93	

Footnote 1 – Bridge replacement to meet Vertical Clearance is not required. The determination to replace an existing bridge overpass to meet vertical clearance will also include a functional and structural evaluation of the bridge.

Footnote 2 – For replaced (new) Highway Structures, consider an additional 0.5 Feet of Vertical Clearance to allow for future pavement surfacing.

All highway structures, within the project limits, will be reviewed to determine if 16-foot vertical clearance has been provided or maintained on rural Interstate and/or if 16-foot vertical clearance has been provided or maintained on an urban Interstate for at least one lane in each direction. Any project that does not provide or maintain a minimum 16-foot vertical clearance for all highway structures will be coordinated with the FHWA and the Surface Deployment and Distribution Command Transportation Engineering Agency (SDDCTEA) of the Department of Defense.

Highway and Roadside Safety

Project planning for Interstate Rehabilitation will require a highway safety screening to determine the amount of safety improvements/countermeasures recommended on each project. By entering the project limits into the Safety Management System (SMS) administered by the Highway Safety Program, a Highway Safety (HWS) Segment Report is generated. The HWS Segment Report will show the Safety Index (SI) rating for the project limits.

The use of the SMS to obtain an SI rating constitutes a highway safety screening and supports the Department's effort to reduce the frequency and severity of highway crashes, and directs attention and funding to 1) those highway sections that have a history of more severe or frequent crashes and 2) those highway sections where construction of safety improvements/countermeasures have the potential to significantly reduce the crash frequency and/or severity.

Highway sections with an SI Rating of 1 or 2 do not have a history of frequent or severe crashes. Although safety improvements/countermeasures may be constructed on these highway sections, the highway safety screening does not require any additional safety work to be added to rehabilitation projects.

Highway sections with an SI Rating of 3 or 4 show a history of frequent or severe crashes and requires the project planning team to evaluate the need to add safety improvements/countermeasures to the project. This evaluation will reveal the potential to reduce the frequency or severity of specific crash types/locations, and is the joint responsibility of Highway Safety, Planning, Traffic, District, and Highway Development.

The safety evaluation will consist of adding multiple safety treatments to the road sections within the SMS prior to the recon or kick-off meeting. At the recon or kick-off meeting, the design team will review all of the treatments suggested, review the benefit to cost ratios, and determine what safety treatments should be added to the project. Proposed safety improvements will be available for inclusion in the project scope.

Rehabilitation projects do not require additional safety improvements to be added to the project. If no safety improvements are recommended for the project after the design team evaluation has been completed, a note will be placed in the project file by the lead designer stating why safety improvements were not added to the project.

Safety improvements, if selected for inclusion in the project scope, will meet applicable geometric and safety design criteria and design values as presented in this Guide for Interstate Rehabilitation Projects, WYDOT *Road Design Manual*, AASHTO *Roadside Design Guide* (RDG), AASHTO *Manual for Assessing Safety Hardware* (MASH), NCHRP *Report 350 Recommended Procedures for the Safety Performance of Highway Features*, and FHWA *Manual on Uniform Traffic Control Devices* (MUTCD).

Highway Capacity

Interstate Rehabilitation projects are not intended to provide for additional Interstate travel lanes. Future year Interstate System capacity needs would typically be evaluated as part of a Reconstruction type project. Auxiliary lanes, including truck climbing lanes, acceleration/ deceleration lanes, and turn lanes can be constructed with a Rehabilitation project, when justified.

Highway Interchanges and Intersections

Interchanges and ramp terminal intersections will be evaluated for all Interstate Rehabilitation projects. This evaluation will address geometric design, capacity and safety needs for interchange ramps and the intersecting highway including the bridge structure. Improvements to correct identified deficiencies can be included in the project scope. Design criteria and values are presented in the WYDOT *Road Design Manual* and supplemented by AASHTO *A Policy on Geometric Design of Highways and Streets.*

Highway Corridor Evaluations

Interstate Rehabilitation projects should evaluate all physical aspects of the highway corridor to identify existing deficiencies and/or other highway and roadside elements that may require continued maintenance. For this Interstate project type, the highway corridor to be evaluated is the project limits for roadside elements and both the project limits and adjacent sections for highway (roadway) geometric elements.

This project type will include an operational evaluation of all roadside hardware, including bridge curb and rail, guardrail barriers and terminals, bridge rail to guardrail connections, sign support breakaway hardware, sign legend and retroreflection, and highway and interchange lighting. These installations may be upgraded, if needed, to meet design standards according to the AASHTO *Manual for Assessing Safety Hardware* (MASH), NCHRP *Report 350 Recommended Procedures for the Safety Performance of Highway Features*, FHWA *Manual on Uniform Traffic Control Devices* (MUTCD), and WYDOT *Operating Policy 25-1 Traffic Control and Roadway Lighting Devices*. Roadside safety hardware upgrades need to be reviewed per the Department's MASH implementation plan.

Interstate Rehabilitation projects may require a hydraulic analysis. The scope of the hydraulic analysis and resultant design work will vary depending on project improvements being undertaken.

All Rehabilitation project designs should be evaluated to avoid right-of-way acquisitions and/or construction easements; this evaluation should also consider avoidance or minimization of environmental impacts and resultant cost of mitigation.

Cost reduction evaluations should be considered during the Design Phase, including Life Cycle Costing, Value Engineering, and Constructability Reviews. The Design Phase should evaluate alternative contracting including, but not limited to, Cost plus Time, Lane Rental, and Incentive/ Disincentive provisions.

APPLICATION CRITERIA – INTERSTATE RECONSTRUCTION PROJECTS

Project Direction

These application criteria, as stated in the Introduction, are directed to each Reconstruction project scope and design. Each project should first evaluate the highway corridor (defined as the project limits for roadside elements and the project limits, adjacent sections, and WYDOT Long Range Transportation/Corridor Plans for highway (roadway) geometric elements) to identify existing deficiencies in pavements, bridge structures, safety, capacity, and highway operations including interchanges and intersections. Early consideration of the existing physical condition of the highway/roadside, and the safety, operational, and maintenance history of the corridor should be used to establish a needs-based justification for any proposed improvement, included in the project scope. Project scopes would then guide development of cost-effective designs.

Highway Pavements

Interstate new construction or reconstruction projects provide for the full range of pavement design strategies for the new construction or the removal and replacement of existing plant-mix asphalt pavements and Portland cement concrete pavements. These designs will provide for a minimum 20-year structure design life.

Interstates will be designed to meet the following criteria for the paved width of travel lanes, shoulders, and auxiliary lanes. The right lane and shoulder will be designed to a full-depth pavement structure for 14 feet (12 feet of outside travel lane plus 2 feet of right shoulder). The remaining right shoulder width will be evaluated for a reduced-depth pavement structure, typically a minimum 4-inch plant-mix asphalt for the remaining full width. The full width of the left lane (or all other travel lanes) will be designed to a full-depth pavement structure, and the full left shoulder will be evaluated for a reduced-depth pavement structure, typically a minimum 4-inch plant-mix asphalt.

Auxiliary lanes, including passing, climbing, and continuous acceleration/deceleration lanes, will be evaluated for a reduced-depth pavement structure as they carry a differing volume and mix of traffic.

Highway and Roadside Geometrics

Interstate reconstruction projects will be designed to meet minimum design values for Controlling Design Criteria and the presented design values for non-controlling geometric and safety elements.

Design values are presented in the AASHTO *A Policy on Design Standards Interstate System*, supplemented with the AASHTO *A Policy on Geometric Design of Highways and Streets*, WYDOT *Road Design Manual*, and AASHTO *Roadside Design Guide* (RDG). AASHTO identifies both minimum and desirable design values for Controlling Design Criteria; this Guide will present minimum values in Table 3 for the eight Controlling Design Criteria relating to highway design. AASHTO minimum design values for the two Controlling Design Criteria relating to bridge structures are presented in Table 4 located in a following section, Highway Structures. These minimum design values are applicable to mainline Interstate sections and are not intended to control the design of auxiliary lanes and interchange ramps.

Highway and bridge structure designs will be based on the minimum design values presented in this Guide. Design values (from referenced AASHTO and WYDOT manuals), above the minimums presented, are available for use when justified due to higher traffic volumes, higher truck traffic volumes, identified safety concerns including higher frequency or more severe crash types, or other identified highway needs.

Table 3. Interstate - Reconstruction Project Type:
Controlling Design Criteria and Design Values

Controlling Design Criteria	Rural[2] Design Values 80 MPH Posted Speed		Rural[2] Design Values 75 MPH Posted Speed		Urban[1,2] Design Values	
Design Speed (DS)	80 MPH		75 MPH		60 MPH	
Lane Width	12 Feet		12 Feet		12 Feet	
Shoulder Width	Left	Right	Left	Right	Left	Right
4-Lane Roadway	4 Feet	10 Feet	4 Feet	10 Feet	4 Feet	10 Feet
Horizontal Curve Radius	80 MPH DS		75 MPH DS		60 MPH DS	
Cross Slope	2.0%		2.0%		2.0%	
Superelevation Rate	Superelevation Tables e_{max} = 8%		Superelevation Tables e_{max} = 8%		Superelevation Tables e_{max} = 8%	
Maximum Grade						
Flat Terrain	3%		3%		4%	
Rolling Terrain	4%		4%		5%	
Mountainous Terrain	5%		5%		7%	
Stopping Sight Distance	910 Feet		820 Feet		570 Feet	

Footnote 1 – Urban design values are applied to those sections of Interstate which have posted speeds below 75 MPH and are located in or near urban areas with adjacent urban-type development/land use.

Footnote 2 – Design Speed must be selected to meet the posted speed limit, for both rural and urban Interstates.

The referenced AASHTO and WYDOT manuals also identify minimum design values for non-controlling design criteria. Selected criteria and design values are presented in Table 3a for non-controlling design criteria relating to highway and roadside geometric design.

Table 3a. Interstate - Reconstruction Project Type:
Non-Controlling Design Criteria and Design Values

Non-Controlling Design Criteria	Rural and Urban Design Values		Footnote
Fore Slope Rate	1V:4H to 1V:6H, including Surfacing Taper		1
Clear Zone Width	See Road Design Manual		
Slope Rate – beyond Clear Zone	See Road Design Manual		1
Median Width	Rural	Urban	
	36 Feet	10 Feet	
Sag Vertical Curve – Headlight Sight Distance	Rural	Urban	2
	910 Feet, 80 MPH DS 820 Feet, 75 MPH DS	570 Feet	
Lateral Offset to Obstruction	See Roadside Design Guide		

Footnote 1 – Selection of slope rates should avoid right-of-way acquisitions and/or construction easements; should also consider avoidance or minimization of environmental impacts and resultant cost of mitigation.

Footnote 2 - Sag vertical curves are normally designed to not restrict the distance of roadway illuminated by vehicle headlights, which would reduce stopping sight distance at night.

Highway Structures

Interstate Reconstruction projects will provide for the construction of new bridge structures, or the reconstruction or rehabilitation of existing bridge structures, consistent with improvements identified in the Bridge Management System. These projects will be designed to meet minimum design values for Controlling Design Criteria. Design values are presented in the AASHTO *A Policy on Design Standards Interstate System*, supplemented with the AASHTO *A Policy on Geometric Design of Highways and Streets*, AASHTO *LRFD Bridge Design Specifications*, AASHTO *Standard Specifications for Highway Bridges*, and the WYDOT *Bridge Design Manual*.

Bridge structure designs will be based on the minimum design values presented in this Guide, see Table 3 and Table 4. The use of design values, above the minimums presented, are available for use when justified due to higher traffic volumes, higher truck traffic volumes, identified safety concerns including higher frequency or more severe crash types, or other identified highway needs. Long structures, defined as length in excess of 200 feet, may have a lesser roadway width to accommodate the traveled way plus 4 feet offsets (left and right side) to curb barrier or rail.

Table 4. Interstate - Reconstruction Project Type:
Structure Controlling Design Criteria and Design Values

Controlling Design Criteria	Rural and Urban Design Values	Footnote
Vertical Clearance – Highway Structures		1, 2, 3
Structure over Interstate Highway	16 Feet	
Structure over NHS Arterial	16 Feet	
Structure over Non-NHS Arterial	16 Feet	
Structure over Non-NHS Collector	14 Feet	
Structure over Non-NHS Local	14 Feet	
Vertical Clearance – Sign Structures		
All Highway Systems	19 Feet	
Structural Capacity	HL-93	

Footnote 1 – For new Highway Structures, consider an additional 0.5 Feet of Vertical Clearance to allow for future pavement surfacing.

Footnote 2 – Bridge replacement to meet Vertical Clearance is not required; a Design Exception will be processed justifying the action to leave the bridge in-place. The determination to replace an existing bridge overpass to meet vertical clearance will also include a functional and structural evaluation of the bridge.

Footnote 3 – The vertical clearance of an overhead structure, which is not at an interchange location, will be evaluated and may be increased to better serve the types of vehicles using the Interstate corridor.

Any new, reconstructed, or rehabilitated bridge structure will be evaluated for structure type, including the location of abutments and piers and length and width requirements. This evaluation will address future capacity needs of the Interstate corridor, using a highway capacity analysis based on a minimum 20-year design life, and will address all Controlling Design Criteria design values.

All highway structures, within the project limits, will be reviewed to determine if 16-foot vertical clearance has been provided or maintained on rural Interstate and/or if 16-foot vertical clearance has been provided or maintained on an urban Interstate, single routing. Any project that does not provide or maintain a minimum 16-foot vertical clearance for all highway structures will be coordinated with the FHWA and the Surface Deployment and Distribution Command Transportation Engineering Agency (SDDCTEA) of the Department of Defense.

Highway and Roadside Safety

Project planning for Interstate Reconstruction will require a highway safety screening to determine the safety improvements/countermeasures recommended on each project. By entering the project limits into the Safety Management System (SMS) administered by the Highway Safety Program, a Highway Safety (HWS) Segment Report is generated. The HWS Segment Report will show the Safety Index (SI) rating for the project limits.

The use of the SMS to obtain an SI rating constitutes a highway safety screening and supports the Department's effort to reduce the frequency and severity of highway crashes, and directs attention and funding to 1) those highway sections that have a history of more severe or frequent crashes and 2) those highway sections where construction of safety improvements/countermeasures have the potential to significantly reduce the crash frequency and/or severity.

Highway sections with an SI Rating of 1 or 2 do not have a history of frequent or severe crashes. Although safety improvements/countermeasures may be constructed on these highway sections, the highway safety screening does not require any additional safety work to be added to rehabilitation projects.

Highway sections with an SI Rating of 3 or 4 show a history of frequent or severe crashes and requires the project planning team to evaluate the project and determine the best areas to add safety improvements/countermeasures to the project to reduce the frequency or severity of specific crash types/locations. This evaluation is the joint responsibility of Highway Safety, Planning, Traffic, District, and Highway Development.

The safety evaluation will consist of adding multiple safety treatments to the road sections within the SMS prior to the recon or kick-off meeting. At the recon or kick-off meeting, the design team will review all of the treatments suggested, review the benefit to cost ratios, and determine what safety treatments will be added to the project. Proposed safety improvements will be available for inclusion in the project scope.

Safety improvements selected for inclusion in the project scope will meet applicable geometric and safety design criteria and design values as presented in this Guide for Interstate Reconstruction Projects, WYDOT *Road Design Manual*, AASHTO *Roadside Design Guide* (RDG), AASHTO *Manual for Assessing Safety Hardware* (MASH), NCHRP *Report 350 Recommended Procedures for the Safety Performance of Highway Features*, and FHWA *Manual on Uniform Traffic Control Devices* (MUTCD).

Highway Capacity

Interstate Reconstruction projects, including new construction, will provide for additional continuous travel lanes needed to meet 20-year projected travel demand. Auxiliary lanes, including truck climbing lanes and continuous acceleration/deceleration lanes, will be constructed when justified.

Capacity improvements to add additional travel lanes may be delayed if not justified within the first ten years of the minimum 20-year design life.

Highway Interchanges and Intersections

Interchanges and ramp terminal intersections will be evaluated for all Interstate Reconstruction projects. This evaluation will address geometric design, capacity and safety needs for interchange ramps and the intersecting highway including the bridge structure. Improvements needed meet 20-year projected travel demands or to correct identified deficiencies will be included in the project scope. Design criteria and values are presented in the WYDOT *Road Design Manual* and supplemented by AASHTO *A Policy on Geometric Design of Highways and Streets*.

Capacity improvements to the intersecting highway or individual ramps may be delayed if not justified within the first ten years of the minimum 20-year design life.

Highway Corridor Evaluations

Interstate Reconstruction projects should evaluate all physical aspects of the highway corridor to identify existing deficiencies and/or other highway and roadside elements that may require continued maintenance. For this Interstate project type, the highway corridor to be evaluated is the project limits for roadside elements and the project limits, adjacent sections, and WYDOT Long Range Transportation/Corridor Plans for highway (roadway) geometric elements.

This project type will include an operational evaluation of all roadside hardware, including bridge curb and rail, guardrail barriers and terminals, bridge rail to guardrail connections, sign support breakaway hardware, sign legend and retroreflection, and highway and interchange lighting. These installations will be upgraded, if needed, to meet design standards according to the AASHTO *Manual for Assessing Safety Hardware* (MASH), NCHRP *Report 350 Recommended Procedures for the Safety Performance of Highway Features*, FHWA *Manual on Uniform Traffic Control Devices* (MUTCD), and WYDOT *Operating Policy 25-1 Traffic Control and Roadway Lighting Devices*. Roadside safety hardware upgrades need to be reviewed per the Department's MASH implementation plan.

Interstate Reconstruction projects will typically require a hydraulic analysis. The scope of the hydraulic analysis and resultant design work will vary depending on project improvements being undertaken.

All Reconstruction project designs should be evaluated to avoid right-of-way acquisitions and/or construction easements; this evaluation should also consider avoidance or minimization of environmental impacts and resultant cost of mitigation.

Cost reduction evaluations should be considered during the Design Phase, including Life Cycle Costing, Value Engineering, and Constructability Reviews. The Design Phase should evaluate alternative contracting including, but not limited to, Cost plus Time, Lane Rental, and Incentive /Disincentive provisions.

REFERENCES

The References presented in this Guide are intended to refer to the most current and adopted editions.

Transportation Research Board (TRB):

Highway Capacity Manual

American Association of State Highway and Transportation Officials (AASHTO):

A Policy on Design Standards Interstate System
A Policy on Geometric Design of Highways and Streets
LRFD Bridge Design Specifications
Standard Specifications for Highway Bridges
Roadside Design Guide (RDG)
Roadway Lighting Design Guide
Manual for Assessing Safety Hardware (MASH)

Wyoming Department of Transportation (WYDOT):

Operating Policy
25-1, Traffic Control and Roadway Lighting Devices
Traffic Studies Manual
Road Design Manual
Bridge Design Manual
Hydraulics Manual
Long Range Transportation Plan – Corridor Visions

National Cooperative Highway Research Program (NCHRP):

Report 350 Recommended Procedures for the Safety Performance of Highway Features

Federal Highway Administration (FHWA):

Manual on Uniform Traffic Control Devices (MUTCD)