GUIDE FOR

Interstate Highways

4R-3R-2R-1R Criteria

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Note: This guide is presented in the original format as it appeared prior to reformatting to the 5 1/2" x 8 1/2" published booklet. The information is the same.

GUIDE FOR INTERSTATE HIGHWAYS
4R-3R-2R-1R CRITERIA

INTRODUCTION

This Guide is directed to developing transportation projects on the Wyoming Interstate System, functionally classified as Principal Arterials. The Guide uses the generally accepted 4R-3R-2R-1R project-type definitions, extended from the traditional highway pavement improvement types to also address geometric design, bridge design, safety design/hardware, capacity considerations and other highway elements.

The criteria presented in this Guide have been developed as recommended practice. Their use should become standard practice to best meet the Department's direction for project designs/contract documents. These criteria may be modified, if 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.

The Criteria presented in this Guide were developed consistent with the WYDOT Mission "To provide a safe, high quality, and efficient transportation system" and related Goal to "Enhance safety on the transportation system." Management systems for safety, pavements, and bridges are used to provide systems-level data supporting project-level decisions. Project -level safety evaluations provide for a systematic approach to the collection of relevant data including crash history, predominant crash type, traffic volumes and vehicle classifications. Safety improvements, to be incorporated into the project design and construction, are evaluated to both improve an existing safety element or address a project purpose of lowering the potential for an identified crash type. Upgrading safety hardware to current safety design standards, constructing clear recovery areas, improved signing and pavement markings, correcting geometric deficiencies, and providing pavement/bridge deck skid resistence, are all considered during the process to develop project scopes that address identified needs and budget funds to construct highway system improvements.

These criteria should guide the initial scope/description of 4R-3R-2R-1R type projects. Changes to the project scope during plan development, to add additional work elements, or use design values higher than initially selected, will be evaluated by Project Development for added cost and overall benefit to the project design. Documentation of the evaluation and resultant change in project design will be included within an amended Reconnaissance Report.

GENERAL DEFINITIONS

1) Functional Classification: Classification of the system of 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 by 1) substantial trip lengths including statewide and interstate travel, 2)

connected travel movements between major urban areas, and 3) full-controlled access integrated with other highway systems and connected at state and national boundaries.

2) Controlling Design Criteria: Controlling design criteria are Minimum Design Speed (MDS), Lane Width, Shoulder Width, Bridge Structure Width, Horizontal Alignment, Cross-Slope, Super-elevation, Vertical Alignment, Grades, Stopping Sight Distance, Horizontal Clearance to Obstructions(Lateral Offset), Vertical Clearance, and Structure Capacity (loading), from the WYDOT *Road Design Manual*. Horizontal Clearance to Obstructions may also be referred to as Lateral Offset, but its definition is not synonymous with the definition of clear recovery area/clear zone, although the design values for Horizontal Clearance to Obstructions may be based on the same computations as used to compute clear recovery areas/clear zones. For 4R type projects, design exceptions may be processed where it is not reasonable to achieve full compliance with AASHTO minimum design values for any of the controlling design criteria. For 3R type projects, design exceptions may be processed where it is not reasonable to achieve full compliance with the tolerable controls. The process for evaluating, justifying, and documenting (including signature authority) the need for a design exception is outlined in the WYDOT *Road Design Manual.*

3) Design, Safety, and Bridge Standards: The standards current with development of this Guide are listed as References. The use of design standards in this Guide refers to the most current adopted version of the referenced standards.

4) Highway Capacity Analysis: This analysis will be completed for the selected design year using procedures in the TRB *Highway Capacity Manual*, or an adopted State analysis method. Interim years, such as 10 years from the year open to traffic, should be analyzed as a basis for decisions required for implementing the criteria in this Guide. For purposes of this Guide, the terms ‘design year’ and ‘design life’ represent the same future year, with that year selected from the anticipated year of project construction. A Level-of-Service (LOS) D has been chosen as the appropriate LOS to warrant capacity improvements for Interstate interchange ramps and intersecting roads. Capacity improvements for mainline Interstate will be warranted based on a LOS C for the selected design year.

5) Project Scope and Funding: Project scopes will be determined at an early planning stage using established management systems for pavement, bridge, safety, and asset management. Early project scoping or the Reconnaissance Phase will develop a consensus on the project purpose, project type, limits, and all location-specific major elements. Projects meeting the 4R-3R-2R-1R criteria presented in this Guide are eligible for State and Federal funding categories.

6) 4R: New construction or reconstruction to provide for the full range of pavement design strategies for plant-mix asphalt pavements to include removal and replacement of a portion or all of the existing pavement structure and base materials. 4R includes construction of portland cement concrete pavements. This type of project will include improvements to address the need for additional continuous travel lanes for added capacity, auxiliary lanes, new interchanges or modification of existing interchanges,

safety clear recovery areas, new or reconstructed bridge structures, and upgrading geometric and other highway elements to design standards. Project designs will meet a minimum 20-year design life.

7) 3R: Restoration or rehabilitation of an existing pavement structure using a full range of pavement design strategies. This project type may include widening to provide for standard shoulder widths or auxiliary lanes, modification of existing interchanges and intersecting roads, safety improvements, reconstructing bridge structures, and upgrading geometric and other highway elements, below tolerable controls, to meet design standards. Project designs will meet a selected design life up to 20 years.

8) 2R: Resurfacing with additional pavement structure to extend serviceability of the roadway pavement. This project type may include grading to maintain the existing paved roadway width (combined travel lanes and shoulder widths), minor safety, bridge, or geometric improvements, and other highway elements to address identified needs for a selected design life up to 15 years.

9) 1R: Preservation of existing pavement structure to extend the service life pending future pavement construction, and reactionary efforts to keep the highway system open to traffic. This type of project will provide a maximum 2" pavement thickness (including leveling thickness), and will not require the selection of a design life.

APPLICATION CRITERIA---INTERSTATE 4R PROJECTS

Pavement Design Process:
Interstate 4R projects provide for the full range of pavement design strategies for plant-mix asphalt pavements to include removal and replacement of a portion or all of the existing pavement structure and base materials. 4R includes construction of portland cement concrete pavements. All 4R designs will provide a minimum 20-year design life. The pavement type determination will meet the procedures of WYDOT *Operating Policy 38-2, Pavement Type Determination.*

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 full-depth pavement structure for 14 feet (12 feet of travel lane plus 2 feet of right shoulder). The remaining right shoulder will be evaluated for a reduced-depth pavement structure, typically a minimum 4-inch plant-mix surface for the full width. The full width of the left lane 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 surface. Auxiliary lanes, including passing, climbing and acceleration/deceleration lanes, will be evaluated for a reduced/modified-depth pavement structure as they carry a differing volume and mix of traffic.

Geometric Design Process and Standards:
Design Process: Interstate 4R projects will be designed to meet design standards for controlling design criteria and best practice for non-controlling geometric elements.

Design Standards: Design standards 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*, and the WYDOT *Road Design Manual*. AASHTO standards identify both minimum and desirable design values for Controlling Design Criteria and these values are presented in Table 1 for the ten Controlling Design Criteria relating to roadway design. AASHTO design values for the three Controlling Design Criteria relating to bridges are presented in Table 2 located in a following section, Bridge Design Process and Standards. These design values are applicable to Interstate mainline sections and are not intended to guide the design of auxiliary lanes including interchange ramps.

Except as footnoted, 4R projects will meet design values approaching the AASHTO minimums when the use of desirable values will result in unacceptable costs or social/environmental consequences.

Table 1. Interstate, 4R Roadway Geometric Controlling Design Criteria

Controlling Design Criteria	Foot Note	AASHTO Minimum Design Values	AASHTO Desirable Design Values
Design Speed (MDS)	1	75 MPH	80 MPH
Lane Widths		12 Feet	12 Feet
Shoulder Widths: Left/Right w/4-Lane Roadway Left/Right w/6-Lane Roadway		 4/10 Feet 10/10 Feet	 4/12 Feet 10/12 Feet
Horizontal Alignment	1,2	75 MPH MDS	80 MPH MDS
Cross-Slope		1.5%	2.0%
Superelevation: (Tables from AASHTO *A Policy on Geometric Design, 2004*)	1	Superelevation Tables, emax = 8%	Superelevation Tables, emax = 8%
Vertical Alignment	1,3	75 MPH MDS	80 MPH MDS
Grades (Maximum): Flat Terrain Rolling Terrain Mountainous Terrain		 3% 4% 5%	 3% 4% 5%
Stopping Sight Distance		820 Feet	910 Feet
Horizontal Clearance to Obstruction (based on 1V:6H or flatter)		Roadside Design Guide (30 Feet)	Roadside Design Guide (30-35 Feet)

Footnotes:

1--Design Speed should be selected to meet or exceed posted speed. For Urban Interstate, a 65-MPH MDS can be selected with matching values for other Controlling Design Criteria.

2--Isolated horizontal curves can be considered to remain in-place when the combination of design elements--curve radius, super elevation, and stopping sight distance--meets a minimum 70-MPH design speed. A Design Exception will be processed justifying the action to leave a horizontal curve in-place.

3--Isolated vertical curves can be considered to remain in-place when the combination of design elements--vertical curve length, grades, and stopping sight distance--meets a minimum 70-MPH design speed. A Design Exception will be processed justifying the action to leave a vertical curve in-place.

Fore-slope rates, the width of clear recovery areas, and median widths are non-controlling geometric elements for which best practice design values have been established by AASHTO. Fore-slopes are measured laterally from the outside edge of shoulder to ditch bottom or point of slope selection on cut sections, and to a point of slope selection on fill sections. The AASHTO minimum fore-slope rate established for Interstate reconstruction projects is 1V:4H with an AASHTO desirable and WYDOT recommended rate of 1V:6H. The first four feet, including the surfacing taper, will be constructed at a minimum 1V:8H using plant-mix or other consolidated and drain-able materials. Design exceptions are not required, but project records should document when it is not reasonable to achieve full compliance with AASHTO minimum design values for this non-controlling design element.

The clear recovery area (clear zone) is measured beyond the edge of the travel lane. Interstate 4R projects will provide for safety grading to meet a project-selected clear recovery area. The width of the clear recovery area is the same as the selected AASHTO design value for Horizontal Clearance to Obstructions, presented above. 4R projects on Interstate highway sections previously constructed with a minimum 30-foot clear recovery area will not require minor grading to further widen the clear recovery area. Beyond the clear recovery area, selection of slope-rates will be based on fill-height tables. Design exceptions are not required for the clear recovery area as it is a non-controlling geometric element. Since the minimum design value for Horizontal Clearance to Obstructions and clear recovery area for Interstate reconstruction projects are the same, a project-selected horizontal clearance width/clear recovery width that does not meet the AASHTO minimum design value for Horizontal Clearance to Obstructions would require a Design Exception.

Median widths are measured between the edges of travel lanes and include the left shoulder widths. The minimum width of medians in rural areas is 36 feet. The minimum width of medians in urban areas is 10 feet. 4R projects should maintain the existing median width with a minimum of 36 feet in rural areas, and a minimum of 10 feet in urban areas. Based on the safety evaluation and resultant crash types required in the Highway Safety Improvement section, medians at these minimum widths should be considered for protection with a longitudinal guardrail barrier.

Bridge Design Process and Standards:
Interstate 4R projects will provide for bridge structure replacement or reconstruction of any element that does not meet design standards. Design standards 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 minimum and desirable design values for Controlling Design Criteria are presented in Table 2.

Except as footnoted, 4R projects will meet design values approaching the AASHTO minimums when the use of desirable values will result in unacceptable costs or social/environmental consequences

Table 2. Interstate, 4R Bridge Geometric Controlling Design Criteria			
Controlling Design Criteria	**Foot Note**	**AASHTO Minimum Design Values**	**AASHTO Desirable Design Values**
Bridge Roadway Width		38 Feet	40 Feet
Vertical Clearance Structure Over Interstate Highway Highway Structure Sign/Utility/Other Structure Structure Over NHS Arterial Structure Over Non-NHS Arterial Structure Over Non-NHS Collector Structure Over Non-NHS Local	1	 16 Feet 17 Feet 16 Feet 16 Feet 14 Feet 14 Feet	For All Structures, add 0.5 Feet of Vertical Clearance to allow for Future Surfacing.
Structural Capacity		HL 93	HL 93

Footnote:

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

Any bridge structure replaced or proposed for reconstruction of major elements will be evaluated for structure type, including location of abutments and piers, and length and width requirements. This evaluation will address future capacity needs of the Interstate system, using a highway capacity analysis based on a minimum 20-year design life. The location of abutments and piers will consider design values for Horizontal Clearance to Obstructions, which vary by highway system crossed (Interstate, NHS Arterial, Non-NHS State Highways).

Highway Safety Improvements:

Early project planning for Interstate 4R projects will include an evaluation of the safety elements of the roadway and roadside. Crash history, predominant crash types, traffic volumes and vehicle classifications, and project scope and budget will all be evaluated to determine the extent of safety improvements needed to improve the existing safety elements, or address a project purpose of lowering the potential for a certain crash type. All roadside safety hardware within the clear recovery area, including bridge curb and railing, guardrail barriers and terminals, bridge-rail to guardrail connections, and sign support breakaway hardware, will be upgraded to meet safety design standards, NCHRP *Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features.*

Highway Capacity Improvements:

Based on a highway capacity analysis, Interstate 4R projects will provide for additional continuous travel lanes needed to meet 20-year projected travel demand. Auxiliary lanes, including truck climbing lanes, will be included, as justified.

Interchanges:
Interstate 4R projects will be evaluated for geometric design, capacity, and safety needs for interchange ramps and the intersecting road. Based on a highway capacity analysis to meet 20-year projected travel demand and design and safety design standards, all improvements will be included in the project plan. Design criteria are presented in the WYDOT *Road Design Manual, supplemented by the AASHTO A Policy on Geometric Design of Highways and Streets, as needed*. The design values, presented in Table 1, are only applicable to Interstate mainline sections and are not intended to guide the design of auxiliary lanes including interchange ramps and acceleration/deceleration lanes. Capacity improvements to the intersecting road or individual ramps may be delayed if not warranted within the first ten years of the selected project design life, and can be programmed for a future stand-alone project. As an alternative, the initially proposed 4R project, to include interchange capacity improvements, may be delayed and a different project type, such as a 2R, may be selected to extend the project life until the capacity improvements are warranted and programmed as a 4R project.

Special Studies:
Cost reduction studies should be considered during the Reconnaissance Phase, including Life Cycle Costing, Value Engineering, and Constructability Reviews. Contract packaging by type of work or special construction requirements, innovative contracting including Cost plus Time, Lane Rental, and Incentive/Disincentive provisions should be evaluated for each project.

APPLICATION CRITERIA---INTERSTATE 3R PROJECTS

Pavement Design Process:
Interstate 3R projects will be designed to restore or rehabilitate the existing pavement structure using a full range of pavement design strategies to a selected design life up to 20 years. The pavement type determination will meet the procedures of WYDOT *Operating Policy 38-2.*

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 full-depth pavement structure for 14 feet (12 feet of travel lane plus 2 feet of right shoulder). The remaining right shoulder will be evaluated for a reduced-depth pavement structure, typically a minimum 4-inch plant-mix surface for the full width. The full width of the left lane will be designed to a full-depth pavement structure. The full left shoulder will be evaluated for a reduced-depth pavement structure, typically a minimum 4-inch plant-mix surface. Any proposed auxiliary lane, including passing, climbing and acceleration/ deceleration lanes, will be evaluated for a reduced/modified-depth pavement structure as they carry a differing volume and mix of traffic.

Geometric Design Process and Standards:
Design Process: Early project planning for Interstate 3R projects will include an evaluation of the existing highway elements against design values, for both controlling design criteria and other major criteria such as fore-slope rates. 3R projects will improve those highway elements related to controlling design criteria that are below tolerable

controls, consistent with WYDOT *Operating Policy 7-1, Design Standards and Tolerable Controls*. Improvements will be designed to meet design standards for controlling design criteria and best practice for non-controlling geometric elements.

Design Standards: Design standards 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,* and the WYDOT *Road Design Manual*. AASHTO standards identify both minimum and desirable design values for Controlling Design Criteria and these values are presented in Table 1 and Table 2. Tolerable controls, relative to those highway elements which can remain in-place for a 3R project, are generally defined as the design values that were in effect at the time of original construction of the Interstate highway section proposed for improvement, or the design values for existing highway elements, related to controlling design criteria, if the roadway has been improved since original construction.

These tolerable controls will be maintained during project design or improved as needed. Tolerable controls, applicable to Interstate mainline sections, are as follows.

Design Speed: 75 MPH is the design standard and tolerable control.

Horizontal Alignment: The combination of design elements for horizontal alignment will meet a minimum 65-MPH tolerable control for design speed. At the 65-MPH MDS, the use of minimum values for curve radius, super elevation, and stopping sight distance (minimum values taken from design standards), should be avoided.

Vertical Alignment: The combination of design elements for vertical alignment will meet a minimum 65-MPH tolerable control for design speed. At the 65-MPH MDS, the use of minimum values for vertical curve lengths, grade differences, and stopping sight distance (minimum values taken from design standards), should be avoided.

Lane Width: All traffic lanes will be at least 12 feet wide.

Shoulder Width: The paved width of the right shoulder will be 10 feet based on minimum design values. 8 feet is the tolerable control width. The paved width of the left shoulder is 4 feet.

Grades: The maximum tolerable grades are as originally constructed. Lessening or changing the profile grade to meet a design standard would typically be addressed as 4R Reconstruction.

Cross Slope: The minimum standard is 1.5 percent with a desirable rate at 2 percent. The tolerable control is 1.5 percent.

Horizontal Clearance to Obstructions: The width for horizontal clearance is determined through application of the procedures for establishing the clear

recovery area from the AASHTO *Roadside Design Guide*. For a 3R project, the tolerable control for horizontal clearance will be the paved shoulder width. When this tolerable control is selected on a highway section that has not previously been safety-graded to provide a clear recovery area, all fixed objects outside of the paved shoulder width but inside a calculated design value for horizontal clearance, will be removed, made breakaway or shielded by crashworthy guardrail. The design value used to provide horizontal clearance on 3R projects should be coordinated with the evaluation of needed safety improvements to be completed during early project planning and further defined in the Highway Safety Improvements section of this Guide. Major safety grading on 3R projects is not required, but each project will be evaluated to determine if safety grading should be included in the project restoration/rehabilitation effort. 3R projects on Interstate highway sections previously constructed to provide a clear recovery area will not require minor grading to further widen for horizontal clearance to meet the procedures of the AASHTO *Roadside Design Guide*.

Fore-slope rates, the width of clear recovery areas, and median widths are non-controlling geometric elements for which best practice design values have been established by AASHTO. Fore-slopes are measured laterally from the outside edge of shoulder to bottom of ditch or to a point of slope selection for a cut section, and to a point of slope selection for fill sections. The AASHTO minimum fore-slope rate and the tolerable control is 1V:4H. The AASHTO desirable and WYDOT recommended rate established for Interstate 3R projects is 1V:6H. The first four feet, including the surfacing taper, will be constructed at a minimum 1V:8H using plant mix or other consolidated and drain-able materials. Design exceptions are not required, but project records should document when it is not reasonable to achieve full compliance with AASHTO minimum design values for this non-controlling design element.

The clear recovery area (clear zone) is measured beyond the edge of the travel lane. The design value and tolerable control widths of the clear recovery area on Interstate 3R projects are the same values, presented above, for Horizontal Clearance to Obstructions. Beyond the clear recovery area, selection of slope-rates will be based on fill-height tables.

Median widths are measured between the edges of travel lanes and include the left shoulder widths. The Interstate system has existing median widths acceptable as the tolerable control. 3R projects should maintain the existing median width with a minimum of 36 feet in rural areas, 10 feet in urban areas. Based on the safety evaluation and resultant crash type, required in the Highway Safety Improvement section, medians at these minimum widths should be considered for protection with a longitudinal guardrail barrier.

Bridge Design Process and Standards:
Design Process: Interstate 3R projects will evaluate bridge structures to determine elements in an advanced state of deterioration. The evaluation will review the roadway width (combined travel lanes and shoulder widths) for improvements to ensure that the bridge width is consistent with the width of the approach roadway. Work needed to extend the functional life of the structure, including structure replacement, widening, or

reconstruction of any element, will be addressed with a 3R project and meet design standards. Any bridge structure replaced or proposed for reconstruction 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 Horizontal Clearance to Obstructions, which vary by highway system crossed (Interstate, NHS Arterial, Non-NHS State Highway).

Design Standards: Design standards 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*. Tolerable controls, relative to those highway elements which can remain in-place for a 3R project, are generally defined as the design values that were in effect at the time of original construction of the Interstate highway section proposed for improvement, or the design values for existing highway elements, related to controlling design criteria, if the roadway has been improved since original construction. These tolerable controls will be maintained during project design or improved as needed. Tolerable controls, applicable to Interstate mainline sections, are as follows.

Bridge Width: Design values for bridge structures provide for a minimum 38 feet of roadway width. The tolerable control, for bridges to remain in place, is 34 feet of roadway width.

Vertical Clearance: The design value for the clear height of Interstate structures, varies by the highway system crossed, and is presented in Table 2.

The tolerable control for vertical clearance of bridge structures is:

Over Interstate: Original constructed clearances, minimum of 15 feet.
Interstate over Interstate: Original constructed clearances, minimum of 15 feet.
Interstate over NHS Arterial: Original constructed clearances, minimum of 14 feet.
Interstate over Non-NHS Arterial: Original constructed clearances, minimum of 14 feet.
Interstate over other Non-NHS State Highway: Original constructed clearances.

3R projects will maintain the existing clearances, with the noted minimums, and can include, if needed, grade changes and structure modifications. Raising structures or reconstructing mainline grades to meet the design value of 16 feet over the roadway width would typically be addressed as 4R Reconstruction.

Structural Capacity: The design value for new bridges is a HL 93 structural capacity. A bridge can remain in-place if its inventory rating is 0.8 or greater.

Highway Safety Improvements:
Early project planning for Interstate 3R projects will include an evaluation of the safety elements of the roadway and roadside, including the clear recovery area, median widths, existing fore-slope rates, and all existing roadside safety hardware. Crash history,

predominant crash types, traffic volumes and vehicle classifications, and project scope and budget will all be evaluated to determine the extent of safety improvements needed to improve the existing safety elements or address a project purpose of lowering the potential for a certain crash type. All roadside safety hardware within the clear recovery area will be evaluated, including bridge curb and railing, guardrail barriers and terminals to include length-of-need, bridge-rail to guardrail connections, and sign support breakaway hardware. Upgrading roadside safety hardware to safety design standards, NCHRP *Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features*, may be included in the project plans or, consistent with the Safety Management System, be phased as a future programmed project or stand-alone safety project. As presented in an earlier section on Horizontal Clearance to Obstructions, a 3R project design that uses the paved shoulder width for horizontal clearance on a highway section that has not been previously constructed with a clear recovery area must upgrade safety hardware to safety design standards.

Highway Capacity Improvements:
3R projects are not intended to provide for additional continuous Interstate travel lanes. Future year Interstate system capacity needs would typically be evaluated as part of a 4R Reconstruction.

Interchanges:
Interstate Mainline: 3R projects will provide for Interstate mainline acceleration and deceleration auxiliary lanes (A/D lanes). As defined in the WYDOT *Road Design Manual*, full length and full width A/D lanes, are the applicable design values. Tolerable controls will provide A/D lengths and widths up to the applicable design values, without requiring the widening of adjacent mainline structures.

Interstate-to-Interstate and Service Interchanges: Interchanges within project limits will be evaluated for needed pavement improvements to ramps or the intersecting road. If the pavement structure or riding surface does not require improvement, no further interchange analysis will be conducted. For those projects that propose pavement improvements consistent with the selected project design life, early project planning will evaluate geometric design, capacity and safety needs for interchange ramps and the intersecting road. The design values to be used are defined in the WYDOT *Road Design Manual,* supplemented by the AASHTO *A Policy on Geometric Design of Highways and Streets*, as needed. The tolerable controls will maintain the existing roadway width of ramps and the intersecting road. Capacity improvements to the intersecting road or individual ramps will be made as part of the project plan or may be delayed, if not warranted within the first ten years of the selected project design life. Bridge structure widening on the intersecting road will be consistent with a minimum 20-year highway capacity analysis of both the intersecting road and mainline Interstate.

Interchange lighting will be evaluated and included in the project scope consistent with WYDOT Traffic Program criteria, WYDOT *Operating Policy 25-1, Traffic Control and Roadway Lighting Devices*.

Interstate 'Junior' Interchanges: WYDOT Planning maintains an inventory of this interchange type which typically provides access to ranches/farm's and BLM roads, but with minimal ramp design criteria, and low current and design year travel volumes on the ramps and intersecting road. If the pavement structure or riding surface does not require improvement, no further interchange analysis will be conducted. For those projects that propose pavement improvements, early project planning will evaluate geometric design, capacity and safety needs for interchange ramps and the intersecting road. Reconstruction of this interchange type is not intended on a 3R project, but can be included based on a highway capacity analysis or delayed if not warranted in the first ten years of the selected project design life.

Special Studies:
Cost reduction studies should be considered during the Reconnaissance Phase, including Life Cycle Costing, Value Engineering, and Constructability Reviews. Contract packaging by type of work or special construction requirements, and innovative contracting including Cost plus Time, Lane Rental, and Incentive/ Disincentive provisions should be evaluated for each project.

APPLICATION CRITERIA---INTERSTATE 2R PROJECTS

Pavement Design Process:
Interstate 2R projects will be designed to resurface the existing pavement structure to a selected design life up to 15 years. Project types include level/mill and overlay, concrete pavement restoration and dowel bar retrofits.

Geometric Design Process and Standards:
Design Process: Early project planning for Interstate 2R projects will include an evaluation of the horizontal alignment for existing curve radius and super-elevation, and the resultant design speed. The evaluation will determine if either of those highway elements is below tolerable controls defined above in the Application Criteria—Interstate 3R Projects. If the horizontal alignment warrants improvement, the selected improvements will meet design values in Table 1. 2R projects are not intended to improve all highway elements that do not meet tolerable controls. Project records such as a Project Evaluation Report will document the evaluation results and justify delaying the improvement of highway elements that do not meet tolerable controls. The formal Design Exception process is not applicable to 2R projects.

Design Standards: 2R projects will maintain the existing roadway width. For those highway segments where the existing roadway width exceeds the design values presented in Table 1, the roadway width may be reduced to meet design values in Table 1.

Bridge Design Process and Standards:
Bridge structures will be evaluated to determine elements in an advanced state of deterioration. Work, generally defined as bridge preservation to extend the functional life of the structure, may be included with a 2R project, including bridge deck repairs or overlays.

Highway Safety Improvements:
2R projects are not intended to improve all roadside features.

Early project planning for Interstate 2R projects will include an evaluation of existing roadside safety hardware. Upgrading roadside safety hardware to safety design standards, NCHRP *Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features* may be included in the project plan or, consistent with the Safety Management System, be phased as a future programmed project or safety project.

Pavement edge drop-offs, that result from the constructed project, will be corrected on a 1V:4H or flatter.

Highway Capacity Improvements:
2R projects are not intended to provide for additional continuous Interstate travel lanes or auxiliary lanes. Future year Interstate system capacity needs would typically be evaluated as part of a 4R Reconstruction.

Interchanges:
Interstate 2R projects, structured to address Interstate mainline pavement resurfacing needs, are not intended to improve the geometric design, capacity or safety needs for interchange ramps and the intersecting road, or improve mainline auxiliary lanes. The evaluation of interchange needs will be part of a 3R or 4R type project. A 2R project may include resurfacing of ramps and crossroads while maintaining existing widths.

APPLICATION CRITERIA---INTERSTATE 1R PROJECTS

Pavement Design Process:
Interstate 1R projects are defined as those pavement preservation strategies and reactionary efforts designed for a maximum 2" pavement thickness (including leveling thickness). Project types include overlays, partial width mill/fills, chip seals, micro-surfacing, crack seals, wearing courses, grind and reseals, and slab repairs.

Geometric Design Process and Standards:
Design Process: Interstate 1R projects, structured to solely address Interstate mainline pavement preservation needs, are not intended to improve the existing mainline geometric elements.

Design Standards: 1R projects will maintain the existing roadway width. For those highway segments where the existing roadway width exceeds the design values presented in Table 1, the roadway width may be reduced to meet design values in Table 1.

Bridge Design Process and Standards:
Work, generally defined as bridge preservation to extend the functional life of the structure, may be included with a 1R project, including bridge deck repair and overlays.

Highway Safety Improvements:
1R projects are not intended to improve roadside safety features.

Pavement edge drop-offs, that result from the constructed project, will be corrected on a 1V:4H or flatter.

Highway Capacity Improvements:
1R projects are not intended to provide for additional continuous Interstate travel lanes, or auxiliary lanes. Future year Interstate system capacity needs would typically be evaluated as part of a 4R Reconstruction.

Interchanges:
Interstate 1R projects are not intended to improve the geometric design, capacity or safety needs for interchange ramps and the intersecting road, or improve mainline auxiliary lanes. The evaluation of interchange needs will be part of a 3R or 4R type project.

REFERENCES

The References presented in this Guide are current and adopted editions. As these references are revised and new editions adopted, all references in this Guide are intended to refer to the most current and adopted edition. For example, NCHRP Report 350, when updated, may be renamed or have a different sponsoring agency, but when adopted, will be the edition required for use by this Guide.

AASHTO: *A Policy on Design Standards Interstate System, January 2005.*

AASHTO: *A Policy on Geometric Design of Highways and Streets, 2004.*

AASHTO: *Roadside Design Guide, 2002.*

TRB: *Highway Capacity Manual Special Report 209, 2000*

NCHRP: *Report 350, Recommended Procedures for the Safety Performance Evaluation of Highway Features*

WYDOT: *Road Design Manual* & *Road Design Manual Memorandums (RDMM)*

WYDOT: *Operating Policy -*
Policy Number 38-2 Pavement Type Determination
Policy Number 7-1 Design Standards and Tolerable Controls
Policy Number 25-1 Traffic Control and Roadway Lighting Devices

WYDOT: *Standards for 4-Lane Rural Roadways*