

Wyoming

Connects



Corridor 9 Plan

WORLAND TO BUFFALO



MAY 2013

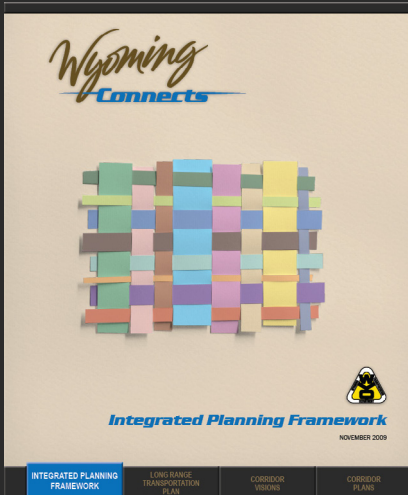
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FRAMEWORK

LONG RANGE
TRANSPORTATION
PLAN

CORRIDOR
VISIONS

CORRIDOR 9
PLAN



The Integrated Planning Framework describes the planning process in detail, including the linkage between strategic goals and project programming - and all the steps in between.



The Long Range Transportation Plan evaluates the state transportation needs from a systems level, describes the issues and problems facing the State including future revenue and programming, and presents options for future investments, all within the context of the Integrated Planning Framework.



Corridor Visions are created for each State Significant Corridor (SSC) as a supplement to the LRTP. These define long term goals and objectives for each corridor based on the strategic goals of the Department, the investment goals of the LRTP, and the specific context of each corridor. The SSC system represents high volume routes in the state that connect major activity centers to each other and to points external to Wyoming. Urban areas are also evaluated as a group.



Corridor Plans build on the Corridor Visions by providing a more detailed look at specific needs and location-based solutions. The plans identify a set of solutions and a recommended program of improvements to be implemented over time that address specific, documented needs.

CORRIDOR PLAN PURPOSE

This Corridor Plan is part of a set of documents created through a comprehensive planning process entitled Wyoming Connects. This set of documents captures consistent, transparent, and repeatable planning steps, analysis, and results designed to provide information to guide project selection and programming decision makers. Each document is designed to build upon prior documents and cascade the Strategic Goals of WYDOT forward from the overarching Strategic Plan to the system wide Long Range Transportation Plan, applied in the development of Corridor Visions, and the definition of Needs and potential Solutions to achieve the vision in Corridor Plans.

PERFORMANCE BASED NEEDS

The Corridor Plan utilizes a performance based approach to needs definition. A system of performance measures is used to evaluate the corridor. The architecture of this tiered system is focused on the three Investment Categories identified in the Long Range Transportation Plan: System Preservation, Safety, and Mobility. Performance measures include both absolute and comparative targets. Absolute measures gauge progress towards long term goals, while comparative measures between corridor and system performance provide information to assist in prioritization.

A need is defined as a deviation between these targets and measured performance. The first tier of the system allows for rapid identification of need in each of the Investment Categories through a Performance Indicator. The second tier provides additional information to qualify potential causes through a set of Performance Qualifiers. GIS based Mapping Analysis tools provide for a spatial analysis of these measurements to further investigate causes and identify overlapping needs.

TIERED APPROACH:

A method to evaluate performance goals at a general level and then advance through the system/hierarchy to filter data and define needs.

INVESTMENT CATEGORY

PERFORMANCE INDICATOR:

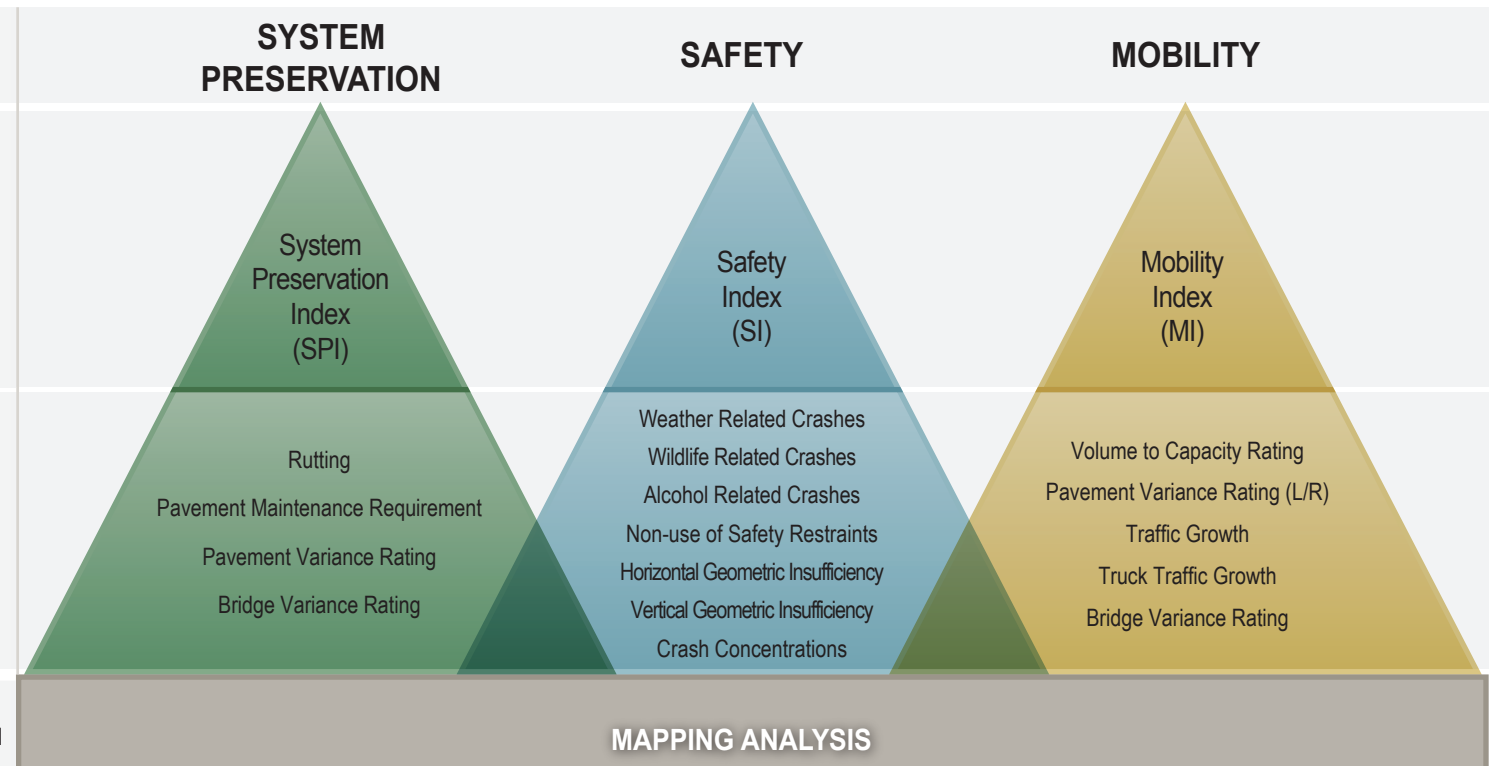
These are quantifiable and repeatable measurements that reflect the overall performance of the transportation corridor being analyzed. Targets for these indicators may be absolute and indicate a desired condition or comparative to current performance of the overall system to indicate relative priority.

PERFORMANCE QUALIFIER:

These measures include items that may contribute to the results of the indicator. These variables are measurable and actionable. They are used to qualify the need so that solution sets may be applied.

MAPPING ANALYSIS:

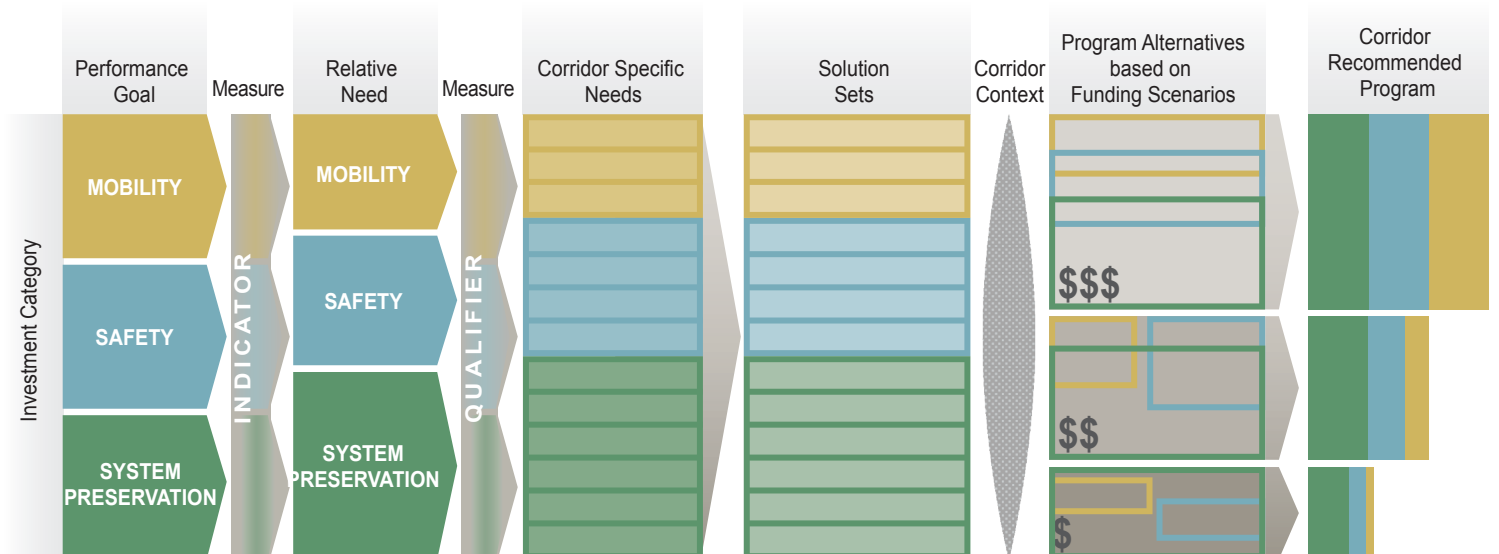
Mapping the deviated performance qualifiers against several factors to effectively prioritize, locate, and identify needs.



NEEDS DRIVEN SOLUTIONS:

Performance based needs are captured and documented. These needs remain until the performance is changed. This approach also separates the discussion of need from the discussion of projects, which enhances the transparency of prioritization.

From WYDOT's list of preferred remedies to specific problems, preliminary solutions sets are developed for the identified needs. These sets may be tailored by the specific context of the corridor. For each of the three funding scenarios of the long range plan, the solutions to be considered may vary and the size of the program change. A recommended program can be selected based on anticipated funding levels.



SSC 9 - WORLAND TO BUFFALO - US 16 CORRIDOR PLAN

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I. STATE SIGNIFICANT CORRIDOR 9 - DESCRIPTION

CORRIDOR DESCRIPTION

State Significant Corridor (SSC) 9 follows US 16 from Worland to Buffalo via Powder River Pass. The 92 mile corridor passes through the three counties, Washakie and Johnson, and WYDOT Districts 4 and 5. Washakie County is a leading producer of sugar beets, corn, small grains, alfalfa hay, and beans on mostly irrigated land. Johnson County is also agricultural, with a lot of large, old ranching operations. Buffalo is a significant gateway to the Big Horn Mountains.

The Corridor is mostly agricultural from Worland to Ten Sleep, and then begins to climb the western foothills of the Big Horn Mountains. Just east of the town of Ten Sleep, SSC 9 travels through Ten Sleep Canyon, which ascends 3,000 feet in less than 10 miles through a series of switchbacks.

As SSC 9 continues into the Big Horn Mountains, it crosses Powder River Pass at an elevation of 9,666 feet. The Cloud Peak Scenic Byway overlays the Corridor

from east of Ten Sleep to just west of Buffalo. This part of the corridor attracts recreational travelers locally and nationally. Recreational uses include all-terrain vehicles, snowmobiles, fishing, hiking, hunting, camping, and skiing.

US 16 makes a steep descent into the town of Buffalo, with a grade of six to seven percent in many places. SSC 9 intersects the US 87 business route in downtown Buffalo, crosses I-25, and terminates I-90 just outside of Buffalo. The entire length of SSC 9 is also designated as part of the Northern Tier East West Bicycle Route.

Additional information including environmental context, key issues, and emerging trends is provided in the Corridor Visions and LRTP phases of Wyoming Connects. This Corridor Plan focuses on the identification of the corridor needs through the analysis of corridor performance.

CORRIDOR SEGMENTS

SSC 9 has been divided into 6 planning segments. Planning segments identify generally consistent sections of the corridor for planning level analysis. The planning segments vary in length depending on the context of the corridor. The corridor was segmented at all urban areas and at the intersection of other SSCs. Other context changes may include: roadway typical section (through lanes, shoulders, etc.), average daily traffic, intersecting routes, and terrain. Each segment break or endpoint was assigned as closely as possible to the nearest maintenance section endpoint; segments generally encompass multiple maintenance sections. The planning segments allow for an appropriate analysis and evaluation of corridor needs at a planning level while still providing geographic reference.

Table 1 and the accompanying map on the next page describe general characteristics of each corridor segment.



Historic barn west of Buffalo

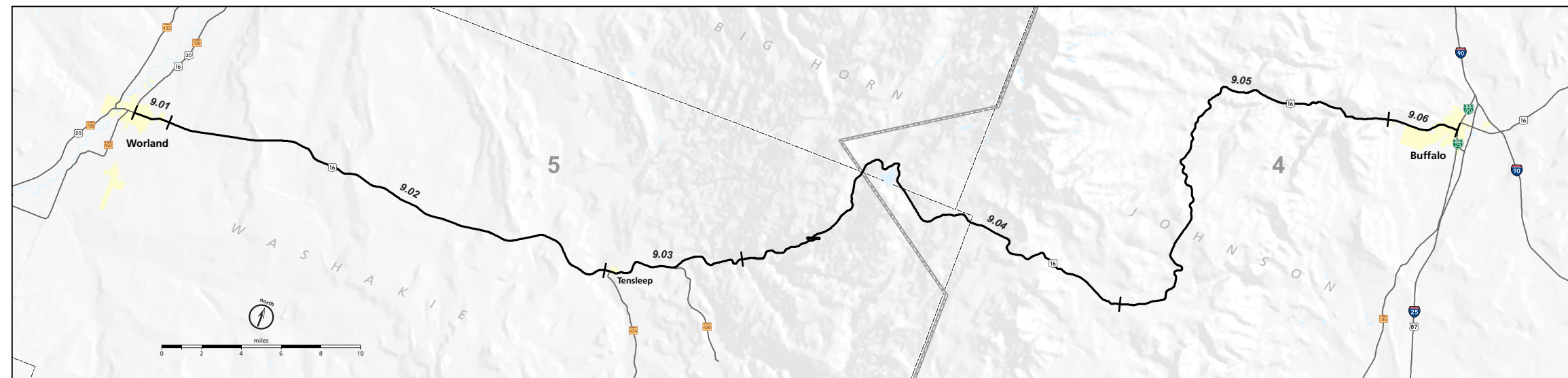
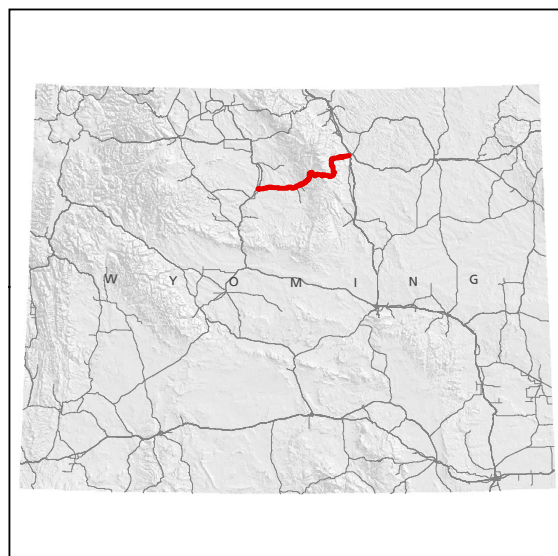


Table 1 - Segments for State Significant Corridor 9

Corridor 9	Segment	ML Route	Begin	End	Length	Description
	9.01	36	0.00	1.94	1.94	Worland Urban Area (pop. 4,958). Features: 4-5 lane cross section with curb, gutter, sidewalks, traffic signals, pedestrian crossings; segment begins at SSC 8 (US 16/20 WYO 789); Worland Municipal Airport; intercity bus route and station; Northern Tier East/West Bicycle Route; fully developed corridor with residential and commercial land uses; agricultural center; urban terrain.
9.02	36	1.94	26.76	24.82	Worland to Tensleep. Features: 2-lane cross section; Slick Creek, Cottonwood Creek, Nowood River; segment ends at Local Route WYO 434; BLM range and ranch lands; access to recreation and tourism land uses; Northern Tier East/West Bicycle Route; rolling terrain.	
9.03	36	26.76	34.00	7.24	Tensleep to Tensleep Canyon. Features: 2-lane cross section with a passing area; intersects Local Routes WYO 436, 435; Ten Sleep Creek (2), Ten Sleep Branch Creek, Canyon Creek; road close gate; BLM range and ranch lands; access to recreation and tourism land uses; enters Bighorn National Forest; Northern Tier East/West Bicycle Route; rolling to mountainous terrain.	
9.04	36	34.00	63.37	29.37	Powder River Pass. Features: 2-lane cross section with occasional passing lanes west side; steep grades; runaway truck ramp; Tensleep Creek, East Ten Sleep Creek; road close gates; Bighorn National Forest; access to recreation and tourism land uses; wildlife crossings; sensitive environmental areas; Cloud Peak Skyway Scenic Byway; Northern Tier East/West Bicycle Route; mountainous terrain.	
9.05	36	63.37	88.39	25.02	Powder River Pass to Buffalo. Features: 2-lane cross section; multiple passing lanes; steep grades; runaway truck ramp; road close gate; Bighorn National Forest; access to recreation and tourism land uses; wildlife crossings; Cloud Peak Skyway Scenic Byway; Northern Tier East/West Bicycle Route; mountainous terrain.	
9.06	36	88.39	92.12	3.72	Buffalo (pop. 4,832). Features: Multi-lane cross section with curb, gutter, sidewalks, traffic signals, pedestrian crossings; transition from rural to urban area with multiple local accesses; fully developed corridor with residential and commercial land uses; recreation and tourism center; intercity bus station; Northern Tier East/West Bicycle Route; urban terrain.	

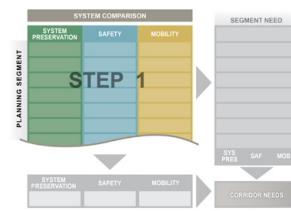
Source: URS Windshield Survey June 2012; Maintenance Section Reference Book 2012; Wyoming Connects: LRTP and Corridor Visions. Note: Descriptions of beginning and endpoints are approximate.



II. EVALUATION OF CORRIDOR PERFORMANCE

This section describes the evaluation of specific corridor needs based on the performance based process defined in the IPF. The Performance Based Needs Process, shown below, illustrates the steps followed for this corridor plan. Indicative Performance measures based on existing or simply defined index measurements for each investment category of System Preservation, Safety, and Mobility were evaluated to preliminarily identify need relative to long term goals. Qualifying performance measures were evaluated to better assess contributing factors to the primary need indicators. The indicators and qualifiers were evaluated and analyzed relative to system averages and, when available, previously specified performance targets. This gap analysis identifies locations where needs exist, qualifies the nature of the need, and provides information on the priority relative to the system of SSCs and available funding.

Many of the measures were established as comparisons to the system average, therefore good performance indicates performance better than the system average. The reverse is also true, poor performance indicates that performance is below the average or rated as poor for a particular indicator or qualifier. As additional corridors are evaluated, specific performance targets may be set to measure absolute performance. The IPF process recommends a mix of absolute measures to evaluate true need relative to long term goals and comparative measures to assist in determining priority.



STEP 1: SUMMARY OF INDICATOR AND QUALIFIER PERFORMANCE MEASURES

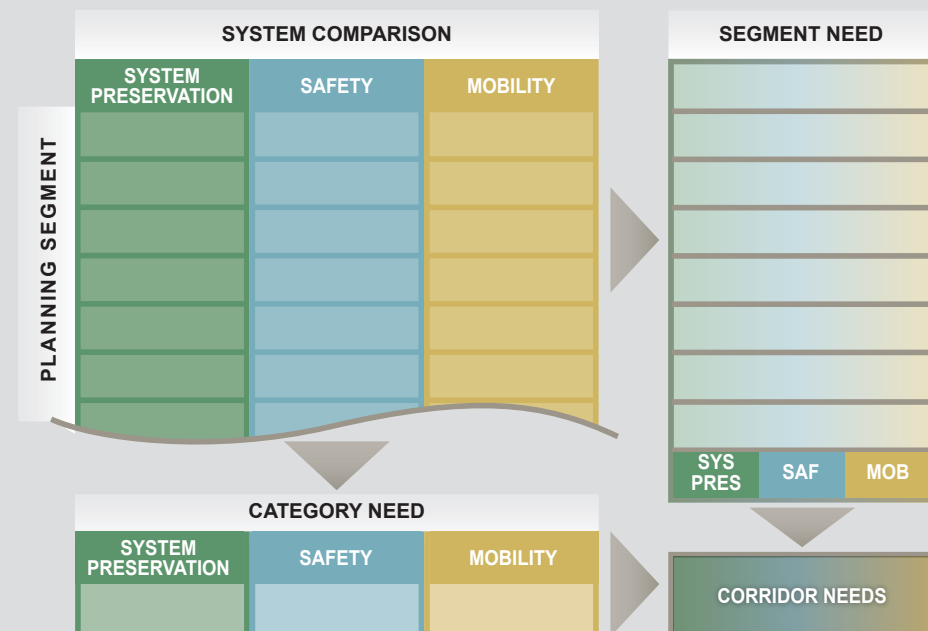
This corridor plan evaluates System Preservation, Safety, and Mobility performance using the process described in the Integrated Planning Framework, published separately. The plan analyzes the performance of planning segments described in Table 1 as compared to system averages. It identifies good, fair, poor or less, average, more performance for each segment in an overall index and for each contributing qualifier measurement.

Throughout this report, the color green is used to represent System Preservation, blue represents Safety, and yellow represents Mobility. Lighter shades represent better performance and darker shades represent worse performance compared to the system average.

Table 2 summarizes the results for each performance index and qualifier for each planning segment on the corridor.

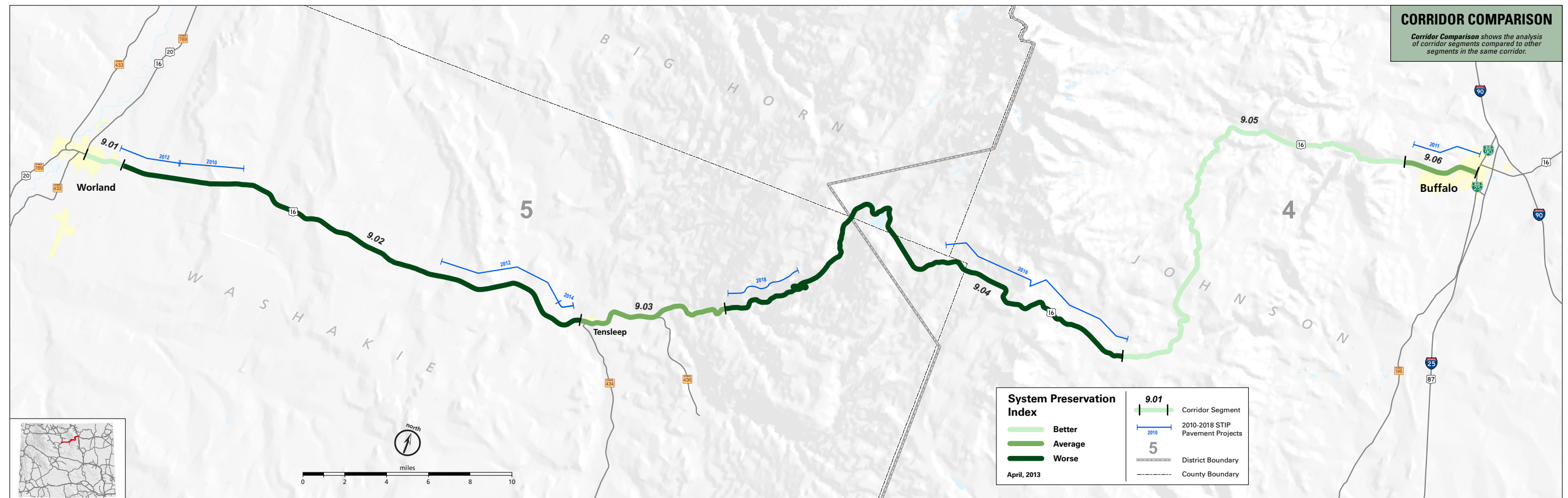
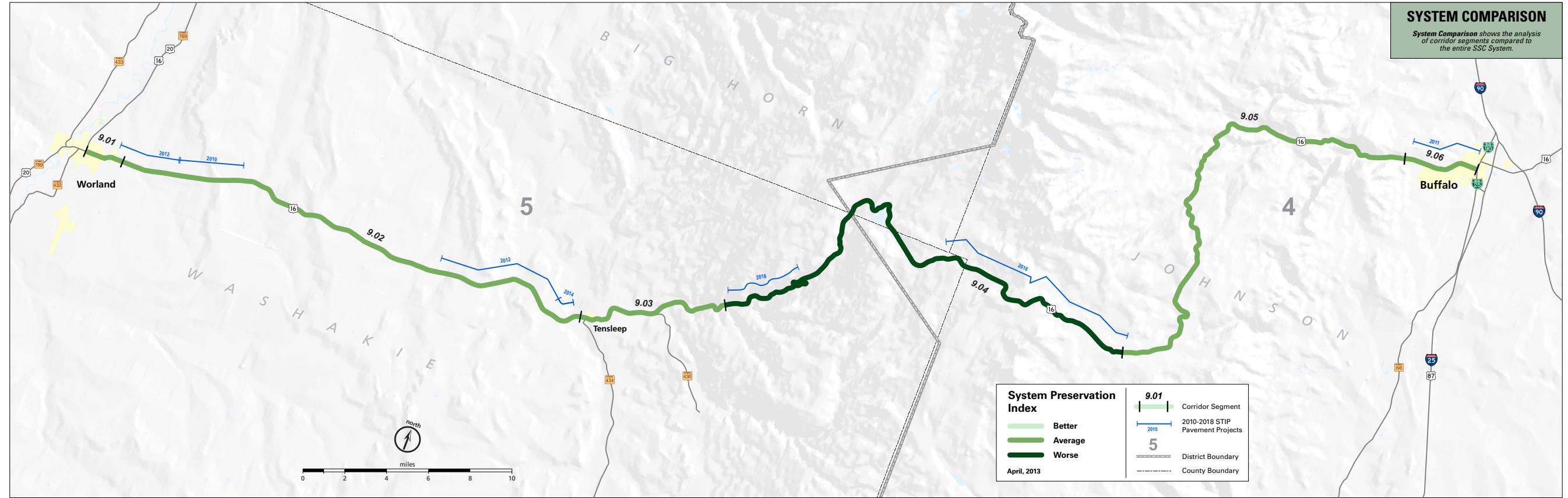
Table 2 - Indicator and Qualifier Performance of SSC 9

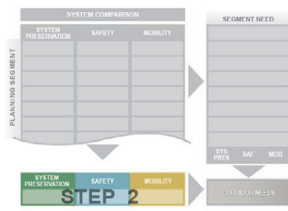
Segment	SYSTEM PRESERVATION					SAFETY								MOBILITY					
	System Preservation Index	Rutting	Pavement Maint. Requirement	Pavement Variance Rating	Bridge Variance Rating	Safety Index	Weather Related Crashes	Wildlife Related Crashes	Alcohol Related Crashes	Non-use of Safety Restraints	Horizontal Geometric Insufficiency	Vertical Geometric Insufficiency	Crash Concentrations	Mobility Index	Volume to Capacity Rating	Pavement Variance Rating (L/R)	Traffic Growth	Truck Traffic Growth	Bridge Variance (L/R)
9.01	Average	Good	Average	Good	Less	Good	Average	Less	Average	Average	Less	Less	Good	Better	Good	Poor	Average	Less	Less
9.02	Average	Fair	Average	Fair	Average	Fair	Average	Average	More	Average	Average	Less	Good	Better	Good	Poor	Average	Average	Less
9.03	Average	Good	Average	Fair	Less	Good	Less	Average	More	Average	More	More	Good	Average	Good	Poor	Less	Average	Average
9.04	Worse	Good	Average	Fair	Average	Good	More	Average	Average	Average	More	More	Fair	Better	Good	Poor	Less	Average	Less
9.05	Average	Good	Average	Good	Less	Fair	Average	Average	Less	Average	More	More	Good	Better	Good	Poor	Average	Average	Less
9.06	Average	Good	Less	Fair	Less	Fair	Average	Average	Average	Average	Less	Less	Good	Average	Good	Poor	Less	Less	Less





CORRIDOR 9





Performance Index

The System Preservation Index is average, with the exception of segment 9.04, which is worse than average.

Refer to the sections below for more information.

SYSTEM PRESERVATION					
Segment	System Preservation Index	Rutting	Pavement Maint. Requirement	Pavement Variance Rating	Bridge Variance Rating
9.01	Average	Good	Average	Good	Less
9.02	Average	Fair	Average	Fair	Average
9.03	Average	Good	Average	Fair	Less
9.04	Worse	Good	Average	Fair	Average
9.05	Average	Good	Average	Good	Less
9.06	Average	Good	Less	Fair	Less

Performance Qualifiers

Rutting

There are no locations where the pavement falls within the poor category for rutting.

Pavement Maintenance Requirements

The pavement maintenance sections that were recommended by the Pavement Management System (Agile Assets) and not yet selected to receive funding within the STIP will continue to decline. If not treated fairly soon, the treatments will become more costly as conditions deteriorate.

Approximately 11% of Corridor 9 has been identified as having a 1S need. This represents 10 miles of pavement. Segment 9.04 has a 1S treatment recommended by the Pavement Management System. Based upon current available funding, only one project, representing 2.5 miles of pavement, has been selected to be completed within the next several years.

Approximately 72% of Corridor 9 has been identified as having a 2S need. This represents 65 miles of pavement. Segments 9.01, 9.02, 9.03, 9.04, 9.05, and 9.06 have 2S treatment recommended by the Pavement Management System. Based upon current available funding, only two projects, representing 17.3 miles of pavement, have been selected to be completed within the next several years.

Approximately 19% has been identified as having a 3S need. This represents 18 miles of pavement. Segments 9.01, 9.02, 9.04, and 9.05 have 3S treatment recommended by the Pavement Management System. Based upon current available funding, no projects have been selected to be completed within the next several years.

Based upon current available funding within the STIP, Corridor 9 has identified one 4S project, representing 2.6 miles of pavement.

Pavement Variance Rating

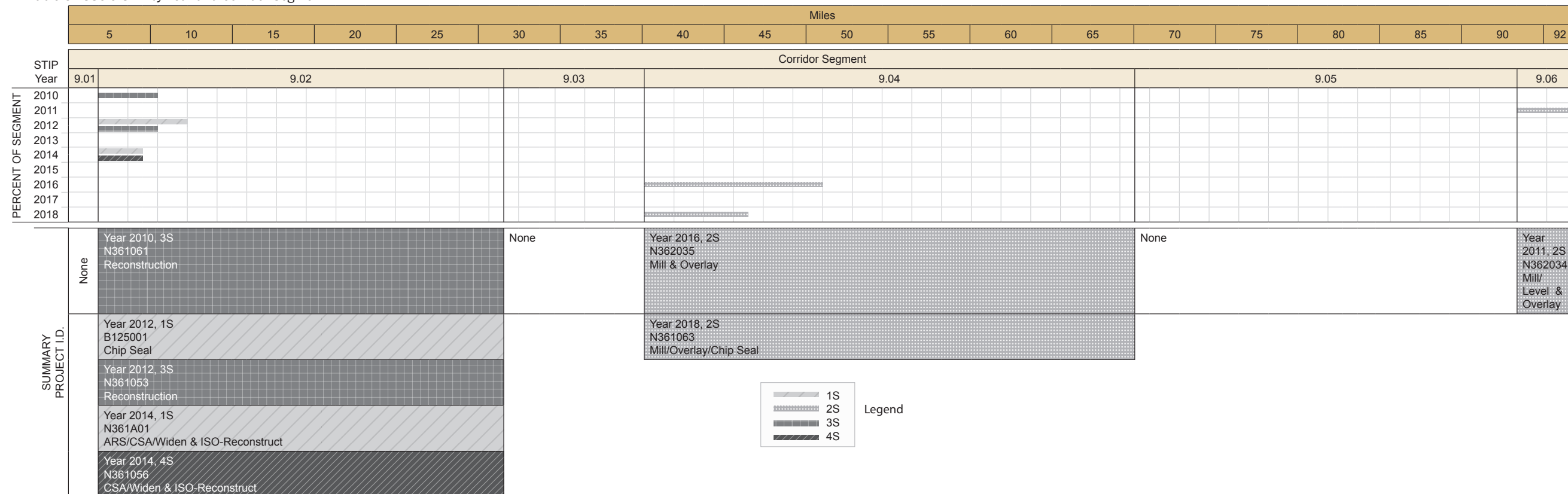
The Pavement Variance Rating is fair or better for the entire corridor. Pavement hotspots, identified by length and severity, occur in Buffalo Segment 9.06 (most severe), and three other locations (moderately or least severe).

Bridge Variance Rating

The Bridge Variance Rating for most of the corridor is average or better than the system average. All segments have at least one bridge with the exception of Segments 9.05 and 9.06. There are two structurally deficient bridges along SSC 9, both with bridge decks under 15,000 ft² and the lowest WYDOT severity rating. The structurally deficient bridges are in Segments 9.02 (1) and 9.04 (1), resulting in a Bridge Variance Rating of average when compared to the system average.

NOTE: See Appendix for maps documenting each performance qualifier.

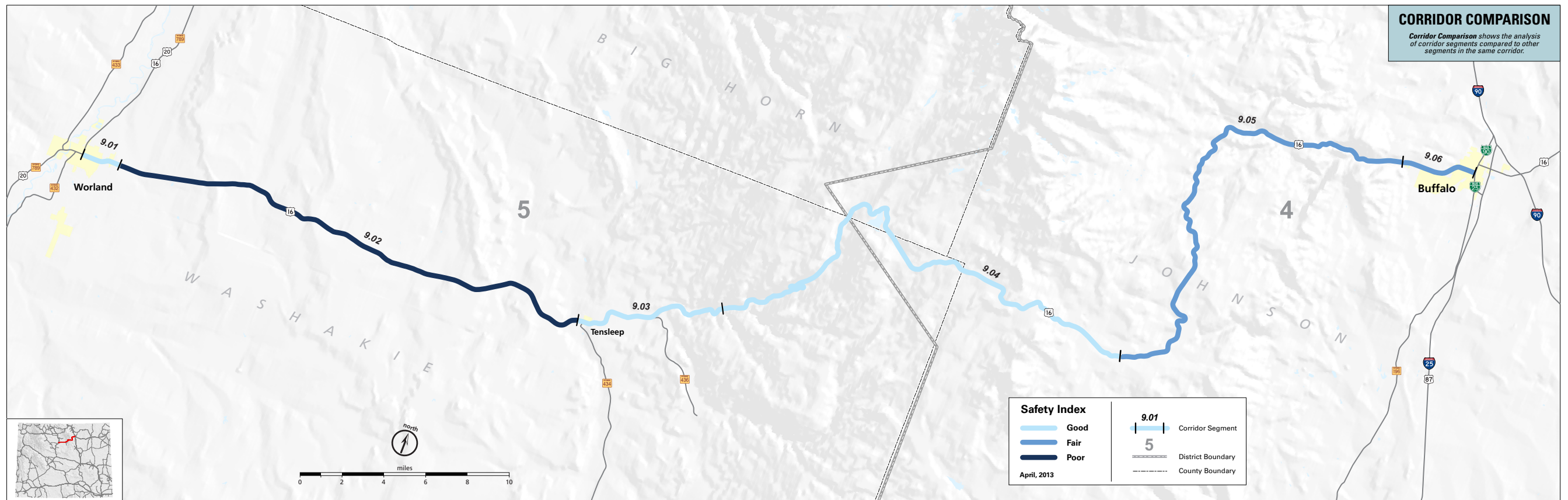
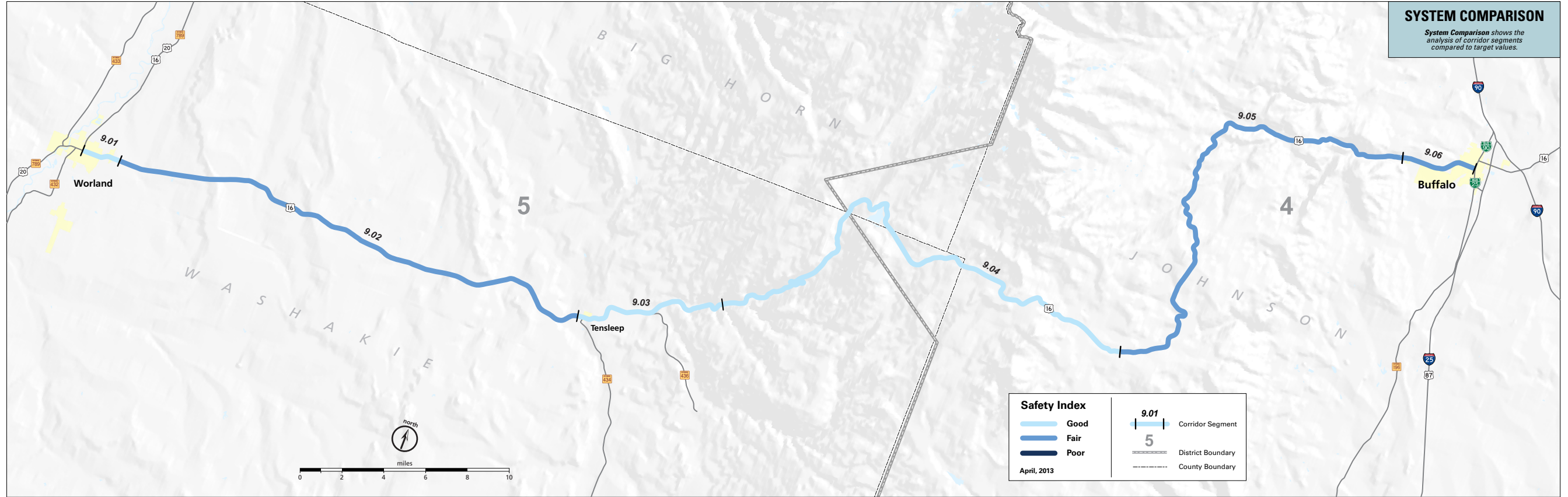
Table 3 - SSC 9 STIP by Year and Corridor Segment

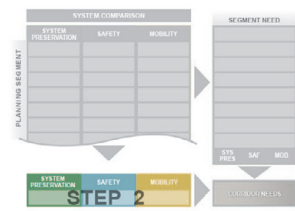




CORRIDOR 9

SAFETY - INDEX





Performance Index

The Safety Performance Index ranges from good to fair across the corridor.

Performance qualifiers with poor performance include:

- Weather Related Crashes are more than the average on segment 9.04.
- Alcohol Related Crashes are more than the average on segments 9.02 and 9.03.
- Crashes on Horizontal Geometric Insufficient Curves are more than the average on segments 9.03, 9.04, and 9.05.
- Crashes on Vertical Geometric Insufficient Curves are more than the average on segments 9.03, 9.04, and 9.05.

Refer to the sections below for more information.

Segment	SAFETY							
	Safety Index	Weather Related Crashes	Wildlife Related Crashes	Alcohol Related Crashes	Non-use of Safety Restraints	Horizontal Geometric Insufficiency	Vertical Geometric Insufficiency	Crash Concentrations
9.01	Good	Average	Less	Average	Average	Less	Less	Good
9.02	Fair	Average	Average	More	Average	Average	Less	Good
9.03	Good	Less	Average	More	Average	More	More	Good
9.04	Good	More	Average	Average	Average	More	More	Fair
9.05	Fair	Average	Average	Less	Average	More	More	Good
9.06	Fair	Average	Average	Average	Average	Less	Less	Good

Performance Qualifiers

Weather Related Crashes

The ratio of weather related crashes to total crashes varied within SSC 9 from below the system average to slightly above the system average. The highest percentage of weather related crashes occurred in segments 9.04 (36.3%) and 9.05 (32.6%). The adverse conditions identified most was snowfall with snow, slush, or ice/frost on the roads. The lowest percentage of weather related crashes occurred in segment 9.03 (11%).

Wildlife Related Crashes

Corridor 9 received an average rating with respect to vehicle/wildlife collisions. These segments were consistent in their rating involving wildlife. Most segments received a rating of approximately 25% of accidents involved wildlife. The one outlier was segment 9.01, which had a low rate (11%) of vehicle accidents involving wildlife. This segment is near the city of Worland.

Alcohol Related Crashes

The percentage of alcohol related crashes is at or below the system for most of the corridor. Segments 9.02 and 9.03, the segments on each side of Ten Sleep, had a percentage rate higher than the system average.

Non-use of Safety Restraint

In SSC 9, the ratio of crashes in which a restraint device was not worn to total crashes is at or below the system average. Segment 9.05 had the highest percentage (65.98%) of crashes in which seat belts were not worn.

Horizontal Geometry Insufficiency

Several horizontal alignments were found to be insufficient based on the associated posted speed and an assumed emax of 8%. Segments 9.03, 9.04, and 9.05 has the most insufficient horizontal alignments within the segment. Further study will need to take place to determine specific needs of each alignment and the constraints to which it was designed and built.

Following is a summary of locations where a horizontal insufficiency corresponded to a crash. The data is not clear if the crash was directly related to geometry. However, locations with several accidents should be further studied. Table 4 summarizes locations of insufficient curves with more than one crash in near vicinity within the 5 year accident analysis period.

Table 4 - Horizontal Geometry Insufficiency

Segment	ML Route	Route Marker	# of Crashes
9.04	ML36	36.45	2
9.04	ML36	45.43	3
9.04	ML36	46.35	2
9.04	ML36	47.05	2
9.04	ML36	55.05	2
9.05	ML36	65.04	2
9.05	ML36	73.97	2
9.05	ML36	84.47	3

Vertical Geometry Insufficiency

Several vertical alignments were found to be insufficient based on the associated posted speed and the length of the curve for stopping sight distance. Segments 9.03, 9.04, and 9.05 have the most insufficient vertical alignments within the segment. Further study will need to take place to determine specific needs of each alignment and the constraints to which it was designed and built.

Table 5 summarizes locations where a vertical profile corresponded to a crash. The data is not clear if the crash was directly related to the geometry. However, locations with several crashes should be further studied. The table summarizes locations of insufficient profiles with more than one crash in the near vicinity within the 5 year crash analysis.

Table 5 - Vertical Geometry Insufficiency

Segment	ML Route	Route Marker	Curve Type	# of Crashes
9.04	ML36	46.35	CREST	2
9.04	ML36	46.49	SAG	6
9.04	ML36	49.95	SAG	2
9.04	ML36	54.00	CREST	3
9.04	ML36	58.98	SAG	3
9.05	ML36	70.02	CREST	8
9.05	ML36	81.01	SAG	3
9.05	ML36	81.73	CREST	2

Crash Concentrations

Crash concentrations are identified by locating spatially significant clusters of individual crash events that are of a similar severity level. The concentrations fall into one of two severity types: Critical, which consists of only "Critical" level crashes; and Other, which consists of "Severe" and "Damage" level crashes.

There is one Critical concentration on Corridor 9, which are listed in Table 6. Additionally, there is one Other type concentration. Segments 9.04 exhibits the most crash concentrations with 1 Critical concentration, which occurred between RM 38 and 38.2.

Table 6 - Critical Crash Concentrations

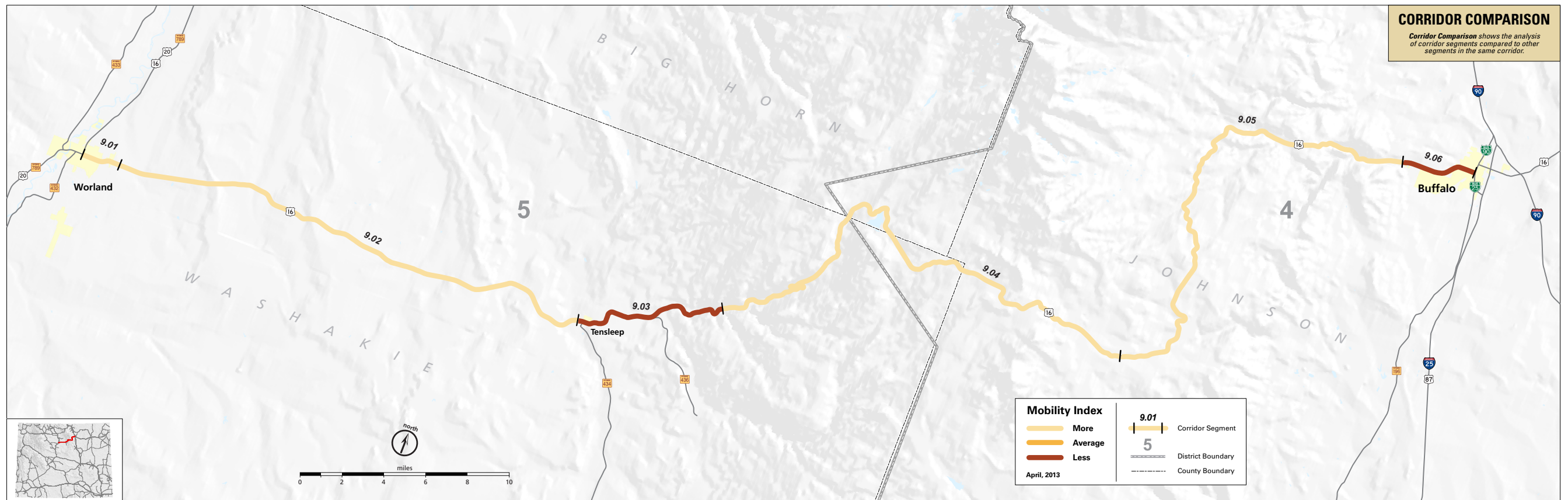
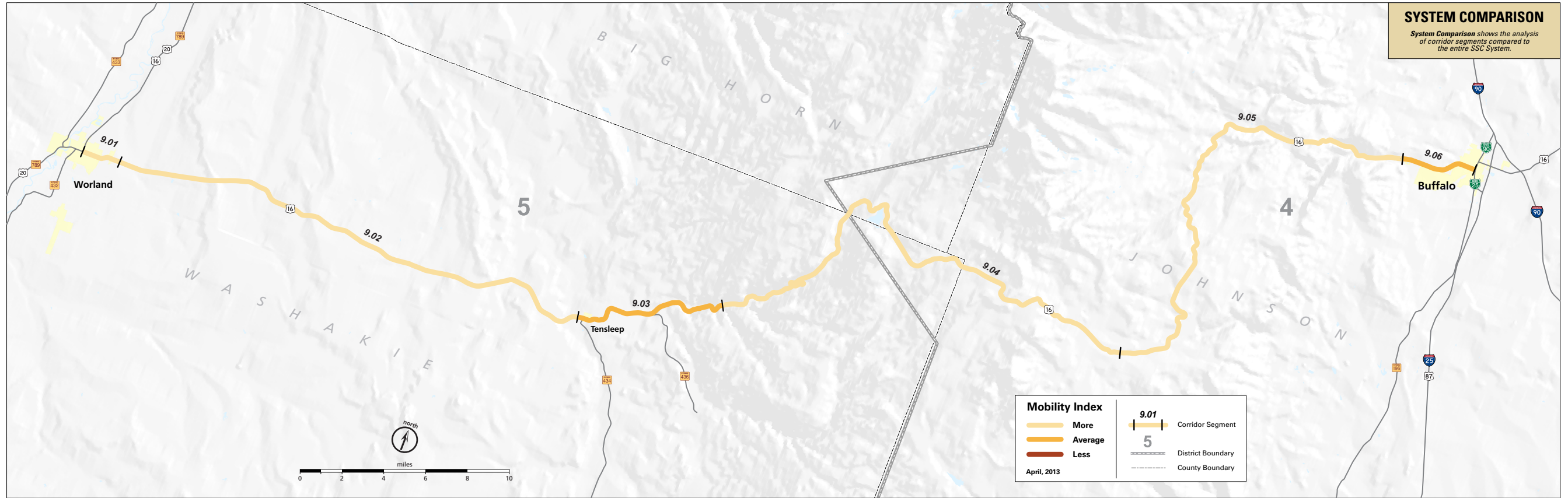
Segment	ML Route	Route Marker	
		From	To
9.04	ML36	38	38.2

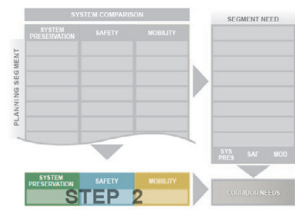
NOTE: See Appendix for maps documenting each performance qualifier.



CORRIDOR 9

MOBILITY - INDEX





Performance Index

The Mobility Performance Index for SSC 9 is average or better than average.

Segment	MOBILITY					
	Mobility Index	Volume to Capacity Rating	Pavement Variance Rating (L/R)	Traffic Growth	Truck Traffic Growth	Bridge Variance (L/R)
9.01	Better	Good	Poor	Average	Less	Less
9.02	Better	Good	Poor	Average	Average	Less
9.03	Average	Good	Poor	Less	Average	Average
9.04	Better	Good	Poor	Less	Average	Less
9.05	Better	Good	Poor	Average	Average	Less
9.06	Average	Good	Poor	Less	Less	Less

The condition of each local and regional route is associated with a planning segment on SSC 9 and directly influences the mobility of that segment. The condition of several local and regional routes is in poor condition. There is currently one structurally deficient bridge on the local and regional routes.

SSC 9 connects Worland to Buffalo and is designated as part of the Northern Tier East-West Bicycle route. The Cloud Peak Scenic Byway overlays part of the corridor. Agriculture is an important industry along the west end of SSC 9. As SSC 9 heads east, it leaves the agricultural area behind as it enters Ten Sleep Canyon and the Big Horn Mountains. Shoulder widths vary from 2' to 8' with some rumble strips noted.

Table 7 - Major Traffic Generators

Major Traffic Generators
Agricultural & employment centers - Worland, Buffalo
Dispersed local/regional recreation on public lands
Cloud Peak Skyway and Scenic Byway - Powder River Pass

Performance Qualifiers

Volume to Capacity Rating

Volume to Capacity Ratio (V/C) is a measure that reflects mobility and quality of travel of a corridor or section of a corridor. It compares roadway demand (vehicle volumes) with roadway supply (carrying capacity). The volume to capacity rating for the entire SSC 9 is good.

Traffic Growth

The average traffic growth within the SSC System is 1.42%. All segments in Corridor 9 are below this average. Segment 9.01 has the highest average annual traffic growth rate. This segment is located in the urban area of Worland on ML36.

Table 8 - Traffic Growth

Segment	AADT 2010	Average 20 Year Growth
9.01	7,738	1.24%
9.02	1,545	1.04%
9.03	876	0.44%
9.04	660	0.50%
9.05	943	1.17%
9.06	3,125	0.88%

Truck Traffic Growth

The average truck traffic growth within the SSC System is 1.34%. All segments in SSC 9 are below this average. The majority of the corridor is a 2-lane rural roadway classification. Segment 9.02 has the highest average annual truck growth rate. This segment is from Worland to Ten Sleep via ML36.

Table 9 - Truck Traffic Growth

Segment	AADTT 2010	% Trucks 2010	Truck Traffic Growth
9.01	293	4.32%	-0.61%
9.02	137	9.11%	1.14%
9.03	94	10.62%	1.01%
9.04	90	11.27%	0.89%
9.05	87	7.36%	0.73%
9.06	112	4.11%	0.44%

Local and Regional Roads

Local and Regional Routes that connect to the SSC affect the Mobility Performance Indicator. These routes serve the important function of connecting rural areas to the primary routes. While traffic volumes are typically low on these secondary routes, maintaining them in acceptable condition is important to general mobility for the state. This analysis includes pavement and bridge condition as qualifiers.

Local and Regional Roads Impacting Pavement Variance Rating (L/R)

The Mobility Index may be affected by local and regional routes that have poor pavement condition as reflected by the Pavement Variance Rating (PVR). The PVR is the product of Pavement Sufficiency Rating (PSR) calculated as the deviation from the system average. Poor PSR is reported on local/regional routes associated with segments 9.03 and 9.06. The PSR on ML2203, ML 435, ML436, and ML59 is low enough to impact the corridor pavement variance rating with a worse than average score for all segments. Table 10 lists the local/regional routes with poor PSR.

Table 10 - Local/Regional Routes with Poor PSR

Segment	Average PVR	ML Route	Route Marker		Average PSR
			Begin	End	
9.03	0.76	ML2203	0.00	12.49	2.49
9.03	1.21	ML435	0.00	0.78	2.04
9.03	0.86	ML436	0.00	5.93	2.39
9.06	1.13	ML59	298.02	299.70	2.12

Bridge Variance Rating (L/R)

The bridge variance rating for local and regional routes on SSC 9 shows 1 structurally deficient bridge. The location of the bridge is shown in the table below.

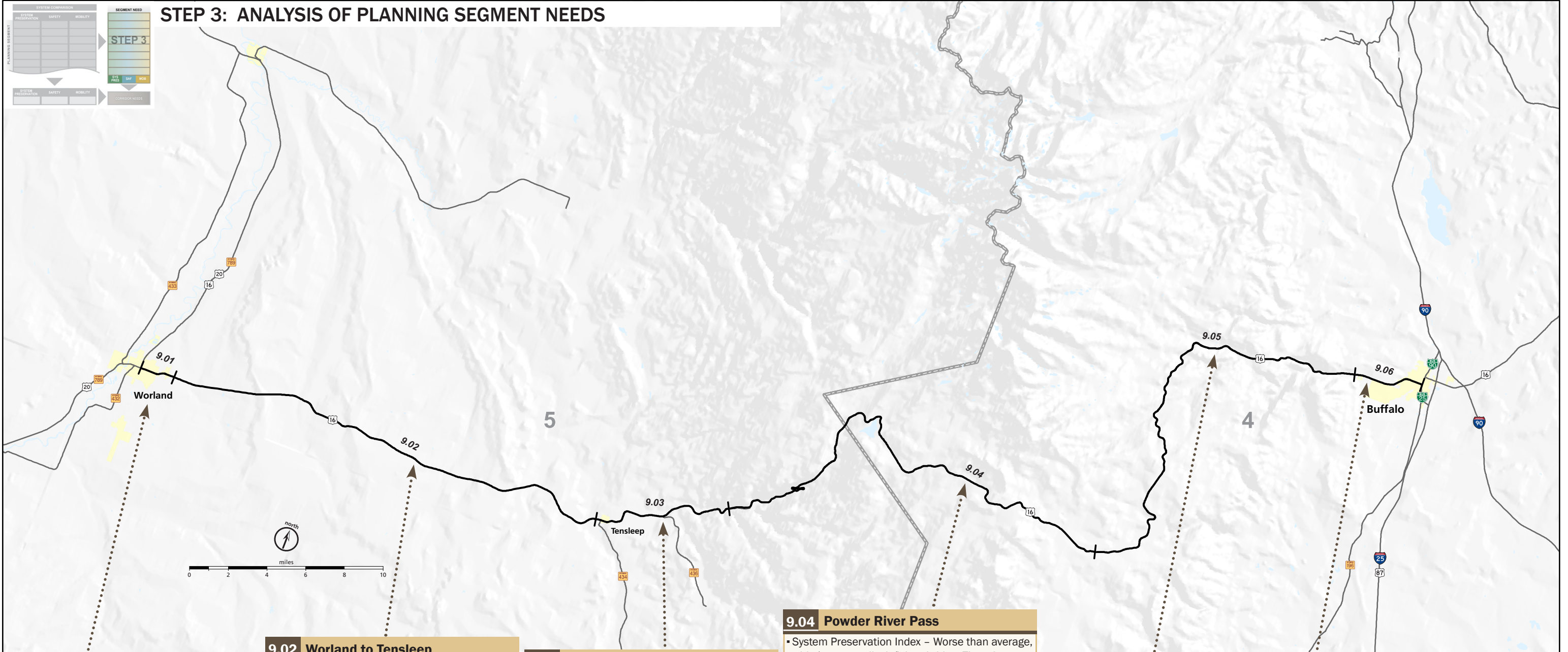
Table 11 - SSC 9 Structurally Deficient Bridges on Local/Regional Routes

Segment	ML Route	Route Marker
9.03	ML2203	0.28

NOTE: See Appendix for maps documenting each performance qualifier.



STEP 3: ANALYSIS OF PLANNING SEGMENT NEEDS



9.01 Worland Urban Area

- System Preservation Index – Average, with average or better performance across all performance qualifiers in the Worland urban area.
- Safety Index – Good, with average or better performance across all performance qualifiers. This segment reported 36 crashes during the 5-year planning period, with 0 fatalities.
- Mobility Index – Better than average, with poor pavement variance rating on local/regional routes. The segment reports AADT 7,738 with 4% trucks.

9.02 Worland to Tensleep

- System Preservation Index – Average, with average or better performance across all performance qualifiers. There is one structurally deficient bridge. There are 2 pavement hotspots reported just west of Tensleep near RM 26. A pavement project is scheduled on the segment in 2013.
- Safety Index – Average, with more than average alcohol related crashes. There were 42 total reported crashes during the 5-year planning period, with 0 fatalities.
- Mobility Index – Better than average, with poor pavement variance rating on local/regional routes. The segment reports AADT 1,545 with 9% trucks.

9.03 Tensleep to Tensleep Canyon

- System Preservation Index – Average, with average or better performance across all performance qualifiers and 1 structurally deficient bridge.
- Safety Index – Good, with more than average alcohol related crashes. There were 27 total reported crashes during the 5-year planning period, with 0 fatalities.
- Mobility Index – Average, with poor pavement variance rating on local/regional routes. Three local routes - ML2203B, ML435B, and ML436B - report poor PSR. There is 1 structurally deficient bridge on ML2203 at RM 0.28. The segment reports AADT 876 with 11% trucks.

9.04 Powder River Pass

- System Preservation Index – Worse than average, with 1 structurally deficient bridge. There is 1 pavement hotspot reported at RM 35. Two pavement projects are scheduled for 2016 and 2018.
- Safety Index – Good, with more than average weather related crashes and crashes on deficient curves. This segment reported 11 crashes on 4 deficient horizontal curves and 16 crashes on 5 deficient vertical curves. There is 1 critical crash concentration at RM 38. There were 89 total reported crashes during the 5-year planning period, with 0 fatalities.
- Mobility Index – Better than average, with poor pavement variance rating on local/regional routes. The segment reports AADT 660 with 11% trucks.

9.05 Powder River Pass to Buffalo

- System Preservation Index – Average, with average or better performance across all performance qualifiers.
- Safety Index – Fair, with more than average crashes on deficient curves. This segment reported 7 crashes on 3 deficient horizontal curves and 13 crashes on 3 deficient vertical curves. There were 102 total reported crashes during the 5-year planning period, with 1 fatality.
- Mobility Index – Average, with poor pavement variance rating on local/regional routes. The segment reports AADT 943 with 7% trucks.

9.06 Buffalo

- System Preservation Index – Average, with average or better performance across all performance qualifiers. There is 1 pavement hotspot reported in Buffalo.
- Safety Index – Fair, with average or better performance across all performance qualifiers. There were 32 total reported crashes during the 5-year planning period, with 2 fatalities.
- Mobility Index – Average, with poor pavement variance rating on local/regional routes. One local route, ML59B reports poor PSR. The segment reports AADT 3,125 with 4% trucks.



Environmental Overview

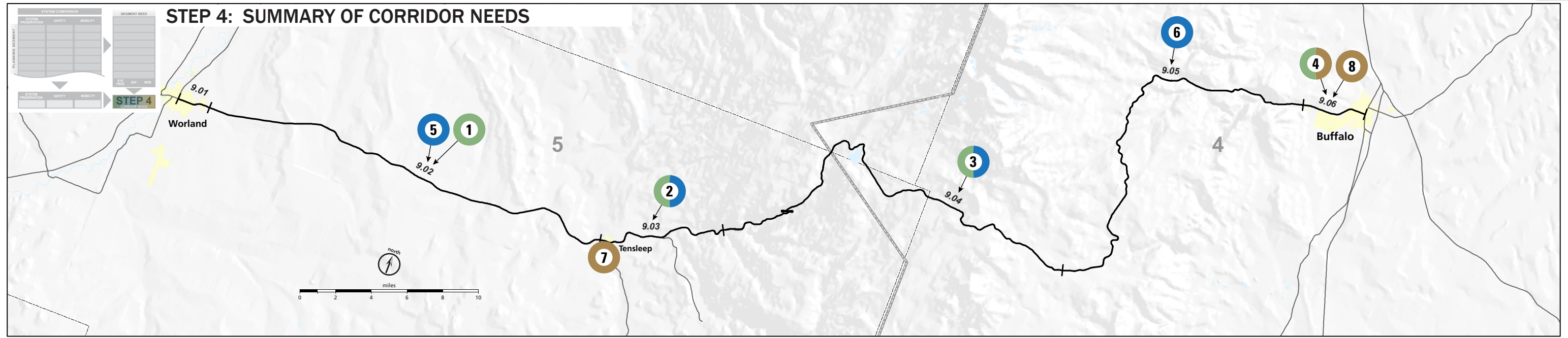
The Wyoming Interagency Spatial Database and Online Management System (WISDOM) was queried to identify natural resources that could be impacted by transportation projects. The following summary lists the general type of potentially impacted resources. The project development phase should investigate these resources in more detail to determine if mitigation activities are required. Please see Appendix and <http://wisdom.wygisc.org/> for detailed information.

There are eleven different terrestrial habitat types located throughout the three special management areas within SSC 9. Four federally listed species within the corridor fall into one of three categories, candidate, endangered, and threatened. Four big game species and ten raptor species are found in SSC 9. There are five different categories that fall under the aquatic habitat. There are eight watersheds, two aquatic crucial priority areas, two aquatic enhancement priority areas, two combined crucial priority areas, and one combined enhancement priority area. See Table 12 for general locations.

Table 12 - Environmental Considerations

Category	WEST (Worland - Ten Sleep)	EAST (East of Buffalo - Buffalo)
Big Game Crucial Range	Mule Deer Pronghorn Antelope	Elk
Big Game Migration Route	na	Elk Pronghorn Antelope
WGFD Aquatic Crucial Priority Areas SHP	Lower Bighorn River Complex	Foothills to Prairie Stream and Riparian Corridors
WGFD Terrestrial Crucial Priority Areas SHP	Sage Grouse Core Areas	Crucial Elk Winter Ranges South Big Horn Mountain Foothills Shrub and Pine Communities
WGFD Combined Crucial Priority Areas SHP	Riparian	High Elevation Riparian & Aspen Communities-East Slope Bighorn Mountains
Occurrence & Distribution (Federally Listed Species)	Gray Wolf Greater Sage Grouse	Canada Lynx Gray Wolf Greater Sage Grouse Yellow-billed Cuckoo

Segments 9.03 and 9.04 are not included in this table due to an issue with WISDOM.



Summary of Needs

This section summarizes needs by planning segment for each of the three performance indicators and the supporting performance qualifiers. The summary identifies overlapping needs, which provides guidance in the efficient prioritization of projects to best address deficiencies. The practice of completing projects that simultaneously address multiple needs may present cost savings as well as being most effective in improving performance indexes across the system. The summary also lists other needs in each of the three performance measurement areas. For more information about needs at the corridor level, see the maps in the appendix which compare both system level and corridor level needs.

SSC 9 needs occur in all categories and are most apparent in Safety. Within Safety, weather and alcohol related crashes as well as crashes related to deficient curves are documented. One area of critical crash concentrations occurs on the corridor. Within System Preservation, five pavement hotspots are documented along with three structurally deficient bridges. Within Mobility, all segments show a poor pavement variance rating on local routes. One structurally deficient bridge on a local/regional route is reported.

Several big game crucial range and migration routes intersect parts of the corridor and should be investigated for concurrence with wildlife related crashes. The Lower Bighorn River complex is considered an Aquatic Crucial Priority Area by the Wyoming Game and Fish Department. Several federally listed endangered species are found in the corridor and should be considered in all project planning.

Based on the needs identified in this analysis and the recommended strategies and solution sets, this plan does not identify specific needs to preserve or acquire additional rights of way to accommodate improvements. Heavier traffic in the Buffalo urban area present challenges for pavement management and should be evaluated for future improvements. Local and specific ROW requirements based on urban area needs should be evaluated in the Urban Areas Corridor Plan in cooperation with local governments and planning organizations.

Overlapping Needs

Overlapping needs are identified on four segments:

- 1 9.02 - SYSTEM PRESERVATION: Pavement Hotspots, Bridge Variance Rating
- 2 9.03 - SYSTEM PRESERVATION/SAFETY: Bridge Variance Rating, Alcohol Related Crashes, Crashes on Deficient Curves
- 3 9.04 - SYSTEM PRESERVATION/SAFETY: Bridge Variance Rating, Weather Related Crashes, Crashes on Deficient Curves, Crash Concentrations
- 4 9.06 - SYSTEM PRESERVATION/MOBILITY: Pavement Hotspots, Pavement Variance Rating (L/R)

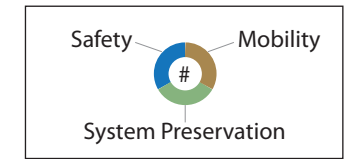
Other Performance Index Needs

Safety

- 5 9.02 - Alcohol Related Crashes
- 6 9.05 - Crashes on Deficient Horizontal and Vertical Curves

Mobility

- 7 9.03 - Pavement Variance Rating (L/R), Structurally Deficient Bridge
- 8 9.06 - Pavement Variance Rating (L/R)





III. SOLUTION SETS

A solutions menu was created to address the needs identified in the previous sections. This menu identifies potential solution strategies grouped by performance measure categories. The strategies are a preliminary list based on industry accepted approaches and the efforts to date of WYDOT programs to document preferred approaches. This list is not intended to be all-inclusive, but represents types of improvements that may be employed to address documented needs.

Section IV recommends how the solution sets may be efficiently grouped depending on funding availability.

Table 13 - Recommended Solution Sets to Improve Performance in Each Index

System Preservation	Safety		Mobility	
<p><i>Pavement Maintenance Requirement & Pavement Variance Rating</i></p> <p><i>Rutting</i> Mill Mill and overlay</p> <p><i>1S Treatments</i> Mill and overlay Seal Coat Cleaning and sealing joints Patching pavement Micro surfacing</p> <p><i>2S Treatments</i> Roadway Restoration</p> <p><i>3S Treatments</i> Reconstruct Roadway Roadway widening Upgrade geometric design</p> <p><i>Bridge Variance Rating</i> Bridge Replacement Channel reconstruction Cleaning and sealing bridge members Lower weight limits Restore drainage systems Scour countermeasures</p>	<p><i>Weather Related</i> Signage Automated anti-icing systems Grooved pavement ITS Larger signs Snow berms/grading Snow fencing Warning beacons</p> <p><i>Wildlife Related</i> Animal detection systems Animal jump-out or one-way gates ITS Remove brush from ROW Signage Warning beacons Wildlife bridge/underpass Wildlife fencing</p> <p><i>Alcohol Related</i> Centerline rumble strips ITS Law Enforcement Media campaign Shoulder rumble strips</p>	<p><i>Horizontal Geometry</i> Centerline rumble strips Dynamic curve warning system Guardrail Improve/restore superelevation Lighting Oversize/length restrictions Reconstruction/realignment Reduce posted speed Reflectors Shoulder rumble strips Signage Warning beacons</p> <p><i>Vertical Geometry</i> Larger signs Reconstruction/realignment Reduce posted speed Reflectors Signage Warning beacons</p> <p><i>Safety Restraints</i> ITS Law Enforcement Media campaign</p>	<p><i>Volume to Capacity Rating & Traffic Growth / Truck Traffic Growth</i> Acceleration lane Capacity improvements Deceleration lane Increase lane width Intersection/interchange improvements Multimodal improvements Passing lanes Shoulder widening Through lanes Turn lane</p> <p><i>Bridge Variance (L/R)</i> Bridge Replacement Channel reconstruction Cleaning and sealing bridge members Lower allowable weight limits on bridge Restore drainage systems Scour countermeasures</p>	<p><i>Pavement Variance Rating (L/R)</i></p> <p><i>Rutting</i> Mill Mill and overlay</p> <p><i>1S Treatments</i> Cleaning and sealing joints Micro surfacing Mill and overlay Patching pavement Seal Coat</p> <p><i>2S Treatments</i> Roadway Restoration</p> <p><i>3S Treatments</i> Reconstruct Roadway Roadway widening Upgrade geometric design</p>



IV. RECOMMENDATIONS

This section describes recommendations for strategies and priorities to address corridor needs. The selected strategies address the needs described in previous sections and are organized by the three strategic performance areas: System Preservation, Safety, and Mobility. These recommendations provide information and guidance consistent with the Strategic and Long Range Plans to help WYDOT select projects in coordination with the STIP process.

The recommended strategies have been packaged into solution sets that recognize the inherent overlap that investments may have across performance areas. For example, truck passing lanes may simultaneously improve traffic flow (Mobility) and reduce crashes (Safety).

The solution sets are tiered to the three Funding Scenarios identified in the Long Range Transportation Plan. The funding scenarios describe a progressively increasing budget, with generally defined allocations to System Preservation, Safety, and Mobility. With each succeeding level of investment, additional funding is allocated to address shortfalls in performance-based goals.

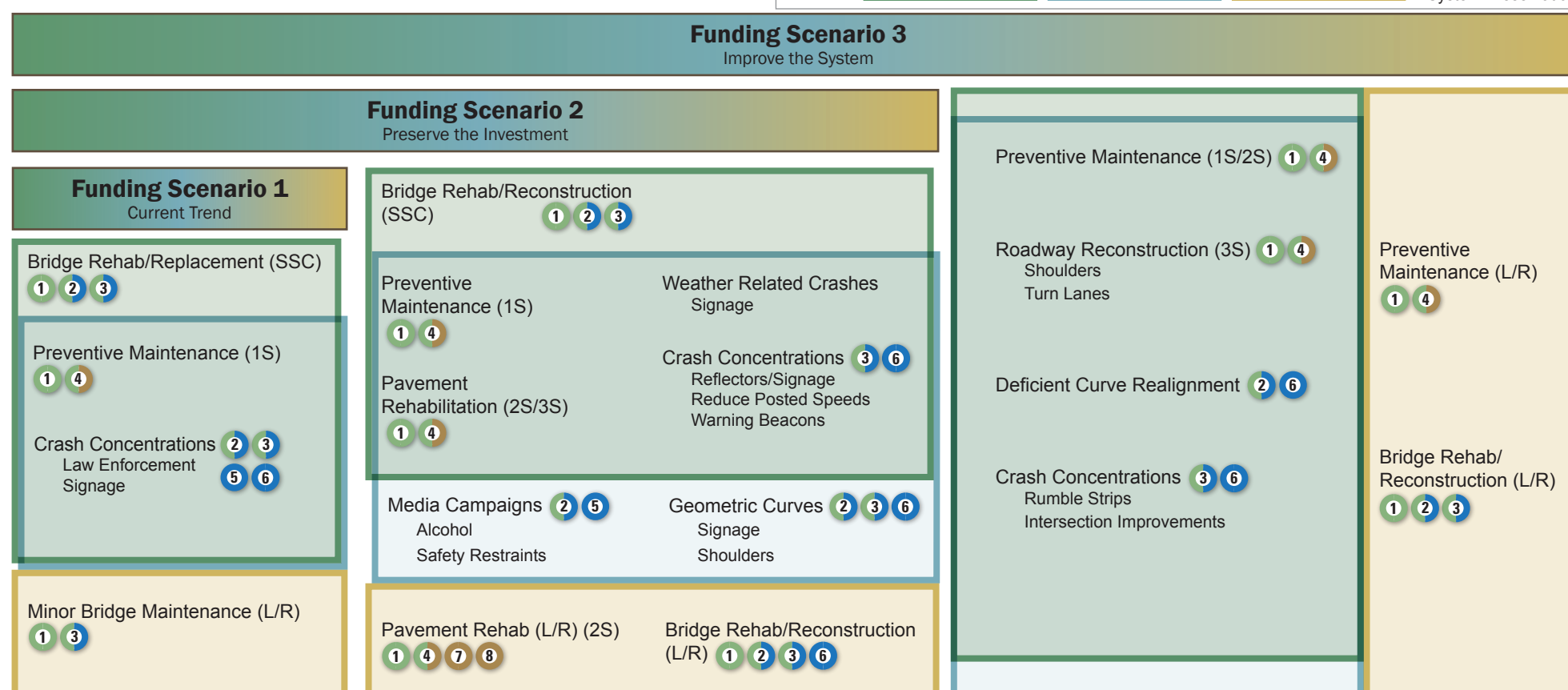
- Funding Scenario 1 – The continuation of program funding at current levels. Most funding is directed to System Preservation needs. System characteristics are expected to decline with inflation and increasing construction costs over time. Few major projects to address Safety, other than with specially restricted and allocated funds, or Mobility would be implemented.
- Funding Scenario 2 – Funding over and above the base level would allow additional investments in pavement and bridge projects to meet WYDOT goals.
- Funding Scenario 3 – Additional funding over and above Scenario 2 would allow WYDOT to maintain and improve existing conditions, achieve pavement and bridge condition goals, plus invest in major projects to improve Mobility.

Funding Scenario 1

Funding Scenario 1, defined as the continuation of current program funding, is focused primarily on addressing System Preservation needs through preventive maintenance efforts. The plan recommends that funds remain allocated to preventive pavement maintenance and bridge repair/rehabilitation on the main corridor, along with reserving a portion to address identified safety needs. Safety needs include specific weather, alcohol and geometry-related crash prone areas. In addition, one critical crash concentration is reported. These needs may be only partially met under current funding and should be focused on areas with documented overlapping needs. Additional needs that cannot be met under Scenario 1 may be delayed pending additional funds under Scenarios 2 or 3.

- Minor surface treatments on the SSC mainline, including mill and overlay, including pavement hotspots.
- Bridge rehabilitation or replacement of structurally deficient bridges on the SSC mainline.
- Minor projects to improve safety not involving major construction, such as signage on deficient curves and in areas likely to experience icy conditions, as well as alcohol-related and safety restraint law enforcement.

Table 14 - SSC 9 Recommended Strategies for Long Range Plan Funding Scenarios



Funding Scenario 2

If sufficient funds to preserve the system in at least its current operational form are made available, WYDOT will direct funding to strengthen pavement and bridge conditions across the system, including on local and regional routes. SSC 9 has three structurally deficient bridges on the main route. This scenario would allow investments to fully achieve WYDOT goals in pavement and bridge conditions. Additional investments should be made to improve safety for wildlife/alcohol related crashes and other areas of crash concentrations.

- Preventive maintenance could be deferred and/or advanced, depending on life cycle, as recommended by the Pavement Management System.
- Reconstruction (2S/3S) to address higher traffic volumes to address pavement hotspots, if required.
- Improvement of pavement condition of local and regional routes, to include preventive maintenance or mill and overlay.
- Minor maintenance on bridges on local and regional routes so as to maintain bridge condition and the Mobility Index.
- Minor projects to improve safety not involving major construction, such as rumble strips and lighted signage to address weather-related crashes, and safety restraint/alcohol-related media campaigns.

Funding Scenario 3

If additional funds are made available to WYDOT under Funding Scenario 3, opportunities would be created to address all three investment categories, thus preserving the investment and improving the overall “health” of the system. Additional funds allow project selection to address overlapping needs, therefore investing funds most effectively. The additional funds would expand to include other items to improve performance in the Mobility Index.

- Roadway reconstruction (3S) to meet long term goals, including on local/regional routes.
- Roadway reconstruction (3S) to meet standards on curves with deficient geometry that experience high crash rates.

Performance Measurement Over Time

As these performance measures are continually monitored over time it will become evident how the recommended solution strategies and the selected projects address the needs of the corridor and the overall system. Addressing deficiencies documented in the corridor plan will effectively improve the System Preservation, Safety, and Mobility indexes at both the corridor and system level.

Ongoing performance measure documentation is critical to identify trends, capture the existing health of the system, and allowing an accurate forecast of the future health of Wyoming’s Transportation system. The need for additional funding and/or more aggressive solutions will become evident if performance measures fail to meet WYDOT goals.

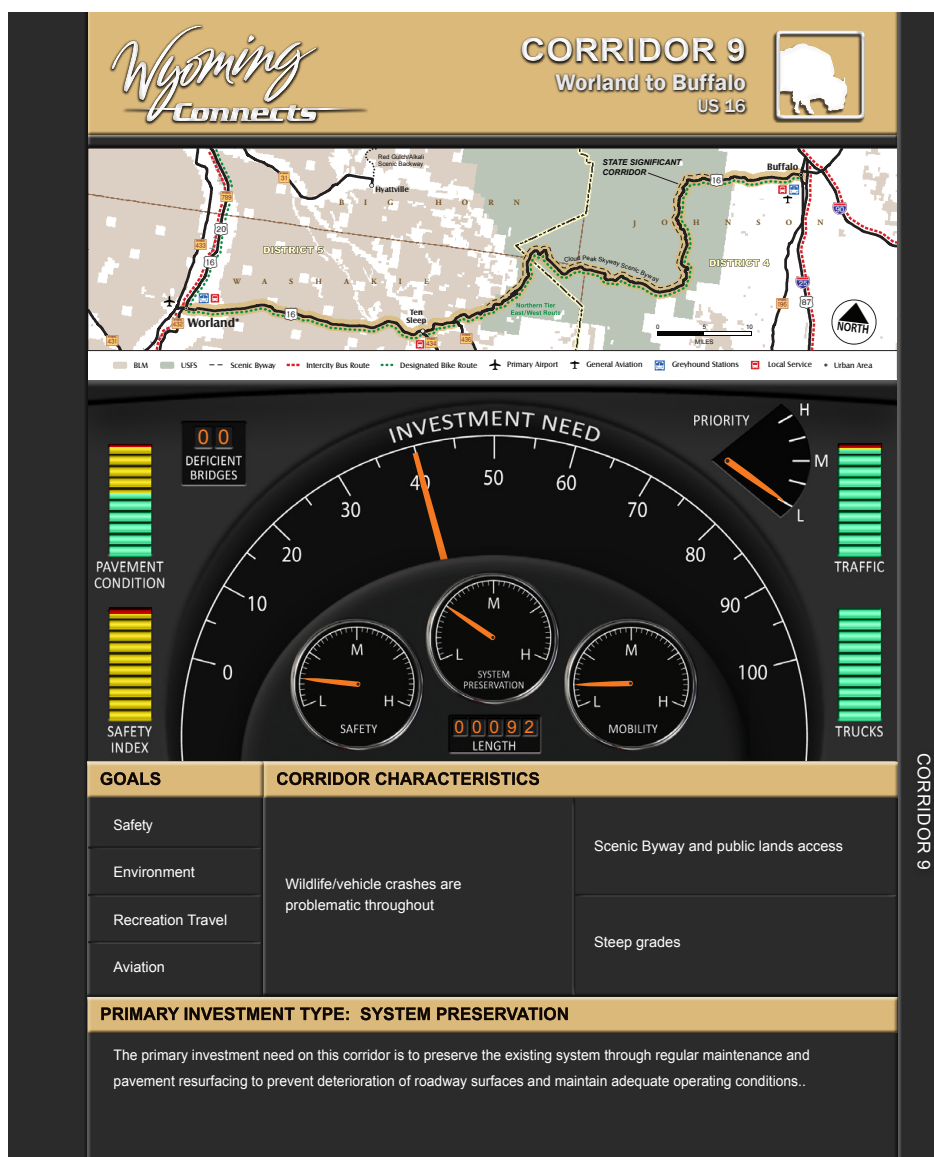


REALIZING THE CORRIDOR VISION

As part of the statewide Wyoming Connects and Long Range Transportation Plan, the Corridor Vision for SSC 9 - and all SSCs - focuses on the identification of overall system performance aggregated from the evaluations of each individual corridor's "health" relative to WYDOT's long-term Strategic Goals. The identified types of investment needs (system preservation, safety, and mobility) expressed in the Corridor Vision are reflected in the three primary need indicators of this Corridor Plan. The analysis of each investment type generated goals representing corridor health issues as communicated by the planning and public process used in development of the Vision. See *Wyoming Connects: Corridor Visions* for more information.

Corridor Vision Goals

The Worland to Buffalo Corridor Vision captured Key Issues and Emerging Trends of critical importance and how SSC 9 could best serve the communities it connects over the long term. While issues were identified relative to each investment type, the Primary Investment Type is System Preservation:



The primary investment need on this corridor is to preserve the existing system through regular maintenance and pavement resurfacing to prevent deterioration of roadway surfaces and maintain adequate operating conditions.

Additional goals which reflect the full context, character, and issues of SSC 9 were set as high priority goals as indicated in Table 15. A review of these Vision Goals compared to the findings of this Corridor Plan provides for a conformance check and identifies additional issues to be considered when evaluating potential projects and implementation plans.

CORRIDOR 9

Dashboard from Corridor Visions

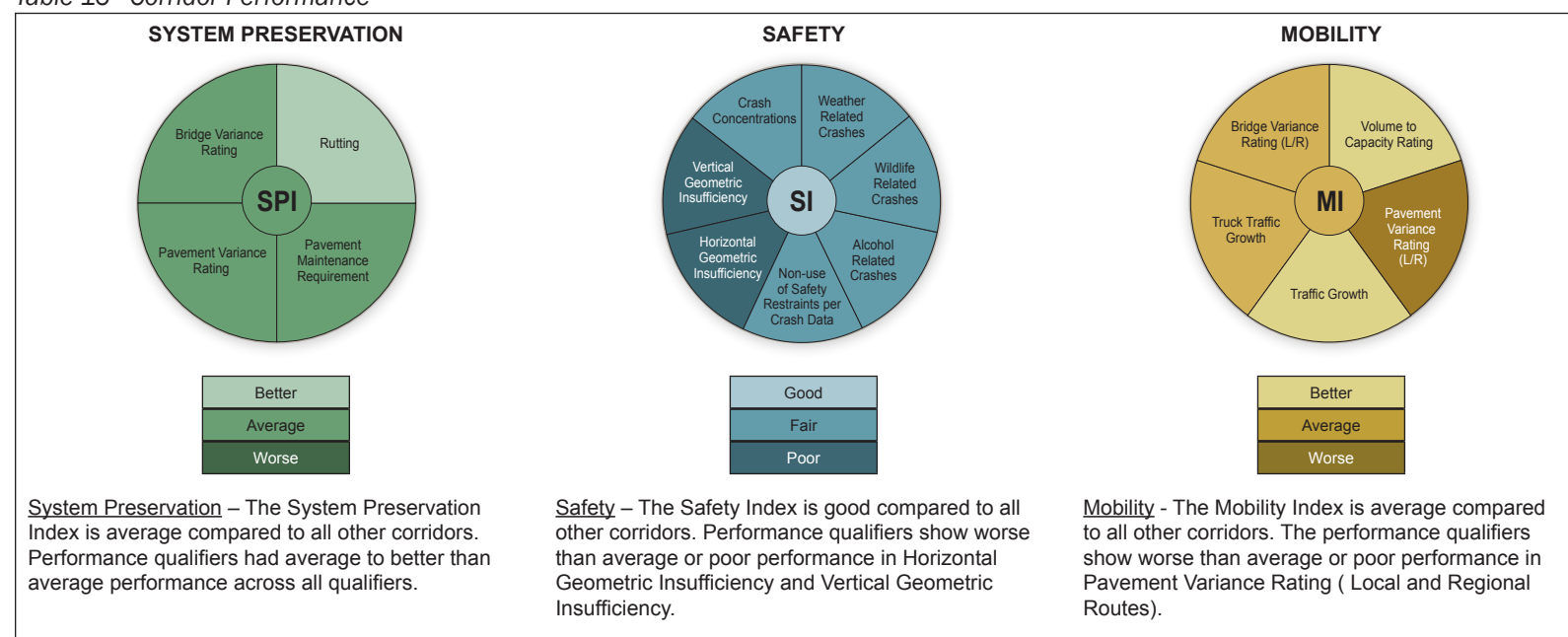
Table 15 - Review of Corridor Vision Goals and Other Considerations

Corridor Visions		High Priority	Other Considerations
Investment Category	Goal		
System Preservation	Preserve the existing transportation system	✓	Corridor Plan identifies pavement hotspots, deficient bridges, and poor pavement on local/regional routes.
	Support farm to market economic sustainability		Maintaining adequate facilities to accommodate regional traffic on the SSC and on local/regional routes important to economic performance.
	Promote environmentally responsible transportation improvements		Several sensitive areas, including aquatic resources, big game migration routes, and endangered species identified.
Safety	Reduce fatalities, injuries, and property damage crash rate	✓	A number of crash concentrations and deficient curves identified, along with strategies to reduce weather and alcohol related crashes.
Mobility	Improve access to public lands		The route provides primary access to a large area of the Bighorn Mountains, important recreation area for local residents and visitors.
	Support recreation travel		The route provides primary access to a large area of the Bighorn Mountains, important recreation area for local residents and visitors.
	Ensure airport facility meets existing and projected demands		Airports at Worland and Buffalo are important regional facilities for north central Wyoming.

CORRIDOR PERFORMANCE

Table 16 shows SSC 9 corridor performance compared to the system. The center of each chart indicates the value of the performance index, with each section indicating the performance qualifier for each measure.

Table 16 - Corridor Performance



Coordination with System Priorities

The corridor comparison can be used to help assign a priority level to entire corridors, if conditions warrant. The Corridor Plans – Executive Summary is published under separate cover and provides an overview of corridor comparisons. The summary identifies areas of greatest need within all performance indexes and for performance qualifiers across the state system. By addressing these areas of greatest need, whether by program, corridor, or corridor segment WYDOT will ensure positive changes in reported conditions throughout Wyoming.