

# **Purpose and Need Technical Memorandum**

**North Sheridan Interchange**

**Sheridan County**

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**Wyoming Department of Transportation**

**and**

**Federal Highway Administration**

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# North Sheridan Interchange Environmental Assessment

## Purpose and Need Technical Memorandum

### Section 1: Project Background

#### ***Project Overview***

The Wyoming Department of Transportation (WYDOT), in coordination with the Federal Highway Administration (FHWA), is studying improvements to the North Main Street/Interstate 90 (I-90) Interchange, also known as the North Sheridan Interchange. The project is located along I-90 in the City of Sheridan in Sheridan County, Wyoming. Sheridan is located in the north-central part of the state at the foot of the Big Horn Mountains, about 30 miles south of the Wyoming-Montana border. Billings, Montana, is the largest city within 200 hundred miles of Sheridan. Other large communities in the vicinity of Sheridan are Buffalo, Wyoming (40 miles southeast), Hardin, Montana (85 miles north), and Gillette, Wyoming (100 miles east). Sheridan is located along the route commonly used to reach Little Bighorn National Monument, Yellowstone National Park, and Mount Rushmore. Because of its proximity to the mountains and its distance from the closest communities, Sheridan is an important stop along I-90 for tourists and truck traffic; thus, the North Sheridan Interchange is important for pass-through traffic, as well as local traffic.

The proposed project includes reconstructing and potentially relocating the North Sheridan Interchange, improvements to I-90, and improvements to North Main Street. This is the first interchange providing access to Sheridan for eastbound vehicles on I-90. The project is needed to improve traffic operations and safety at the interchange and along the corresponding segments of I-90 and North Main Street. The existing interchange has sharp curves, steep ramps, and limited space for traffic to merge with I-90 traffic, all of which result in safety and operational issues on the interchange, along I-90, and along North Main Street. The selected location of the North Sheridan Interchange must allow for placement consistent with the 2009 FHWA access requirements<sup>1</sup> of another interchange between the proposed North Sheridan Interchange and the port-of-entry interchange.

The project is being proposed to provide safe, direct regional access from I-90 to the north Sheridan area in support of local land use plans, and improve deteriorating segments of I-90 and North Main Street. The project must comply with current design standards and comply with the FHWA's interstate access policy, which requires minimum spacing between adjacent interchanges whether existing or planned. These items are discussed in more detail in Sections 3 and 4 of this report.

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<sup>1</sup> FHWA requires a comprehensive interstate network study for new or relocated interchanges and in areas where the potential exists for future multiple interchange additions; these additions must be within the context of a long-term plan. Sheridan identified an interchange as part of its study of the West Corridor transportation facility, and it must be considered when determining a location for the North Sheridan Interchange. Minimum spacing between adjacent interchanges whether existing or planned also must be considered.

### ***Project History***

WYDOT considered improvements to this interchange along with improvements to the port-of-entry in the late 1990s. The port-of-entry project advanced through construction, but the interchange improvements were postponed. Prior to being postponed, multiple conceptual alternatives were developed and presented to the public. Three alternatives were recommended for further consideration: upgrading the existing interchange, a new interchange at Wyoming 338/Decker Road (referred to hereafter as Decker Road), and a new interchange north of Decker Road. WYDOT is now moving forward with the interchange improvements and is reviewing alternatives for further consideration in an Environmental Assessment (EA) being prepared in compliance with the National Environmental Policy Act (NEPA) process.

### ***Study Area***

WYDOT is considering improvements to the North Sheridan Interchange along I-90 and North Main Street. Three distinct study areas correspond with the three types of road improvements associated with the project. The study area for improving or relocating the North Sheridan Interchange extends from the center of the existing North Main Interchange to 1.5 miles west of the existing interchange. The width of this area is one-half mile on each side of I-90. This study area includes the potential realignment areas of Decker Road that are under consideration. The study area for improvements to the mainline of I-90 extend approximately 1.5 miles east of the existing North Sheridan Interchange and 2.0 miles west, within existing I-90 right of way. The study area for improvements along North Main Street includes the existing interchange south to Fort Road within existing WYDOT right-of-way. The limits were selected to represent the areas that could be directly or indirectly affected by potential improvements.

## **Section 2: Traffic Analyses**

Traffic analyses were performed to evaluate the capacity and safety conditions of the existing North Sheridan Interchange. Capacity analyses were performed for current traffic volumes and projected future-year traffic volumes (in 2035), while safety was studied using the crash data that was analyzed in the reconnaissance report prepared by WYDOT for the project, supplemented with 2008-2009 crash data. A reconnaissance report is the planning document that WYDOT uses to justify and provide design data for proposed improvements to the state highway system. For this project, the Reconnaissance Report for Sheridan Marginal (WYDOT 2008) was used. To be consistent with FHWA guidelines, 2035 was the future year studied.

### ***Capacity Analyses***

WYDOT provided existing traffic volumes and future-year traffic volume projections. Existing traffic volumes consisted of daily traffic volumes along various road segments, and PM peak-hour turning movement counts (TMCs) at the North Main Street and Canfield Street intersection and the Canfield Street and Decker Road intersection. Future-year traffic volume projections were completed using population forecasts. HDR used these traffic volume projections and the existing TMCs to project future-year TMCs for analysis purposes.

The capacity analyses performed for this project focused on the local intersections because they constrict the capacity of the North Sheridan Interchange. Capacity analysis results are reported as levels of service (LOS), which are based on the amount of delay motorists experience at an intersection. The results range from LOS A to LOS F, with LOS A indicating free-flowing traffic and limited delay and LOS F indicating severely restricted flow and excessive delay. See Table 1 for the amount of delay associated with a particular LOS for signalized and unsignalized (i.e. two-way stop controlled) intersections. The minimum acceptable peak-hour levels of service would be LOS D, which indicates moderate congestion with moderate delay.

**Table 1. Level of Service and Delay at Signalized and Unsignalized (Two-Way Stop Controlled) Intersections**

LOS	Average Control Delay (in seconds) at Signalized Intersection	Average Control Delay (in seconds) at Unsignalized Intersection
A	≤10	≤10
B	>10 and ≤ 20	>10 and ≤15
C	>20 and ≤35	>15 and ≤25
D	>35 and ≤55	>25 and ≤35
E	>55 and ≤80	>35 and ≤50
F	>80	>50

Source: *Highway Capacity Manual*, Transportation Research Board, 2000

**Existing Traffic Conditions:** The historic traffic volumes and truck percentages provided by WYDOT were evaluated to determine patterns in the existing traffic conditions, in particular what effect relocating the port-of-entry may have had on traffic patterns in the study area. Table 2 provides the total average daily traffic (ADT) from 1999 to 2008 for I-90 and North Main Street. Truck traffic volumes and percentage of the total ADT are also included. While traffic numbers along I-90 are generally unchanged, with just a slight increase in overall ADT from 1999 to 2008, traffic along North Main Street slightly decreased. Some yearly variations are noted, especially along North Main Street.

Truck volumes and ADT decreased along North Main Street from the North Sheridan Interchange to the Canfield Street intersection. Truck volumes dropped by nearly 75 percent between 2004 and 2007. Overall traffic volumes along this same stretch dropped in 2006 to pre-2003 levels, but there was a sustained spike in volume from 2003 to 2005. The current ADT for the study area is roughly the same as the ADT in 2003, even with the large drop in the number of trucks using the North Sheridan Interchange.

The existing TMCs were analyzed to determine how well the intersections handle current travel demand. The two intersections within the study area include a signal-controlled intersection at North Main and Canfield streets and a stop-controlled intersection at Canfield Street and Decker Road. Analysis of existing traffic volumes at each intersection yielded LOS B at both intersections.

Table 2. Historic and Existing ADT and Truck Volumes along I-90 and North Main Street

Road Segment	1999			2001			2003			2005			2007			2008			
	Total ADT	Truck Vol.	Truck Percent	Total ADT	Truck Vol.	Truck Percent	Total ADT	Truck Vol.	Truck Percent	Total ADT	Truck Vol.	Truck Percent	Total ADT	Truck Vol.	Truck Percent	Total ADT	Truck Vol.	Truck Percent	
<b>I-90 --</b>																			
Sheridan N. Urban Limits to NSI*	3,040	610	20.1	3,115	590	18.9	3,160	600	19.0	3,360	680	20.2	3,410	690	20.2	3,700	650	17.6	
<b>1-90 --</b>																			
NSI* to Fifth Street	2,700	610	22.6	3,080	585	19.0	3,125	595	19.0	3,320	670	20.2	3,240	680	21.0	3,880	770	19.8	
<b>North Main</b>																			
Street- NSI* to SH 338	7,050	740	10.5	7,380	940	12.7	10,360	920	8.9	9,850	500	5.1	6,870	240	3.5	6,390	220	3.4	
<b>North Main</b>																			
Street- SH 338 - Fort Road	8,500	320	3.8	8,040	300	3.7	8,360	290	3.5	7,880	260	3.3	8,650	300	3.5	8,040	280	3.5	
<b>North Main</b>																			
Street- Fort Road to Sheridan N. Corp Limits	11,000	350	3.2	9,510	350	3.7	8,930	330	3.7	10,610	280	2.6	9,840	340	3.5	9,150	320	3.5	

\* North Sheridan Interchange

**Table 3. Future (2035) ADT Under the Build and No-Build Alternatives**

Road Segment	Existing	No-Build Alternative		Alternative 2		Modified Alternative 4	
		With West Corridor	Without West Corridor	With West Corridor	Without West Corridor	With West Corridor	Without West Corridor
<i>I-90</i> – North of NSI*	3,700	18,100	17,400	19,200	19,200	19,200	19,200
<i>I-90</i> – South of NSI*	3,800	17,900	16,100	17,900	16,300	18,300	16,900
<b>North Main/Decker Road</b> – South of I-90	6,400	11,100	16,700	18,300	16,700	19,200	17,600
<b>North Main Street</b> – South of Canfield Street	8,000	16,200	18,800	14,900	18,900	15,800	17,200
<b>Decker Road</b> – North of Canfield	1,700	10,000	11,400	17,300	18,700	18,300	19,300
<b>Decker Road</b> – North of I-90 Bridge	1,700	5,900	3,300	3,700	3,700	3,700	3,700

\* North Sheridan Interchange

Future-Year Traffic Conditions: The West Corridor is a planned north-south transportation corridor through the western part of Sheridan. The West Corridor was proposed in a citywide traffic study conducted by the City in 2001. It is intended to provide roadway capacity for city traffic independent of the proposed North Sheridan Interchange improvements. Funding has not been identified for construction. Future-year conditions analyses for the North Sheridan Interchange improvements considered traffic with and without the West Corridor.

As seen in Table 3, future ADT (2035) is expected to increase from the existing conditions. This is due in large part to the proposed Wrench Ranch development area and Sheridan High-Tech Business Park that are under consideration on the north and west sides of town. The amount of increase on any road segment depends on these developments and whether the West Corridor is constructed. Traffic on Decker Road, for instance, could increase more than tenfold under the scenario of full build-out of both developments if the West Corridor is not constructed.

The projected PM peak-hour TMCs were analyzed to determine how well the existing intersections (North Main Street and Canfield Street, Canfield Street and Decker Road) could accommodate travel demand under the No-Build Alternative and how well the new intersections of the proposed Build Alternatives (realigned North Main Street/Decker Road/Canfield Street intersections and two ramp intersections at the new interchange) would function. Future-year traffic conditions were also analyzed with and without the construction of the West Corridor. The results are provided in Table 4.

Under the No-Build Alternative, the signal control at North Main and Canfield streets would remain and the stop control at Canfield Street and Decker Road would remain. Under the Build Alternatives, the two

existing intersections would be combined into a signal-controlled North Main Street/Decker Road and Canfield Street intersection and two new intersections would be created where the ramps connect to Main Street/Decker Road; control of these two ramp intersections has yet to be determined.

**Table 4. Level of Service Analysis Under the 2035 Alternatives for PM Peak-Hour.**

Intersections	No-Build Alternative		Alternative 2		Modified Alternative 4	
	With West Corridor	Without West Corridor	With West Corridor	Without West Corridor	With West Corridor	Without West Corridor
North Main and Canfield Street	C	E	--	--		
Canfield Street and Decker Road	F	F	--	--		
North Main/Decker Road and Canfield Street	--	--	B	B	B	B
Decker Road and Eastbound On- and Off-Ramps	--	--	F/B*	E/A*	F/B*	F/B*
Decker Road and Westbound On- and Off-Ramps	--	--	F/C*	F/B*	F/C*	F/B*

\*The ramp terminals would experience LOS E or F under stop control and LOS A, B or C under signal control.

As shown in Table 4, LOS would be unacceptable under the No-Build Alternative. Geometric improvements would be required at the intersection of Main and Canfield streets and the Decker Road and Canfield Street intersection would likely have to be signalized. Operations would be acceptable under the Build Alternatives, if the ramp terminals were constructed with signal control; the intersections under stop control would have excessive delay, resulting in LOS E or LOS F.

### **Safety Analysis**

The intent of the safety analysis was to identify significant crash patterns that have occurred at the existing interchange.

The period analyzed included the years 1999 through 2009. These data include the period before and after the port-of-entry was removed from the existing North Sheridan Interchange. The data studied included all<sup>2</sup> reported crashes that occurred along the following segments:

- I-90, from roughly one-half mile northwest of the interchange to roughly one-half mile southeast of the interchange;
- North Main Street, from the Decker Road/Canfield Street<sup>3</sup> intersection to I-90; and

<sup>2</sup> The total numbers include the crashes that were impacted by driver impairment; however, those crashes were excluded when more detailed analyses were performed. The number of driver-impaired crashes was small enough that the quantitative analysis was not impacted.



- Decker Road, from North Main Street to just north of the I-90 bridge.

Table 5 shows the number of reported crashes that occurred in each year analyzed, the resulting crash rate for each year, and how that crash rate compares to the statewide average. This table is part of the analysis performed by WYDOT and includes crashes along I-90 from Mile Post (MP) 16.24 to MP 23.25 (WYDOT 2010a).

**Table 5. Crash and Crash Rates for I-90 including the North Sheridan Interchange**

Year	Total Number of Crashes	Calculated Crash Rate	Statewide Average Crash Rate
1999	19	1.27	1.12
2000	19	1.28	1.16
2001	5	0.31	1.07
2002	20	0.96	1.17
2003	17	0.77	1.17
2004	20	0.91	1.00
2005	27	1.21	0.94
2006	27	1.25	1.21
2007	26	1.21	1.17
2008	12	0.55	1.12
2009	8*	0.55	1.12

\*Crash data received from WYDOT was for MP 20.42 to 21.41.

Source: "Request for Interchange Modification" for North Sheridan Interchange, April 6, 2009 and December 1, 2010. Page 3

Note: Highlighted years experienced crash rate above statewide average

As shown in Table 5, 5 of the 11 years studied experienced a higher than average number of crashes when compared to the statewide average for interstate routes.

A more refined analysis was performed on the crashes that occurred within the confines of the North Sheridan Interchange EA study area. Crash data analyzed for this project are a subset of the data that WYDOT used to determine crash rates (WYDOT 2010a). The data analyzed included crashes along I-90, North Main Street, and Decker Road, but only the data along I-90 and within the confines of the interchange yielded substantial crash patterns. These patterns led to several conclusions related to the safety of the existing interchange:

- Most crashes along the ramps involved only one vehicle.<sup>4</sup>
- The high number of single-vehicle crashes indicates that the geometry of these ramps is not consistent with driver speeds and expectations. Eighty percent of the vehicles that crashed while entering I-90 traveling westbound left the road. All of the vehicles that crashed exiting I-90 traveling westbound and traveling eastbound left the road. The vehicles left the road

<sup>3</sup> The study area includes Fort Road, but the improvements from Canfield to Fort Road would occur within existing right-of-way and would not change the configuration of the road. Therefore, accidents within this segment have not been included.

<sup>4</sup> Conclusions drawn from this data did not consider five crashes that involved driver impairment.

during mostly dry conditions, indicating that weather was not a factor; rather, the horizontal curves are too sharp, which results in vehicles leaving the road.

- For crashes involving vehicles entering I-90, about half were multiple-vehicle accidents, indicating problems with drivers' ability to merge into traffic on I-90. Vertical curves combined with horizontal curves do not allow for sufficient acceleration length and hamper the ability of drivers to accelerate to highway speeds, resulting in crashes where the on-ramps meet I-90. The 2005 relocation of the port-of-entry did not improve crash rates at the North Sheridan Interchange. A review of the crash data reveals a spike in crashes in 2005; crashes declined after the 2005 spike but did not return to pre-2005 levels. Two of the 5 years experienced higher than average crash rates: 2006 and 2007, immediately following the relocation of the port-of-entry. Two of the other 3 years were 1999 and 2000, which indicates that the relocation of the port-of-entry did not reduce crashes. Thus, the crash data does not indicate that the port-of-entry at the existing North Sheridan Interchange created an unsafe condition.

### Section 3: Project Purpose

The project is being proposed to provide safe, direct regional access from I-90 to the north Sheridan area in support of local land use plans and to improve deteriorating segments of I-90 and North Main Street. The project must comply with both current design standards and with the FHWA's interstate access policy (2009)<sup>5</sup>.

### Section 4: Project Need

The need for this project is demonstrated by the following major issues:

- **Interchange Deficiencies:** Existing interchange geometric conditions include substandard horizontal curves, insufficient acceleration and deceleration lanes, and excessive grades—all of which contribute to safety hazards.
- **System and Regional Connectivity:** Regional and system connectivity are limited to the south side of the interstate with no direct access provided to the north of the interstate to support long-range planning and expected growth.
- **Deteriorating Roadway Segments:** The current pavement section has outlived its design life and is in disrepair.

Each issue is described in more detail in the following paragraphs.

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<sup>5</sup> FHWA requires a comprehensive interstate network study for new or relocated interchanges and in areas where the potential exists for future multiple interchange additions; these additions must be within the context of a long-term plan. Sheridan identified an interchange as part of its study of the West Corridor transportation facility, and it must be considered when determining a location for the North Sheridan Interchange. Minimum spacing between adjacent interchanges whether existing or planned also must be considered.

### ***Interchange Deficiencies***

Three design elements of the North Sheridan Interchange have been identified as not meeting current design standards: horizontal curves, insufficient acceleration and deceleration lanes, and steep grades. Minimum standards are established to ensure that roads are as safe as possible. The interchange was constructed 50 years ago and met design standards at that time; however, standards have been revised, based on new safety information. The existing interchange does not meet current standards. When these standards are not met, the safety of the interchange and connecting road segments is diminished, which can lead to an increase in crashes or unsafe driving conditions.

Design standards for roadways are based on “A Policy on Geometric Design of Highways and Streets,” published by the American Association of State Highway Transportation Officials (AASHTO). Also known as The Green Book, it provides guidelines for these design elements. WYDOT has developed a set of design standards that are based on the AASHTO guidelines; these design standards are presented in the *Wyoming Road Design Manual*. The basis for these guidelines and standards, and the safety issues that can result from not meeting these standards, are discussed in this memorandum. A discussion of crash patterns and reduced safety at the existing North Sheridan Interchange is included.

**Horizontal Curvature:** The horizontal curvature of a road, or what is commonly referred to as the curves of the road (in comparison to vertical curvature or the hills), depends on several factors:

- type of traffic using the road (such as cars, trucks, or RVs),
- number of cars or trucks using the road,
- speed the road is designed for (such as interstate or city street traffic speeds),
- topography of the surrounding area,
- angle of intersecting roads, and
- type of ramps used for exiting the road (such as diamond or trumpet).

The type of traffic, number of vehicles, and design speeds are discussed above in the traffic analysis section.

The topography in the study area can be generally described as rolling, which influences the horizontal and vertical curvature of the roads. The topography and presence of Goose Creek and the Burlington Northern Santa Fe (BNSF) railroad near the existing interchange constrained its design. The current interchange is a trumpet interchange. Main Street is at a skewed angle to the mainline of I-90, which results in sharp curves at the North Sheridan Interchange (See Figure 1). These curves do not meet the AASHTO standards. The westbound on- and off-ramps are posted at 20 miles per hour (mph). The eastbound on-ramp is posted with a 30 mph advisory, meaning that caution should be taken when driving this ramp at 30 mph. The eastbound off-ramp is posted with a 45-mph advisory.

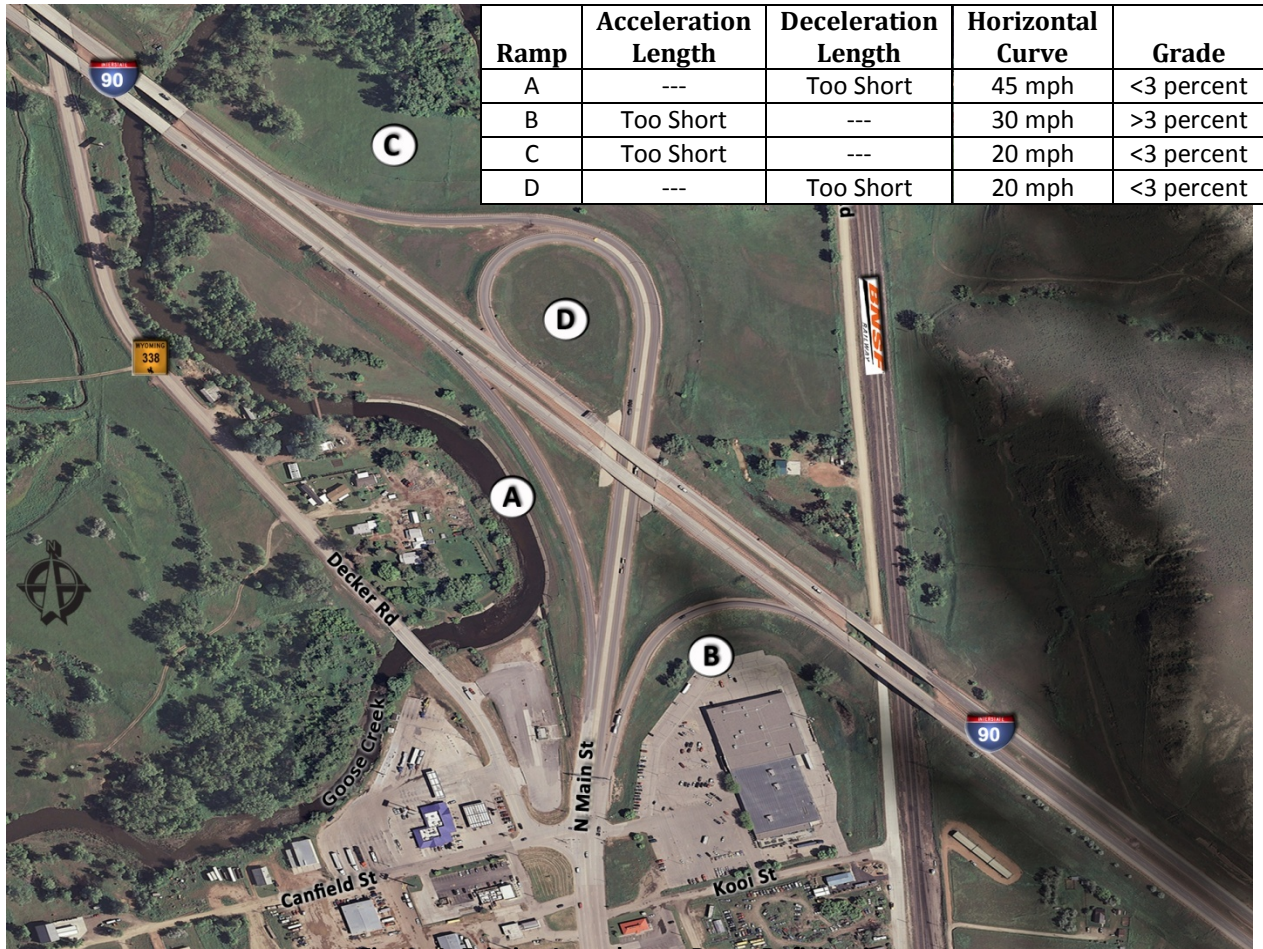


Figure 1. Existing Interchange Ramp Deficiencies

Under the AASHTO standards, the interchange ramps need to accommodate drivers accelerating or decelerating to match the speed of the road to which the vehicle is merging. If curves are too short, drivers cannot accelerate or decelerate at a reasonable rate. Driving too fast along the curve, or making an abrupt deceleration or overcorrection increases the chance that a vehicle will leave the road. Generally, when the posted speed is 75 mph, the exit ramp should be designed for 40 mph to allow the safest acceleration/deceleration (AASHTO 2004). As noted above, except for the 45 mph eastbound off-ramp, the horizontal curves at the existing North Sheridan Interchange ramps are designed and posted for speeds below this threshold. These sharp curves mean that drivers may brake sharply when exiting I-90, may not reach mainline speed when entering I-90, or may not be able to stay on the road at speeds higher than the posted speed. In addition, driving speeds must be further reduced under snowy or icy conditions.

As evidenced by the crash analysis, the westbound on- and off-ramps and the eastbound on-ramp, where horizontal curves are the greatest, have the highest crash rates. Approximately 79 percent (15 of 19) of crashes at the interchange involved only one vehicle. Nearly half of these crashes involved an overturned vehicle, and four more involved a vehicle hitting the guardrail. (These four could have been

overturned vehicles if the guardrail not been in place.) High speeds accounted for a majority of these crashes, but as noted above, the ramp speeds are below what drivers would expect for ramps entering or exiting an interstate highway. Signs or other safety warning devices have been suggested as a means for addressing the crashes discussed above. However, improving geometry and standard horizontal curves is the only proven means for reducing crashes.

Acceleration and Deceleration Lanes: A driver’s ability to enter and exit a roadway at a constant speed and in a continuous flow is linked to the horizontal curves of acceleration and deceleration lanes. Deceleration and acceleration lanes are short lanes provided to assist drivers in transitioning from one rate of speed to another rate of speed. For example, a driver exiting from the interstate would need to slow down to enter onto the exit ramp and ultimately onto a city street. Likewise, a driver may need to accelerate to drive from a city street onto the entrance ramp and onto an interstate. These lanes need to be long enough to ensure that the driver can safely enter or exit the interstate at a constant rate of speed. Any horizontal curves along the interchange ramps need to account for the length of the acceleration and deceleration lanes.

Deceleration lane lengths are measured from the exit ramp gore point to the first horizontal curve in the ramp. The Green Book provides acceleration and deceleration lengths for on- and off-ramps.<sup>6</sup> These values, along with the existing acceleration and deceleration lengths at the North Sheridan Interchange, are shown in Table 6.

**Table 6. Comparison of Existing Conditions and AASHTO Standards for Acceleration and Deceleration Lengths**

Ramp and Location	Lane Length	
	AASHTO Green Book Standards (feet) <sup>^</sup>	Existing Geometry (feet)
Ramp A – Eastbound off-ramp from I-90 to North Main Street deceleration lane	490	0*
Ramp B – Eastbound on-ramp from North Main Street to I-90 acceleration lane	1,730	705
Ramp C – Westbound on-ramp from North Main Street to I-90 acceleration lane	1,510	925
Ramp D – Westbound off-ramp from I-90 to North Main Street deceleration lane	620	453

<sup>^</sup> A Policy on Geometric Design of Highways and Streets, (AASHTO), Exhibits 10-71 and 10-73

\* The current deceleration along the eastbound off-ramp is 0 feet because of the presence of a horizontal curve at the gore point

Neither of the existing deceleration lanes meets the required deceleration length outlined in the AASHTO standards. The result is that the off-ramp does not provide enough room for exiting traffic to slow down. This condition has likely contributed to the eight crashes that have occurred at this interchange.

<sup>6</sup> A Policy on Geometric Design of Highways and Streets, AASHTO, Exhibits 10-71 and 10-73.

The lengths of the existing acceleration lanes do not meet the required acceleration lengths outlined in the AASHTO standards. As a result, there is not enough room for entering traffic to get up to speed with traffic already traveling on I-90. When conditions allow, interstate traffic can merge into the left travel lane of I-90. However, if that lane is occupied or the driver chooses not to move left when a vehicle is entering I-90, the entering driver must alter the vehicle's speed, which could involve abrupt braking in order to avoid the vehicle driving on the interstate, which creates even greater difficulty in obtaining the proper interstate speed. Conversely, the driver already on I-90 may be forced to break to allow the entering vehicle to merge. The result is can be observed by the 12 crashes that occurred along the on-ramps and at the merge points on westbound and eastbound I-90.

Because of the physical constraints posed by Goose Creek, the BNSF railroad tracks, and topography, combined with the skew of North Main Street at I-90, it would be difficult to increase the acceleration and deceleration lanes along the existing I-90 mainline. Longer lanes would require widening, at least minimally, existing structures over the railroad and Goose Creek.

Steep Grades: Steep grades are associated with vertical curves: hills. It is desirable to maintain constant speed along high-speed roads such as I-90 to keep the flow of traffic as constant as possible. Grades that are too steep can cause vehicles to slow down excessively as they travel up the hill. Likewise, vehicles can gain excess speed when they are traveling down hills. Both conditions can lead to increased conflicts for drivers. These problems can be exacerbated by snow and ice.

Generally, cars can negotiate an uphill grade of 7 to 8 percent, but trucks lose speed when the grade is 5 percent. Cars typically do not gain excessive speeds when the downhill grade is less than 8 percent; trucks begin to gain speed when the grades are more than 3 percent. The AASHTO standards define impactful grades as those that exceed 3 percent when there are sharp horizontal curves or a significant amount of truck traffic. These conditions can be worse when snow and ice are present. As previously noted, there are sharp horizontal curves at the existing North Sheridan Interchange. As noted in the existing traffic section, trucks account for 19 percent of ADT on I-90.

The North Sheridan Interchange's eastbound on-ramp has a vertical grade of 4.6 percent to allow vertical clearance over the existing BNSF railroad tracks. The high point of this vertical grade is reached before the acceleration lane length begins, which means the ramp does not require as much additional acceleration length as is typically required when the grade is designed into the acceleration lane. This ramp, however, is used by the large number of trucks coming out of the Common Cents truck stop and RVs entering the interstate from the KOA, so the 4.6 percent uphill grade is a limiting factor for this ramp. These factors affect the ability of trucks and RVs entering the interstate to accelerate to highway speed as they approach and enter the interstate. As noted above, vehicles entering at speeds lower than the interstate traffic can cause conflicts. WYDOT has also recorded that this ramp requires additional maintenance to keep traffic flowing during winter periods of snow and ice.

The public commented that if a longer acceleration ramp is added at this on-ramp, the grade issue can be overcome. The Kmart is close to the on-ramp, however, making it is difficult to change the curve

radius or lengthen the acceleration lane to mitigate the vertical grade of the on-ramp without impacting the Kmart.

### ***System/Regional Connectivity***

The North Sheridan Interchange provides the northernmost interchange access to/from I-90 within Sheridan. Main Street, which has direct access to I-90, is the major north-south travel corridor in the city. It serves the northern area of Sheridan, as well as the historic downtown, which has many active businesses. The northern area of Sheridan adjacent to the interchange is mainly commercial, and includes Kmart, Common Cents truck stop, McDonald's, Pizza Hut, several gas stations, and several hotels. Farther south along Main Street are a rental business, repair businesses, a lumber yard, a tire shop, and other businesses.

North and west of the existing interchange are several rural residences and active agricultural fields. This area was recently annexed into the City and has been identified in local planning documents as a future growth area for Sheridan. It is being considered for a combination of commercial and residential developments. An efficient, safe, regionally convenient interchange is needed to support the long-term growth of the north Sheridan area, while serving local trips. Direct access to Decker Road from I-90 is needed to support long-term planning and growth and regional access to the north Sheridan area.

Decker Road crosses through northern Sheridan County and continues into Montana. At its southern terminus, Decker Road connects into Main Street at Canfield Street. Decker Road is a two-lane rural arterial road with a posted speed of 55 mph for the majority of its length. Closer to Sheridan, the speed is reduced to 40 mph, then to 30 mph near its intersection with Main Street.

Decker Road is a significant regional connector servicing industrial, recreational, agricultural, and residential needs. It has been identified by the County as an important primary and secondary access route. It serves the agricultural and rural residences north of I-90, as well as recreational users of the Tongue River Reservoir. It provides a connecting link for residents that live in Sheridan but work north at two coal mines in Decker, Montana: the Decker Coal Mine and Spring Creek Coal Mine. A new mine is being proposed in Wyoming south of the existing coal mines. Workers and equipment servicing the coal bed methane industry also use Decker Road for commuting purposes.

The *Sheridan County Comprehensive Plan* identifies Decker Road as both a heavy truck corridor and as an alternative cross-county route. Sheridan County designated Decker Road as a Heavy Truck Corridor, acknowledging Decker Road as the principal access to industrial land and energy production areas serviced by commercial trucks. Alternative cross-county routes show secondary access to communities in Sheridan County and to the City of Sheridan. The routes highlight the potential connections among communities in the event of accidents or natural disasters.

Although Decker Road intersects Main Street, it does not have a direct connection to I-90. A daily average of 146 cars and trucks, or 7 percent of traffic traveling on Decker Road, connect onto Main Street to gain access to I-90. Likewise, 197 cars and trucks, or 5.5 percent of daily traffic, exit I-90 at Main Street, but continue on to Decker Road.

The existing North Sheridan Interchange also does not have a direct north connection from I-90 to Decker Road, which limits overall regional and system connectivity and direct access to existing uses and areas north of I-90. Further, the existing North Sheridan Interchange does not support City and County land use plans that show the area around Decker Road and north as a future growth area for Sheridan.

WYDOT and FHWA must consider future growth and plans, which would require request for additional interstate access. Any proposal for interstate access must comply with FHWA’s interstate access policy.

***Deteriorating Roadway Segments***

Three elements of the roadway system within the study area have been identified as nonexistent or deteriorating along segments of I-90, North Main Street, and Decker Road: pavement condition, stormwater drainage, and sidewalks. Proper stormwater drainage is nonexistent in several areas in the corridor. Sidewalks are lacking or are in poor condition in the area of proposed improvements.

Pavement Condition: The pavement along North Main Street and stretches of I-90 is showing signs that its design life has been exceeded (See Table 7). According to the reconnaissance report prepared for this project, WYDOT performed pavement recycle projects in 1991 and 2000, but the pavement life was not extended as much as expected. The pavement is stripping and rutting, which may be due to aggregate problems. Full reconstruction of the pavement section is necessary to solve the sub grade problems.

**Table 7. Pavement Condition**

Road Segment	Mile Post	Surfacing Type	Condition
I-90 Mainline	19.70 - 21.30	Asphalt	Fair
I-90 Mainline	21.30 - 21.68	Asphalt	Fair
I-90 Mainline	21.68 - 22.45	Asphalt	Fair
Main Street	20.92 - 21.09	Asphalt	Poor
Main Street	21.09 - 21.19	Asphalt	Poor
Main Street	21.19 - 21.65	Asphalt	Poor
Decker Road	0.00 - 0.12	Concrete	Poor
Decker Road	0.12 - 1.00	Asphalt	Excellent

Source: WYDOT 2010c

Structure Condition: The structures along I-90 are 50 years old but generally in good shape. They will need minor rehabilitation work (WYDOT 2010b).

Drainage: Insufficient drainage along roadway surfaces can be harmful to roadway safety; if water backs up on to the road, it can create slippery and unsafe conditions for drivers. Drainage along I-90 is through a series of existing culverts and an outfall channel to Goose Creek.

Along Main Street, drainage is provided by a curb and gutter system linked to the City’s storm sewer system. In many locations the curb and gutter is crumbling with visible portions missing. This is also true to storm sewer inlets.



The drainage along Decker Road is typical of a rural road section. There are no curb or gutters along the road. In some instances, there are roadside ditches, but in other locations, the drainage runs off the road to adjacent land. The area along the road is generally flat with little slope to promote runoff.

Sidewalks: Sidewalks exist along short stretches of the east side of North Main Street, but there are no sidewalks along the west side of the street. There also are no sidewalks along Decker Road. Without sidewalks, pedestrians and bicyclists are forced to travel in the roadway, which poses a safety risk for pedestrians, bicyclists, and vehicles. Improving North Main Street and Decker Road with added sidewalks would improve safety along each road, and it would satisfy the goals of the Joint Land Use Plan and the *North Main Area Master Plan*.

## Section 5: Additional Project Goals and Objectives

The City of Sheridan is actively working with several groups to revitalize the North Main Area. Several plans that address land use issues in the North Main Area, including the *Sheridan County Comprehensive Plan*, *Sheridan Joint Area Planning Land Use Plan*, the *North Main Area Master Plan*, *Transportation Policy Plan*, and *West Corridor Plan*, have been adopted. The City of Sheridan, Sheridan County, the North Main Neighborhood Association, and several interested citizens have asked WYDOT to consider these planning and revitalization efforts during planning and project development for the North Sheridan Interchange. It is a goal of this project to be consistent with the direction, elements, and objectives of these plans and to work cooperatively with the City, County, and other groups working to revitalize the North Main Area. The selected location of the North Sheridan Interchange, however, must allow for placement consistent with the FHWA access requirements of another interchange between the proposed North Sheridan Interchange and the port-of-entry interchange. The North Sheridan Interchange should not be located so that it would preclude an additional interchange for the West Corridor tie-in. The direction, elements, and objectives of recent City and County planning efforts include the following.

- Sustain natural and scenic resources and environmental quality, including Goose Creek riparian area.
- Expand open space in north Sheridan area (e.g. turning the former port-of-entry site into a welcome center).
- Provide pedestrian improvements (e.g. wider sidewalks, bulb-outs, street lighting, etc.) and trail accommodations (i.e. along Goose Creek).
- If the interchange is moved, it should be maintained as close to the existing interchange as possible.
- Enhance access of commercial businesses along North Main Street for quality commercial centers.
- Preserve Goose Creek, Big Horn Mountains, and agricultural viewsheds in North Sheridan area.
- Provide an efficient and multimodal transportation system, including continuation of the designated heavy truck corridor and cross-country route along Decker Road.
- Allow for tie in to I-90 from proposed West Corridor.

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- WYDOT 2010a. Personal communication between John Seyer, HDR Engineering and Tom Carpenter and Matt Carlson, WYDOT regarding crash rates.
- WYDOT 2010b. Personal communication between Kevin Powell and Jeff Booher, WYDOT regarding I-90 structure condition.
- WYDOT 2010c. Email communication between Laura Lutz-Zimmerman, HDR Engineering and Greg Milburn, WYDOT regarding pavement condition.