Noise Technical Memorandum

North Sheridan Interchange

Sheridan County

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Wyoming Department of Transportation

and

Federal Highway Administration

Prepared by:

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North Sheridan Interchange Environmental Assessment

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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.

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 serving 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 be consistent with the FHWA access requirements for 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, to improve deteriorating segments of I-90 and North Main Street, and to comply with the FHWA's interstate access policy.

Study Area

Three distinct study areas were defined to correspond with the three types of improvements associated with the North Sheridan Interchange project.

The study area for improving or relocating the existing interchange extends from the center of the existing interchange to a point along I-90 approximately 1.5 miles west. The width of this area is one half mile on each side of I-90. This study area includes an area for the potential realignment of Decker Road. The study area for improvements to the mainline of I-90 extends to approximately 1.5 miles east of the existing interchange and to approximately 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.

The City of Sheridan has identified the north Sheridan area as a primary growth area, and a large tract of land west of Decker Road was annexed into the City. The City has developed plans for the Sheridan High-Tech Business Park, and a subdivision plat for Phase I of the Wrench Ranch development area has

been approved. These developments are likely to generate different future traffic patterns as the developments are built out. Additionally, the West Corridor is a planned north-south transportation facility that will traverse 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 new roadway capacity independent of the proposed North Sheridan Interchange improvements. Funding for the West Corridor has not been identified.

Proposed Alternatives

WYDOT developed and screened a range of alternatives as part of the North Sheridan Interchange Environmental Assessment. As described in the *Alternatives Technical Memorandum* (HDR Engineering 2012),[1] after screening WYDOT has two remaining build alternatives—Alternative 2 and Modified Alternative 4—that will be carried through the Environmental Assessment for further analysis in addition to the No-Build Alternative. More information on these alternatives, including location figures, can be found in the *Alternatives Technical Memorandum*.

Alternative 1: No-Build: This alternative represents the conditions if major improvements are not completed as a result of this study. This alternative would not improve the existing geometric deficiencies, regional connectivity shortcomings, or deteriorating roadway segments within the three study areas.

Alternative 2: Rebuild at the Existing Interchange: This alternative would construct a tight diamond interchange about 750 feet north of the existing interchange and within the same general interchange footprint. The crossroad would connect with Decker Road using a free-flow T-intersection. The existing interchange would be demolished in order to build the new interchange. This alternative would include demolition of residences (including rental properties) and, potentially, relocation of a small business. This alternative would necessitate acquisition of land from the KOA tent site as well.

Modified Alternative 4: Diamond Interchange Close to Decker Road: This alternative would construct a diamond interchange about 2,300 feet west of existing Decker Road and about 4,560 feet northwest of the existing interchange. The “straight through” alignment of Decker Road would be eliminated and traffic would flow along a realigned North Main Street / Decker Road that would cross I-90 perpendicular. The existing North Sheridan Interchange would continue to carry traffic until construction of the proposed interchange is complete. Right-of-way would be required from currently undeveloped land. There would be no residential or commercial relocations.

Study Methodology

Traffic noise impacts were evaluated using noise models and methodologies approved by FHWA and WYDOT.

The following methods were used to assess traffic noise impacts associated with the proposed project alternatives:

[1] Alternatives at Decker Road and farther north of Modified Alternative 4 were considered but were screened out because they did not meet purpose and need. These interchange locations were not included in this analysis.

- Existing activities, developed land, and undeveloped land where development is planned, designed, or programmed and that could be affected by noise from the proposed project alternatives were identified from field surveys and aerial photographs.
- Noise levels were predicted using the FHWA Traffic Noise Model (TNM), Version 2.5 (February 2004).
- Noise impacts and noise abatement measures, if warranted, were identified using the evaluation criteria contained in WYDOT's *Noise Analysis and Abatement Policy* (July 2011).

Traffic Noise Model (TNM)

Traffic noise levels were determined by computer modeling using the FHWA-required TNM, Version 2.5. The TNM estimates acoustic intensity at receiver locations based on the level of sound energy generated from a series of straight-line road segments. Where appropriate, the effects of local shielding from existing structures, vegetation, terrain, and other adjustment factors can be included in the model to provide greater detail and enhanced accuracy.

Noise levels were modeled to reflect the expected traffic conditions in 2035 after the project is completed. Traffic volumes in 2035 reflect worst-case conditions (that is, when the most vehicles would be using the facility, generating the most traffic-related noise). Vehicle speeds and roadway alignments (including elevations above or below the existing ground surface) used in the noise model were based on the design information provided by project engineers.

The goal of the noise impact analysis was to determine if the predicted noise levels associated with the project alternatives would approach or exceed the applicable WYDOT Noise Abatement Criteria (NAC) (66 dBA for residential locations), thereby warranting consideration of noise-abatement measures, such as sound walls. If noise-abatement measures were warranted, the analysis then determined the optimal design characteristics for the barrier (e.g., height, length, and cost-effectiveness per WYDOT requirements).

Regulatory Setting

The Federal Noise Control Act of 1972 (Public Law 92-574) requires that all federal agencies administer their programs in a manner that promotes an environment free from noises that could jeopardize public health or welfare. FHWA has implemented its program by developing noise regulations, which can be found in 23 CFR 772 *Procedures for Abatement of Highway Traffic Noise and Construction Noise*.

WYDOT has adopted criteria for evaluating noise impacts associated with federally funded highway projects and for determining whether such impacts are sufficient to justify funding noise-abatement measures. WYDOT's NAC are summarized in Table 1.

Table 1. WYDOT Noise-Abatement Criteria

Activity Category	L_{eq}* Noise Levels (dBA)	Description of Activity Category
A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	Residential (includes undeveloped lands permitted for this activity category).
C	67 (Exterior)	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio structures, recording studios, recreation area, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52 (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72 (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in Categories A-D or F.
F	—	Agriculture, airports, bus yards, emergency services, industrial logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	Undeveloped lands that are not permitted.

Source: WYDOT 2011

* equivalent sound level

A traffic noise impact occurs when a predicted traffic noise level approaches or exceeds the NAC listed in Table 1 for a specific activity category or when the predicted traffic noise level substantially exceeds the existing noise level. As defined by WYDOT, a design-year noise (that is, 2035) level within 1 dBA (i.e. 66 dBA) is considered to "approach" the NAC. A predicted noise level greater than or equal to the NAC is considered to exceed the NAC, and a 15 dBA increase over existing noise levels is considered to substantially exceed the NAC.

Section 2: Existing Conditions

Land use around the North Sheridan Interchange consists of **{** XE "noise:current conditions" **}**a mix of low-density residential, recreational, and commercial land uses on both sides of I-90. There is also a substantial amount of undeveloped open space on both sides of I-90. The Sheridan Veterans

Administration Medical Center (VA Medical Center) is about 0.75 of a mile west of North Sheridan Interchange (south of I-90).

Existing noise levels in the study area were determined by taking short-term (10-minute) sound-level measurements at eight locations. Noise-measurement locations were selected to represent existing residential developments, recreational areas, or other areas where people could be exposed to traffic noise for extended periods. Noise-monitoring locations (represented as ML-1 to ML-8) are shown in Figure 1. The measured noise levels for the eight monitoring locations are shown in Table 2.

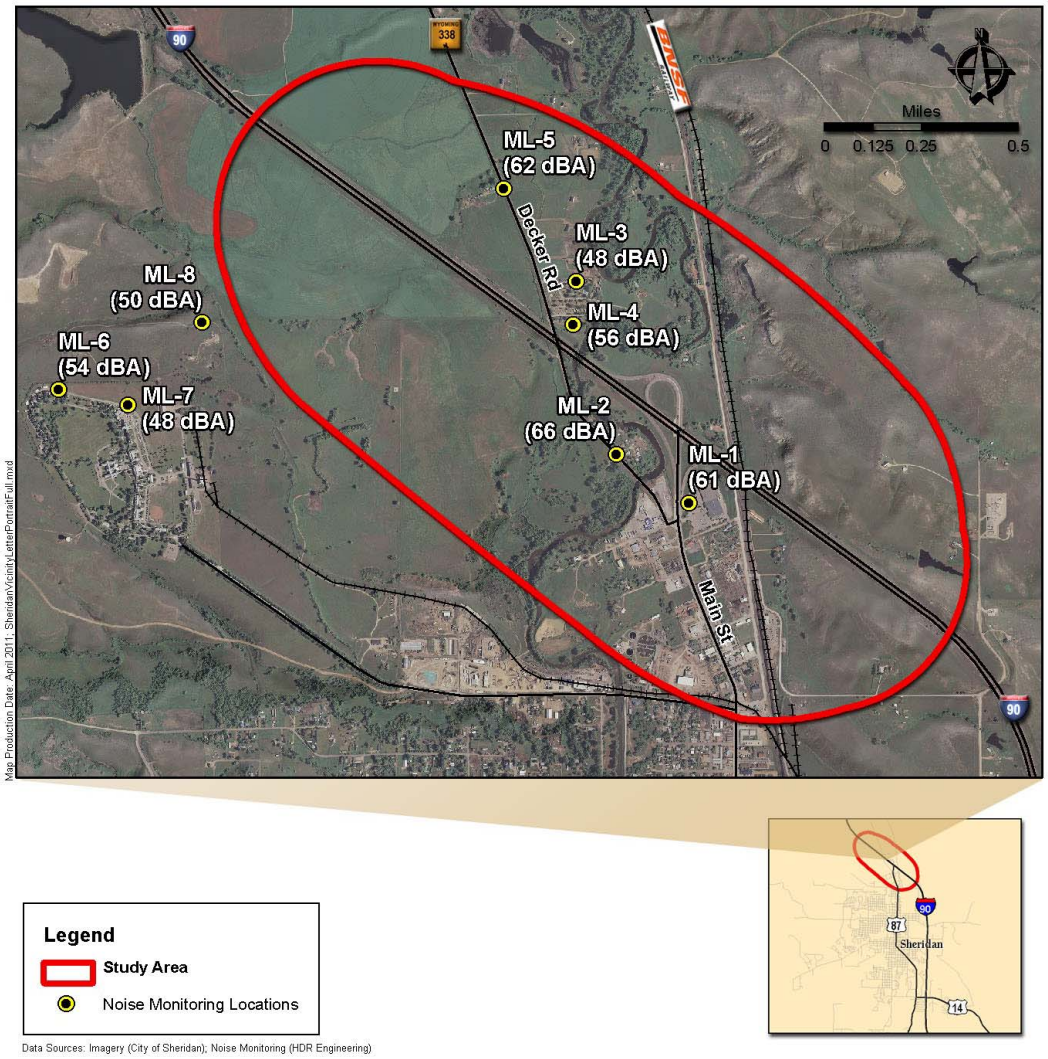

Figure 1. Noise-Monitoring Locations

Table 2. Existing Noise Levels in Vicinity of North Sheridan Interchange

Monitoring Location	FHWA Activity Category[a]	Land Use	Location	Measured Noise Level (dBA)
1	E	Commercial	Kmart at Main Street and eastbound On-ramp to I-90	61
2	B	Residential	Residential – Decker Road, south side of I-90	66
3	B	Recreational	KOA campground – Decker Road, east side of I-90	48
4	B	Recreational	KOA campground – Decker Road, east side of I-90	56
5	B	Residential	Residence – 338 Decker Road.	62
6	B	Residential	Residences – west side of VA Medical Center	54
7	B	Residential	VA Medical Center – east side	48
8	G	Undeveloped	Undeveloped open space east of VA Medical Center	50

[a] See Table 1, WYDOT's Noise-Abatement Criteria, for a description of the FHWA activity categories.

Measured noise levels were typical of suburban environments and ranged from about 48 dBA to 66 dBA. As expected, higher noise levels were recorded at locations nearer to I-90 and other high-traffic local roads (for example, 66 dBA at ML-2 adjacent to Decker Road on the west side of I-90). With the exception of ML-2, all measured noise levels were below the WYDOT noise-abatement criterion of 66 dBA for residential and recreational locations. The measured noise level at the ML-2 location was 66 dBA, just at the noise impact threshold according to the WYDOT noise policy.

Section 3: Project-Related Noise Impacts

No-Build Alternative

Under the No-Build Alternative, the North Sheridan Interchange project would not be built, so no noise impacts would occur due to the project. However, other transportation projects identified in the area's long-range plans and by the City of Sheridan would be constructed, and these projects would contribute to localized noise impacts throughout the area.

Modeled noise levels in 2035 under the No-Build Alternative are shown in Table 3. Under the 2035 No-Build Alternative, modeled noise levels would range from about 50 dBA to 66 dBA. The residential NAC (66 dBA) was approached at one receptor location (R8), a single-family residence at the corner of Decker Road and Eagle Drive (the entrance to the KOA campground facility). The modeled noise level at this location was 66 dBA. Modeled noise levels at all other locations, including those at the VA Medical Center were below the 67 dBA NAC because of the distance from the predominant source of noise (I-90) and noise attenuation (that is, the loss of sound energy) over distance. In addition, other factors such as

wind speed and direction, as well as terrain effects further reduce noise levels at distance from the source.

Alternative 2

As shown in Table 3, modeled noise levels under Alternative 2 would range from 51 dBA to 68 dBA. Under Alternative 2, noise levels would decrease by 1 dBA at two receptors, stay the same at 13 receptors, increase by 1 dBA to 3 dBA at 12 receptors, and increase by 4 dBA or more at three receptors (R2, R4, and R21 in Figure 2). It is important to note that a 3 dBA difference in noise levels is not discernible to the human ear (for example, people would not be able to discern a difference between a 60 dBA noise source and a 63 dBA noise source). Under Alternative 2, the residential NAC (66 dBA) would be exceeded at one receptor location (R8) (Figure 2). R8 is a single-family residence at the corner of Decker Road and Eagle Drive (the entrance to the KOA facility).

Modified Alternative 4

Modeled noise levels under Modified Alternative 4 would range from about 48 dBA to 65 dBA. Under Modified Alternative 4, the new interchange would be located farther from Decker Road and Main Street than it would be under Alternative 2. Under Modified Alternative 4, noise levels would stay the same or increase by up to 3 dBA at twenty-four receptors and increase by 4 dBA to 6 dBA at three receptors. Noise levels would decrease by 1 dBA to 3 dBA at two receptors, and by 4 dBA or more at one receptor. Under Modified Alternative 4, the residential NAC (67 dBA) would not be exceeded.

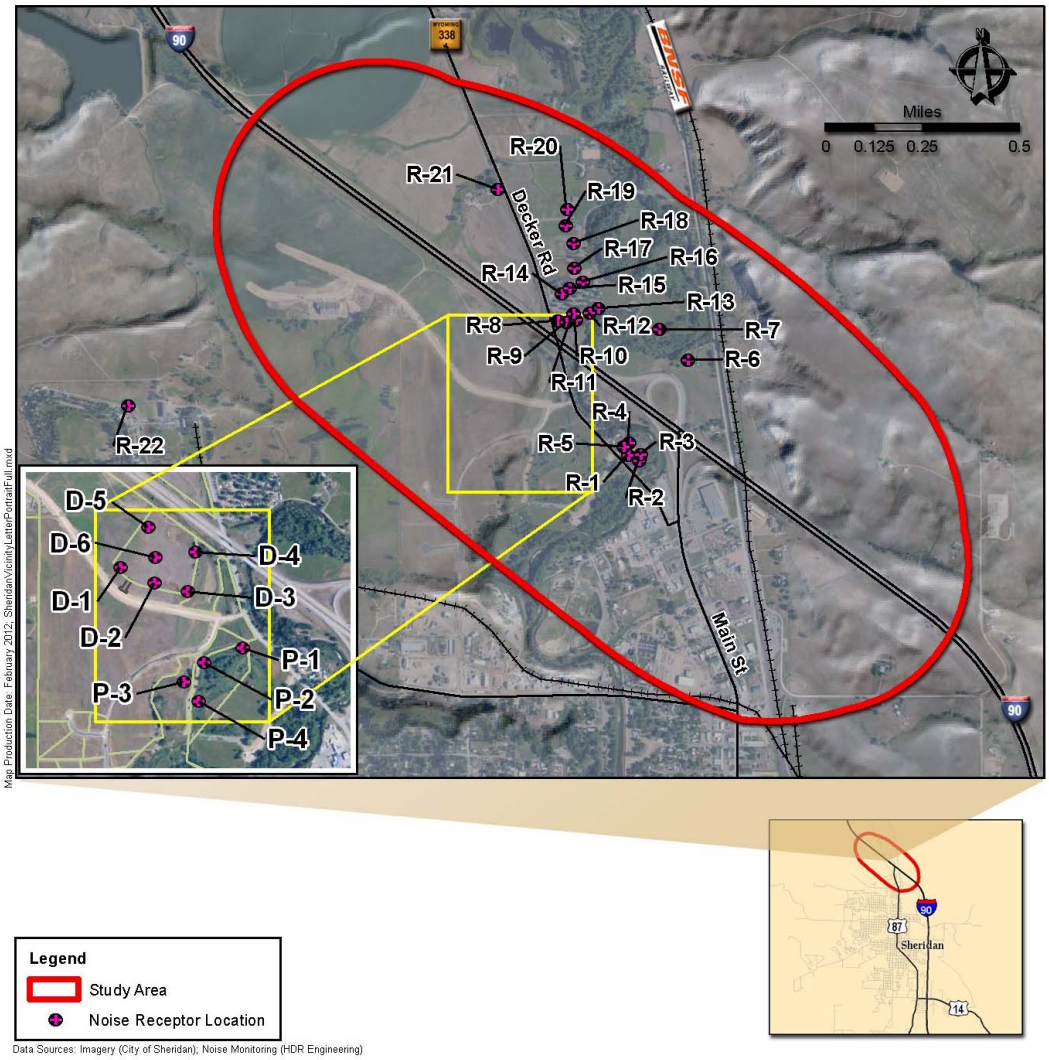

Figure 2. Noise Receptors

Table 3. Modeled Noise Levels (dBA) – North Sheridan Interchange

Receptor[a]	2035 No-Build	Alternative 2[b]	Impact Due to Project	Modified Alternative 4	Impact Due to Project
1	62	--	--	65	3
2	61	65	4	63	2
3	60	63	3	61	1
4	60	65	5	62	2
5	60	--	--	64	4
6	56	57	1	56	0
7	52	54	2	53	1
8	**66**[c]	**68**[c]	2	65	-1
9	65	65	0	65	0
10 (4 RV Spaces)	63	62	-1	62	-1
11 (4 RV Spaces)	62	62	0	62	0
12 (2 RV Spaces)	61	60	-1	61	0
13 (3 RV Spaces)	57	58	1	58	1
14 (5 RV Spaces)	59	60	1	60	1
15 (3 RV Spaces)	58	58	0	59	1
16 (2 RV Spaces)	55	56	1	57	2
17	54	55	1	56	2
18	53	54	1	55	2
19	51	52	1	53	2
20	50	51	1	52	2
21	59	64	5	51	-8
22	50	51	1	52	2
D-1	53	53	0	58	5
D-2	54	54	0	59	5
D-3	58	58	0	60	2
D-4	65	65	0	65	0
D-5	61	61	0	61	0
D-6	58	58	0	59	1
P-1	57	58	0	63	6
P-2	54	55	0	58	4
P-3	52	52	0	55	3
P-4	52	52	0	54	2

[a] See Figure 2 for Receptor Locations
[b] Under Alternative 2 residences represented by R1 and R5 are takes/relocations
[c] Noise levels in bold approach or exceed residential NAC

Section 4: Consideration of Noise-Abatement Measures

Under the WYDOT noise policy, noise abatement measures will be considered where they are both reasonable and feasible. Feasibility deals primarily with engineering considerations (for example, whether a barrier can be constructed given the terrain, whether a substantial noise reduction can be achieved by the barrier, can a barrier be located without causing safety issues, etc.). Reasonableness is a

more subjective criterion than feasibility and implies that common sense and good judgment have been applied in reaching a determination to build a barrier.

Reasonableness criteria include (among other factors):

- Amount of noise reduction provided by the barrier
- Number of residences benefitting from a barrier
- Cost of the barrier
- Future noise levels resulting from the project alternatives
- Timing and consideration of development along the transportation facility

Under Alternative 2, there would be one residential noise impact (68 dBA) on the east side of I-90 near the KOA campground entrance. Under Modified Alternative 4, there would be no noise impacts.

While noise barriers would be technically feasible (that is, there would be no obvious engineering constraints to their construction), they would not be reasonable under WYDOT's noise policy. According to WYDOT's reasonableness criteria (summarized above), noise barriers that benefit few residences are not feasible because the cost of the barrier would exceed WYDOT's allowable cost of $23,000 per residence.

WYDOT gives greater consideration to residential areas where high absolute traffic noise levels are expected to occur (i.e., greater than 70 dBA) or where large increases over No-Build noise levels are predicted (i.e., a greater than 15 dBA increase). Under both project alternatives, the highest predicted noise level is 68 dBA (at R8 under Alternative 2) and the greatest increase over the 2035 No-Build Alternative is 5 dBA (R1 under Modified Alternative 4). In addition, noise impacts due to the project alternatives are 1 dBA to 2 dBA over the residential NAC of 66 dBA. Under these circumstances, the expenditure of public funds for noise barriers that would benefit few residences would not be good use of limited resources.

As a result, noise barriers are not considered reasonable for the North Sheridan Interchange project under WYDOT's noise policy.

Section 5: Summary of Findings

Based on the findings of this noise impact assessment, the largest project-related noise impacts would result from Alternative 2. Under Alternative 2, interchange ramps and cross streets would be located closer to existing residences than under the No-Build Alternative. Under Modified Alternative 4, the interchange would be constructed about 4,560 feet from the existing interchange and further away from existing residences. As a result, project-related noise impacts under Modified Alternative 4 are less than the 2035 No-Build Alternative.

References

HDR Engineering 2012. *Alternatives Technical Memorandum*.

WYDOT 2011. Noise Analysis and Abatement Policy.