Noise Analysis Report

South Avenue Bridge Project

Bitterroot River - W of Missoula

BR 9032(65)

UPN 6296000

Missoula County, Montana

November 2016

Prepared for:

Missoula County Department of Public Works
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EXECUTIVE SUMMARY

HDR Engineering, Inc., (HDR) conducted a traffic noise analysis to evaluate the potential noise impacts associated with the proposed South Avenue Bridge in Missoula County, Montana. The Project includes a new bridge that will extend South Avenue across the Bitterroot River, beginning at the future intersection with River Pines Road in the west and continuing east over the river to Hanson Drive.

The purpose of this analysis is to fulfill the requirements of Title 23 of the Code of Federal Regulations (CFR) Part 772, “Procedures for Abatement of Highway Traffic Noise and Construction Noise,” and the Montana Department of Transportation (MDT) Traffic Noise Analysis and Abatement Policy (July 2011).

This Noise Study Report has been prepared consistent with the noise regulations at 23 CFR 772, effective July 2011. The 2035 design year alternative noise level is on average 4 dB(A) greater than the noise level predicted for the existing year (2015) alternative, with a maximum 10 dB(A) increase in noise level for residences east of the river.

Based on the noise analysis of predicted design year noise levels, noise increase as a result of the proposed project is not predicted to result in an impact at any of the locations identified as defined by the Federal Noise Abatement Criteria.

Contents

Tables

Figures

Appendices

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1 Introduction

This report evaluates potential noise impacts from the South Avenue Bridge Project in Missoula County, Montana. The Montana Department of Transportation (MDT) Traffic Noise Analysis and Abatement Policy constitutes the official Montana noise policy and procedures for the purpose of meeting the requirements of Title 23 of the Code of Federal Regulations (CFR) Part 772 and applicable state laws. This analysis conforms to Federal Highway Administration (FHWA) Regulation 23 CFR 772, "Procedures for Abatement of Highway Traffic Noise and Construction Noise," and all applicable state laws. The project is considered a Type I project under 23 CFR 772 because it includes a proposed roadway on structure in a new location, which triggers the requirement for a noise analysis.

1.1 Project Purpose

Missoula County, in cooperation with MDT and FHWA, is proposing to construct a new bridge that will extend South Avenue across the Bitterroot River. This analysis was conducted to evaluate the potential noise impacts associated with the proposed South Avenue Bridge project (Project) in Missoula County, Montana. The purpose of the project is to enhance the operational characteristics and increase safety for the traveling public for the foreseeable future by constructing a facility that meets current design standards as well as meeting the current and future traffic demands for the area.

The purpose of this noise report is to:

- Provide a discussion of the fundamentals of noise and traffic noise analysis;
- Evaluate existing traffic noise levels in the corridor;
- Predict the traffic noise levels associated with the proposed Project for identified sensitive receptors. Sensitive receptors are uses adjacent to the studied corridor (such as houses, parks and schools) that might be affected by traffic noise;
- Identify the typical distance from the roadway at which noise levels would be predicted to approach the Federal Noise Abatement Criteria (NAC) noise levels of Leq(h) 57 dB(A), 67 dB(A) and 72 dB(A). "Approaching" this level is defined by MDT policy as a noise level within one decibel of the NAC;
- Quantify the number of properties that are predicted to experience roadway noise levels that exceed the applicable standards; and,
- Evaluate potential mitigation measures for sensitive receptors adjacent to the proposed bridge alignment that approach or exceed the NAC, or cause a substantial increase in noise over existing noise levels. MDT defines a substantial increase as 13 dB(A) over existing.

1.2 Project Description and Location

The proposed Project is located at the western terminus of South Avenue west of the Missoula city limits and within Missoula County. The Project will extend South Avenue across the Bitterroot River and connect with River Pines Road immediately west of the river. The project limits extend between the intersection of South Avenue and Hanson Drive to the east and River Pines Road to the west. A segment of River Pines Road will be realigned to include a T-intersection on the west side of the river.

The proposed Project involves construction of a new 2-lane bridge (one travel lane in each direction) that provides for bicycle/pedestrian accommodations separated from vehicular traffic. The bridge design currently being evaluated is a four span welded plate girder design approximately 746 feet long. The project includes removal of the existing single-lane Maclay Bridge on North Avenue located approximately 0.4 mile downstream of the proposed bridge location. The project is located in Sections 26, 27, 34, and 35 of Township 13 North, Range 20 West, Montana Principle Meridian, and is centered at approximately 46.8491° North latitude and 114.1043° West longitude.

The project area location and vicinity are shown in Figure 1.

Figure 1. Project Area

2 Methodology

The noise study for this project was prepared in accordance with the Montana Department of Transportation Traffic Noise Analysis and Abatement Policy to comply with the amended 23 CFR 772, which became effective July 2011.

The noise study includes two distinct scenarios consisting of the Existing year (2015) conditions and the design year (2035) Build Alternative conditions. A No-Build scenario is not required for this project. The noise study boundary extends 500 feet from either side of the proposed project.

2.1 Noise Metrics

Noise can be described as unwanted sound that may interfere with communication or disturb the community. Noise levels are measured in decibels (dB), a unit used to measure the intensity or pressure level of a sound on a logarithmic scale. For traffic noise purposes the A-weighted scale is used, which provides a single number measure that weighs different frequencies in a manner similar to the sensitivity of the human ear. Thus, the A-weighted sound level in decibels, expressed in dB(A), provides a simple measure of intensity and frequency that correlates well with the human response to environmental noise.

The noise level descriptor used by MDT is the equivalent sound pressure level (Leq). The Leq is defined as the continuous steady sound level that would have the same total A-weighted sound energy as the real fluctuating sound measured over a given period of time. Traffic noise levels are measured with the hourly equivalent sound pressure level, expressed as Leq(h). Table 1 illustrates how traffic noise levels relate to other sound sources.

Table 1. Typical Noise Levels

Common Outdoor Activities	Noise Level dB(A)	Common Indoor Activities
	-110-	Rock Band at 16 ft
Jet Fly-over at 1000 ft	-100-	Inside Subway Train (New York)
Gas Lawn Mower at 3 ft	-90-	Food Blender at 3 ft
Diesel Truck at 50 ft	-80-	Garbage Disposal at 3 ft Shouting at 3 ft
Gas Lawn Mower at 100 ft	-70-	Vacuum Cleaner at 10 ft
Commercial Area	-60-	Normal Speech at 3 ft Large Business Office
Quiet Urban Daytime	-50-	Dishwasher Next Room
Quiet Urban Nighttime Quiet Suburban Nighttime	-40-	Small Theater, Large Conference Room Library
Quiet Rural Nighttime	-30-	Bedroom at Night Concert Hall (Background)
	-20-	Broadcast/Recording Studio
	-10-	Lowest Threshold of Human Hearing
	-0-	

Source: FHWA

2.2 Federal and State Regulations

Traffic noise impact from the proposed Project was assessed in accordance with FHWA and MDT noise assessment regulations and guidelines. FHWA's Procedures for Abatement of Highway Traffic Noise and Construction Noise, 23 CFR 772, requires the following during the planning and design of a highway project.

1) Identification of highway traffic noise impacts;

2) Examination of potential abatement measures;

3) Gather public input approval for reasonable and feasible abatement measures;

4) Incorporation of reasonable and feasible highway traffic noise abatement measures into the highway project;

5) Coordination with local officials to provide helpful information on compatible land use planning and control; and

6) Identification and incorporation of necessary measures to abate construction noise.

The highway traffic noise impact identification process involves a review of the existing and permitted noise-sensitive properties that parallel the highway corridor and determining existing and future noise levels within those areas. Noise-sensitive land use is identified by inspecting aerial photography and performing site reconnaissance. Highway traffic noise analyses are also performed for undeveloped lands when they are considered permitted developments.

The FHWA mandates the most recent version of the Traffic Noise Model® (TNM) software be used to predict noise levels from roadway operations. Additional information is given on this software in the next section. After the existing and proposed land uses are established, the horizontal and vertical geometry of the study area is validated in the TNM through a process that compares modeled noise levels to actual measured noise levels. The noise model must predict noise levels that are within 3 dB(A) of the actual levels in order to be considered valid. Future design year traffic is applied to a model that has been validated for the existing condition to estimate design year (2035) noise levels.

The FHWA NAC presented in 23 CFR 772 establish criteria for traffic noise impact assessment with respect to various land uses (Table 2). A traffic noise impact is defined as a future noise level that approaches or exceeds the FHWA NAC or a future noise level that creates a substantial noise increase over existing noise levels. An approaching noise level is defined as being 1 dB(A) less than the noise level listed as the FHWA NAC for Activity Categories A through E in Table 2. The FHWA allows states to define a substantial noise increase as an increase of anywhere between 5 and 15 dB(A). MDT uses a 13 dB(A) increase between the existing and modeled design year sound levels to identify substantial increase impact.

If one or more receptors are affected by project-related traffic noise levels that approach or exceed the abatement criteria, or that substantially exceed existing noise levels, then abatement measures must be considered. If the abatement criteria is not approached or exceeded, or if projected traffic noise levels do not substantially exceed existing noise levels, abatement measures will not be considered. For this analysis, noise impacts were evaluated for residential properties within 500 feet of the Project and compared to the FHWA criteria for Activity Category “B.”

Table 2. Noise Abatement Criteria

Hourly A-Weighted Sound Level – decibels (dB(A))				
Activity Category	Activity Criteria Leq(h)[1]		Evaluation Location	Description of Activity Category
	FHWA	MDT		
A	57	56	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[2]	67	66	Exterior	Residential
C[2]	67	66	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 studios, recording studios, recreational areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	51	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[2]	72	71	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in 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.

(Based on Table 1 of 23 CFR Part 772)

[1] The Leq(h) Activity Criteria values are for impact determination only and are not design standards for noise abatement measures.

[2] Includes undeveloped lands permitted for this activity category.

2.3 FHWA Traffic Noise Model

The Existing year (2015) and design year (2035) Build Alternative traffic noise levels for the Project were predicted for 26 noise receptors using TNM, version 2.5. Noise contours for the Build Alternative were also predicted using the TNM. In accordance with 23 CFR 772.9(c), “Noise contour lines may be used for project alternative screening or for land use planning … but shall not be used for determining highway traffic noise impacts.” Consequently, the dimensions of the contours were determined, but are not shown on an aerial image because they were not used in the analysis. The model predicted noise levels at each receptor location, and these values are documented in this report.

TNM is FHWA’s computer program for highway traffic noise prediction and analysis. The use of the most recent TNM software is a mandatory requirement for all traffic noise related projects, under State and Federal regulations. The following parameters are used in this model to calculate an hourly Leq at a specific receptor location:

- Distance between roadway and receptor;

- Relative elevations of roadway and receptor;
- Hourly traffic volumes by classification;
- Vehicle speeds;
- Ground absorption;
- Weather conditions; and
- Topographic features, including retaining walls and berms.

Available project design plans, topographic and aerial data were used to create a three-dimensional model of the existing and future design roadway configurations and the surrounding terrain. Conceptual design plans overlaid on project aerials were used in conjunction with United States Geological Survey (USGS) quadrangle maps to develop the horizontal and vertical coordinate input data required for the TNM. Roadway coordinates were placed down the center of the total roadway pavement width in both roadway directions. Receptor locations were identified from recent available aerial imagery and the Missoula County Property Information System.

2.4 Traffic Data

Hourly existing traffic volumes from 2013 and 2014 provided by MDT were used by HDR to develop the existing and design year traffic volumes to be entered into TNM. The hourly existing counts were summarized in order to find the worst-case noise hour based on the highest volume found from all hours for each roadway. The analysis found that the 18:00 hour provided the worst-case noise hour for South Avenue and receptors east of the river while the 17:00 hour provided the worst-case noise hour for River Pines Road and receptors west of the river. For the build case, growth rates from the Project's preliminary traffic study were used to project future volumes for the 2035 Build Alternative year from the existing hourly volumes. The worst-case noise hour remained the 18:00 hour for all receivers along the proposed project, both east and west of the river, while the 17:00 hour remained the worst-case for receptors on River Pines Road.

Vehicle percentages were determined based on MDT-provided vehicle classification counts for South Avenue, North Avenue, and Blue Mountain Road. The vehicle mix data was summarized for entry into the TNM into five vehicle classifications: automobiles (A); medium trucks (MT); heavy trucks (HT); Buses (B); and Motorcycles (M). The resulting vehicle percentages were used for the existing and future case. Percentages found for North Avenue were used on River Pines Road and those found on Blue Mountain Road were also used on Big Flat Road.

Vehicle speeds were based on the roadway posted speed limits. Medium trucks include all vehicles with two axles and six tires, generally having a gross vehicle weight greater than 9,900 lbs. Heavy trucks include all vehicles having three or more axles, generally having a gross vehicle weight greater than 26,400 lbs. The traffic parameters used in the noise model for prediction of existing and future noise levels are presented in Appendix B.

Due to varying worst-case noise hours in the project area, the TNM was run with both the 17:00 traffic for all roadways and the 18:00 traffic for all roadways in both the existing and future cases. Due to the change in worst-case hour condition for receptors

west of the river, one receptor experienced a slight decrease (0.1dB) in future noise levels.

3 Traffic Noise Analysis

3.1 Noise Receptor Locations

A receptor is a discrete or representative location, such as a residence, on any of the land use categories listed in Table 2 at which impacts are assessed.

In determining traffic noise impacts, primary consideration is given to exterior areas where frequent human use occurs, unless no exterior activities are likely based on field observation. Based on the proposed alignment, noise receptors were placed in the most conservative location for frequent outdoor use for each residence relative to the centerline of proposed roadway. All of the noise receptor locations within 500 feet from the nearest existing centerline or 500 feet from the proposed re-alignment centerline were modeled, which is a sufficient distance to identify all potential impacts. Parcels with active building permits (i.e., future residential structure) in the River Pines Estates subdivision were included in the analysis. The modeled receptor locations are shown on Figures A and B in Appendix A.

3.2 Measured Noise Levels

Existing traffic noise levels were measured in the field and then compared against TNM predictions to verify the accuracy of the model. If the predicted and measured levels are within plus or minus 3 dB(A) of one another, this is an indication that the model is within the accepted level of accuracy. Field measurements are not used to identify impacts or determine abatement measures.

3.2.1 Field Testing Procedure

On April 18, 2016, HDR staff measured representative sites along South Avenue and River Pines Road, on both sides of the roadway. Traffic noise measurements were conducted in accordance with the FHWA-PD-96-046 Measurement of Highway Related Noise (May 1996). Traffic was counted manually, classified by vehicle type, and used as input in the validation of the TNM. Traffic counts are available on the Field Monitoring Logs in Appendix C.

3.2.2 Field Measurement Methods and Instrumentation

Noise monitoring was conducted using a Larson Davis 812 Sound Level Meter (SLM), serial number 0221, with calibrations traceable to the National Institute of Standards and Technology (NIST). The microphone was set at a height of approximately 5 feet for all measurements and covered with a windscreen. Table 3 summarizes the measurement locations.

Weather conditions included a clear day where the temperature ranged from approximately 50 to 70 degrees during the measurements, with less than 5 mile per hour wind speeds for all measurements. The SLM was programmed to compute the A-

weighted equivalent sound level (LAeq), expressed in dB(A), which closely approximates the range of frequencies a human ear can hear. The duration of the Leq measurements included three repetitions of 15 minutes. The SLM was calibrated before, in the middle of, and after monitoring. No significant calibration drifts were detected during the study.

Table 3. Noise Monitoring Results Summary

Measurement No.	Location	Date	Start Time	Duration (Min.)	Measured Leq (dB(A))
A.1	8061 Grebe Ct ≈ 255 feet north of future South Avenue	18-Apr-2016	15:09	15	42.4
A.2			15:26	15	40.5
A.3			15:43	15	44.4
B.1	2363 Blue Mountain Road ≈ 132 feet south of future South Avenue	18-Apr-2016	16:29	15	45.8
B.2			16:46	15	45.2
B.3			17:02	15	46.8
C.1	4700 South Avenue ≈ 85 feet north of South Avenue	18-Apr-2016	10:56	15	43.7
C.2			11:13	15	39.3
C.3			11:29	15	35.7

3.2.3 Field Measurements and Model Validation

The measured and modeled noise levels for the monitoring sites selected along the project corridor are presented in Table 4. Three measurement periods at each of the three monitoring sites were entered into the model for validation. It was not possible to validate Site C, located east of the river, due to very low traffic volumes. The measured levels at this site were averaged and considered an ambient environment noise level. For the other two sites, the set of modeled and measured data was found to be within the acceptable plus or minus 3 dB(A) tolerance, which satisfies the MDT requirement for validating noise measurements.

Table 4. Model Validation Results

Measurement Location	Measurement No.	L_{Aeq1h} (dB(A))		
		Measured	Predicted	Difference
A	A.1	42.4	42.2	-0.2
	A.2	40.5	41.9	+1.4
	A.3	44.4	44.1	-0.3
	Average	42.4	42.7	+0.3
B	B.1	45.8	48.0	+2.2
	B.2	45.2	48.0	+2.8
	B.3	46.8	49.3	+2.5
	Average	45.9	48.4	+2.5
C	C.1	43.7	29.3	-14.4
	C.2	39.3	35.6	-3.7
	C.3	35.7	28.0	-7.7
	Average	39.6	31.0	-8.6

3.3 Predicted Noise Levels

The results of the noise analysis are presented in Table 5. No sensitive receptors approach or exceed the NAC in the Existing year (2015) or design year (2035) Build Alternative. Substantial increase impacts occur primarily when proposed roadway improvements are planned in the vicinity of noise-sensitive areas, where existing noise levels are relatively low. Review of the modeled noise levels presented in Table 5 indicates the proposed project will not cause substantial noise level increases and therefore do not result in a noise impact as defined by the FHWA NAC.

The predicted noise levels show a range of increase from existing to future of 0 to 4 dB(A) for receptors on the west side of the river and 3 to 10 dB(A) for receptors on the east side of the river. The Existing year (2015) noise levels range from 40 to 58 dB(A) on the west side of the river and 39 to 57 dB(A) on the east side of the river. The predicted future year (2035) noise levels range from 43 to 58 dB(A) on the west side of the river and 43 to 59 dB(A) on the east side.

Table 5. Noise Analysis Results

Receptor	FHWA Activity Category	Noise Abatement Criteria Leq(h) (dB(A))	Dwelling Units	Leq (dB(A))			
				2015 Existing Noise Level	2035 Build Alternative	Increase Over Existing	Impact?
P01	B	66	1	58	58	0	N
P02	B	66	1	46	48	2	N
P03	B	66	1	53	53	0	N
P04	B	66	1	48	50	1	N
P05	B	66	1	48	50	2	N
P06	B	66	1	44	47	3	N
P07	B	66	1	42	45	3	N
P08	B	66	1	41	44	3	N
P09	B	66	1	51	53	1	N
P10	B	66	1	50	50	0	N
P11	B	66	1	42	46	4	N
P12	B	66	1	49	52	3	N
P13	B	66	1	41	50	9	N
P14	B	66	1	40	48	8	N
P15	B	66	1	40	47	8	N
P16	B	66	1	40	46	7	N
P17	B	66	1	46	55	10	N
P18	B	66	1	54	58	5	N
P19	B	66	1	43	49	6	N
P20	B	66	1	40	46	6	N
P21	B	66	1	55	59	4	N
P22	B	66	1	44	48	4	N
P23	B	66	1	40	44	4	N
P24	B	66	1	53	56	4	N
P25	B	66	1	54	57	4	N
P26	B	66	1	46	49	2	N

3.4 Noise Impact Analysis

Noise abatement measures are considered when predicted traffic noise levels approach or exceed the NAC, or when the predicted traffic noise levels substantially exceed (increase by 13 dB(A) or more) the existing noise levels. As shown in Table 6, noise impacts are not predicted, and therefore noise abatement was not investigated and is not required for the proposed project.

Table 6. Noise Impact Analysis Summary

Alternative	# of Impacts
2015 Existing Conditions	0
2035 Build Alternative	0

4 Conclusions

The proposed project is predicted to increase traffic noise levels relative to existing conditions. The 2035 design year alternative noise level is on average 4 dB(A) greater than the noise level predicted for the existing year (2015) alternative, with a maximum 10 dB(A) increase in noise level for residences located on the east side of the Bitterroot River. However, noise receptor locations are not predicted to exceed the FHWA NAC during the existing year (2015) or the design year (2035) Build Alternative, and therefore the predicted noise increase does not result in a noise impact for any of the receptor locations.

5 Construction Noise and Vibration

Adjoining properties in the study area could be exposed to noise from construction activities from the proposed project. Construction noise differs from traffic noise in several ways:

- Construction noise lasts only for the duration of the construction event, with most construction activities in noise-sensitive areas being conducted during hours that are least disturbing to adjacent and nearby residents.
- Construction activities generally are short term and, depending on the nature of the construction operations, could last from seconds (e.g., a truck passing a receptor) to months (e.g., constructing a bridge).
- Construction noise is intermittent and depends on the type of operation, location, and function of the equipment, and the equipment usage cycle.

Construction noise is not assessed like operational traffic noise; there are no MDT/FHWA NACs for construction noise. Construction noise would be subject to relevant local regulations and ordinances, and any construction activities would be expected to comply with them.

Construction of a new bridge is proposed by the project, which could be a substantial noise (and possibly vibration) source to properties near the bridge. The construction contractor may consider including appropriate mitigation actions to minimize disturbances from bridge construction. To address the temporary elevated noise levels that may be experienced during construction, standard abatement measures could be incorporated into construction contracts, where it is feasible to do so. Typical road construction actions could include:

- Place stationary noise sources away from receptors.
- Use portable noise barriers or natural terrain to provide shielding.

- Turn off idling equipment.
- Drive equipment forward instead of backward; lift instead of drag materials; and avoid scraping or banging activities.
- Avoid operating equipment in such a manner that may annoy, disturb, and endanger the comfort, repose, health, peace, or safety of any reasonable person of normal sensitivity.
- Use quieter equipment with properly sized and maintained mufflers, engine intake silencers, less obtrusive backup alarms, engine enclosures, noise blankets, or rubber linings.
- Confine work that does not have to be done at night to daylight hours. When work must be done at night, complete the noisiest work as early as possible and provide hotel vouchers.

6 Public Coordination

An increase in traffic noise can significantly affect the value and usefulness of property near roadways. In March 2008, MDT published Growing Neighborhoods in Growing Corridors: Land Use Planning for Traffic Noise, to provide technical assistance to local authorities that wish to consider noise as an integral part of land use planning decisions (MDT 2008). The document recommends that traffic noise levels of Leq(h) 60 dB(A) be used to determine the location of indoor and outdoor noise sensitive areas including the location of residential building façades closest to the roadway, and to avoid traffic noise problems in the future. For comparison, 60 dB(A) represents the typical exterior background noise levels of a large urban area and the background noise levels inside large busy offices. If the 60 dB(A) criteria can be met by the proposed project, then the need for traffic noise control measures, such as barrier walls, earthen berms, etc., can be avoided.

To avoid traffic noise impacts for future development, the minimum setback distances from the proposed roadway centerline to where the 2035 Build Alternative 60 dB(A) and other noise levels of note are expected to occur were determined and are listed in Table 7.

Table 7. Noise Contours

Roadway Segment	Activity Category	Noise Level Leq(h), dB(A)	Approximate Distance (ft) to NAC under 2035 Build
			South Avenue/River Pines Road
South Ave/River Pines Rd	A	56	≈ 63/75
South Ave/River Pines Rd	--	60	≈ 25/38
South Ave/River Pines Rd	--	64	≈ 5/18
South Ave/River Pines Rd	B & C	66	≈ <5/5
South Ave/River Pines Rd	E	71	≈ <5

7 Bibliography

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U.S. Department of Transportation, Federal Highway Administration. FHWA Traffic Noise Model: User's Guide (Version 2.5 Addendum). April 2004.

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Appendix A. Receptor Location Figures

Figure A

Receptor Location Map

Figure B

Receptor Location Map

Appendix B. Traffic Data

	2015 17:00 Hour Existing Traffic Data						
Roadway Segment (Both directions of travel)	**Speed Limit (mph)**	**DHV**	**Autos**	**MT**	**HT**	**Buses**	**Motorcycles**
South Avenue, West of Humble Road	30	156	151	2	1	1	1
River Pines Road/O'Brien Creek Road	35	287	272	8	2	0	4
Blue Mountain Road, South of O'Brien Creek Road	35	180	175	1	4	0	0
Big Flat Road, North of O'Brien Creek Road	35	179	174	1	4	0	0

	2015 18:00 Hour Existing Traffic Data						
Roadway Segment (Both directions of travel)	**Speed Limit (mph)**	**DHV**	**Autos**	**MT**	**HT**	**Buses**	**Motorcycles**
South Avenue, West of Humble Road	30	206	199	3	2	2	1
River Pines Road/O'Brien Creek Road	35	174	165	5	1	0	2
Blue Mountain Road, South of O'Brien Creek Road	35	243	236	2	5	0	0
Big Flat Road, North of O'Brien Creek Road	35	228	221	2	5	0	0

	2035 17:00 Hour Build Traffic Data						
Roadway Segment (Both directions of travel)	**Speed Limit (mph)**	**DHV**	**Autos**	**MT**	**HT**	**Buses**	**Motorcycles**
South Avenue, West of Humble Road	30	256	247	3	2	2	1
River Pines Road/O'Brien Creek Road	35	621	590	18	5	0	9
Blue Mountain Road, South of O'Brien Creek Road	35	390	378	3	8	0	0
Big Flat Road, North of O'Brien Creek Road	35	387	376	3	8	0	0

	2035 18:00 Hour Build Traffic Data						
Roadway Segment (Both directions of travel)	**Speed Limit (mph)**	**DHV**	**Autos**	**MT**	**HT**	**Buses**	**Motorcycles**
South Avenue, West of Humble Road	30	338	326	4	3	3	2
River Pines Road/O'Brien Creek Road	35	377	357	11	3	0	5
Blue Mountain Road, South of O'Brien Creek Road	35	526	511	4	11	0	0
Big Flat Road, North of O'Brien Creek Road	35	494	479	4	11	0	0

Appendix C. Field Monitoring Logs

TRAFFIC NOISE MONITORING LOG SHEET

Project Description: South Ave Bridge

Job Number: 251333 Noise Source: Autos

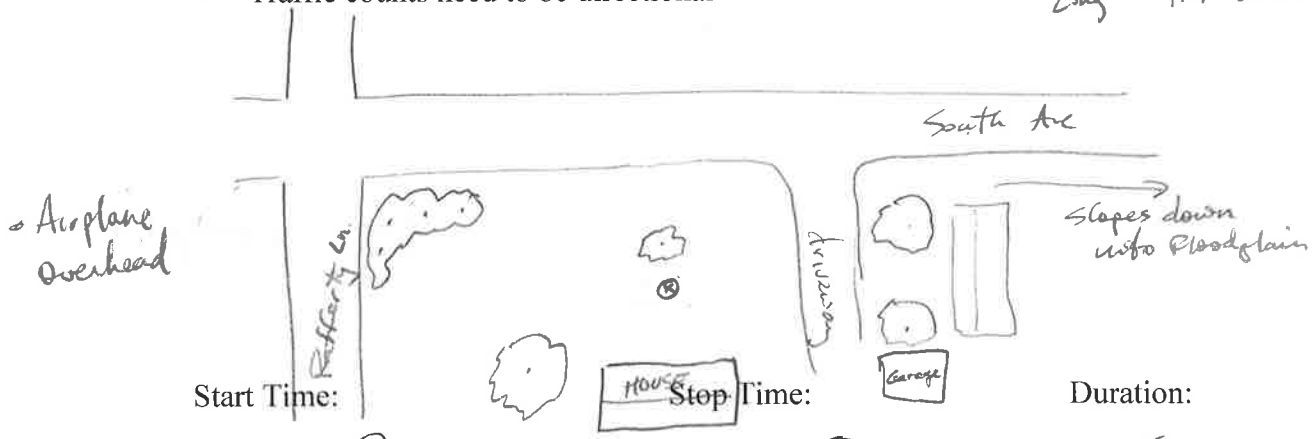
Date: 4-18-16 By: Jon Schick

Equipment make/model/serial # 0221
Larson Davis 812 Data File: —

Location Description: Site 4 4700 South Ave
Reading 1 of 3

Location Diagram: Site: Lat: 46° 50.936' N
Long: -114° 05 879' W

- Traffic counts need to be directional



Start Time: 10 : 56 AM PM Stop Time: 11 : 11 AM PM Duration: 15 min

Wind Speed: 0 mph (calm) Wind Direction: —

Temperature: 45° F Humidity: 49%

Calibration results before: 114.1 dBA and after 114.2 dBA

Leq 43.7 dBA Lmin 32.5 dBA Lmax 60.1 dBA L5 49.4

L10 45.9 dBA L50 35.9 dBA L~~90~~ 33 38.1 dBA

Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles
EB ← 0				
WB → 1 1				

Traffic counts need to be directional

TRAFFIC NOISE MONITORING LOG SHEET

Project Description: S. Ave bridge

Job Number: 251333 Noise Source: Autos

Date: 4-18-16 By: Jon Schick

Equipment make/model/serial # 0221 Larson Davis 812 Data File: —

Location Description: Site 4 4700 S Ave

Reading 2 of 3

Location Diagram:

- Traffic counts need to be directional

Start Time: 11 : 13 (AM) PM Stop Time: 11 : 28 AM PM Duration: 15 min

Weather station: Missoula Airport for all data sheets

Wind Speed: 0 mph (calm) Wind Direction: —

Temperature: 52° F Humidity: 38%

Calibration results before: 114.1 dBA and after 114.2 dBA

Leq 39.3 dBA Lmin 32.7 dBA Lmax 51.0 dBA L5: 45.7

L10 42.9 dBA L50 36.2 dBA ~~L90~~ L33 37.3 dBA

Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles
EB ← 111 3				
WB → 11 2				

Traffic counts need to be directional

TRAFFIC NOISE MONITORING LOG SHEET

Project Description: S. Ave Bridge

Job Number: 251333 Noise Source: Autos

Date: 4-19-16 By: Jon Schick

Equipment make/model/serial # 0221
Larson Davis 812 Data File: —

Location Description: Site 4 4700 S. Ave
Reading 3 of 3

Location Diagram:

- Traffic counts need to be directional

Start Time: 11 : 29 (AM) PM Stop Time: 11 : 44 (AM) PM Duration: 15 min

Wind Speed: 0 mph (calm) Wind Direction: —

Temperature: 52° F Humidity: 38%

Calibration results before: 114.1 dBA and after 114.2 dBA

Leq 35.7 dBA Lmin 29.7 dBA Lmax 49.7 dBA L5 = 38.8

L10 36.1 dBA L50 32.9 dBA ~~L90~~ L33 33.7 dBA

Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles
EB ← 1 1				
WB → 0				

Traffic counts need to be directional

TRAFFIC NOISE MONITORING LOG SHEET

Project Description: South Ave Bridge

Job Number: 251333 Noise Source: Autos

Date: 4-18-16 By: Jon Schick

Equipment make/model/serial # 0221
Larson Davis 812

Data File: —

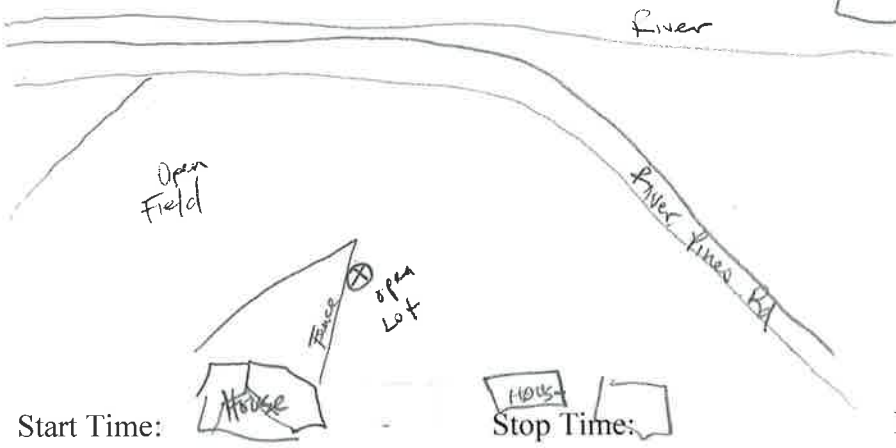
Location Description: Site 5 8061 Globe Ct

Reading 1 of 3

Site Lat: 46° 51.034' N
Long: -114° 06.408' W

Location Diagram:

- Traffic counts need to be directional



Start Time: 3:09 AM PM

Stop Time: 3:24 AM PM

Duration: 15 min

Wind Speed: < 10 mph

Wind Direction: N

Temperature: 68°

Humidity: 11%

Calibration results before: 114.1 dBA and after 114.2 dBA

Leq 42.4 dBA Lmin 30.1 dBA Lmax 57.4 dBA L5= 47.2

L10 45.0 dBA L50 39.5 dBA L~~90~~ 33 41.0 dBA

Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles
EB ← to bridge: 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 | | | 33				
WB → to Blue Mnt Rd: 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 | | 32			1 1	1 1

Traffic counts need to be directional

TRAFFIC NOISE MONITORING LOG SHEET

Project Description: South Ave Bridge

Job Number: 251333 Noise Source: Autos

Date: 4-18-16 By: Jon Schick

Equipment make/model/serial # 6221 Larson Davis 812 Data File: —

Location Description: Site 5 8061 Grebe Ct.

Reading 2 of 3

Location Diagram:

- Traffic counts need to be directional

Vehicles audible from Blue Mt Rd
Distant gun shot?

Start Time: 3 :26 AM PM Stop Time: 3 :41 AM PM Duration: 15 min

Wind Speed: <10 mph Wind Direction: N

Temperature: 68° Humidity: 11%

Calibration results before: 114.1 dBA and after 114.2 dBA

Leq 40.5 dBA Lmin 30.2 dBA Lmax 52.1 dBA L5: 45.1

L10 43.9 dBA L50 38.1 dBA L~~90~~ 33 40.0 dBA

Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles
𝍸 𝍸 𝍸 11 17	1 1			
𝍸 𝍸 𝍸 𝍸 𝍸 1 26	11 2			1 1

EB ← to Martin Bridge

WB → To Blue Mt Rd.

Traffic counts need to be directional

TRAFFIC NOISE MONITORING LOG SHEET

Project Description: South Ave Bridge

Job Number: 251 333 Noise Source: Autos

Date: 4-18-16 By: Jon Schick

Equipment make/model/serial # 0821
Larson Davis 812 Data File: —

Location Description: Site 5 8061 Grake Ct.

Reading 3 of 3

Location Diagram:

- Traffic counts need to be directional

A couple full size trucks w/ trailers

Unit SHUT OFF @ 14 min 14 sec (data retrieved OK)

Start Time: 3 :43 AM PM

Stop Time: 3 :57 AM PM

Duration: 15 min

Wind Speed: < 10 mph

Wind Direction: N

Temperature: 68°

Humidity: 11%

Calibration results before: 114.1 dBA and after 114.2 dBA

Leq 44.4 dBA Lmin 30.8 dBA Lmax 57.9 dBA L5 = 50.4

L10 47.2 dBA L50 40.5 dBA L~~90~~ 33 42.4 dBA

Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles
EB ← to Tracy Rd 21	1 1 (includes short-bus)			
WB → to Blue Mnt Rd 38			111 3	111 3

Traffic counts need to be directional

* Site 1, 1st measurement = No Med trucks they were full size pickups

TRAFFIC NOISE MONITORING LOG SHEET

Project Description: South Ave Bridge

Job Number: 251333 Noise Source: Autos

Date: 4-18-16 By: Jon Schick

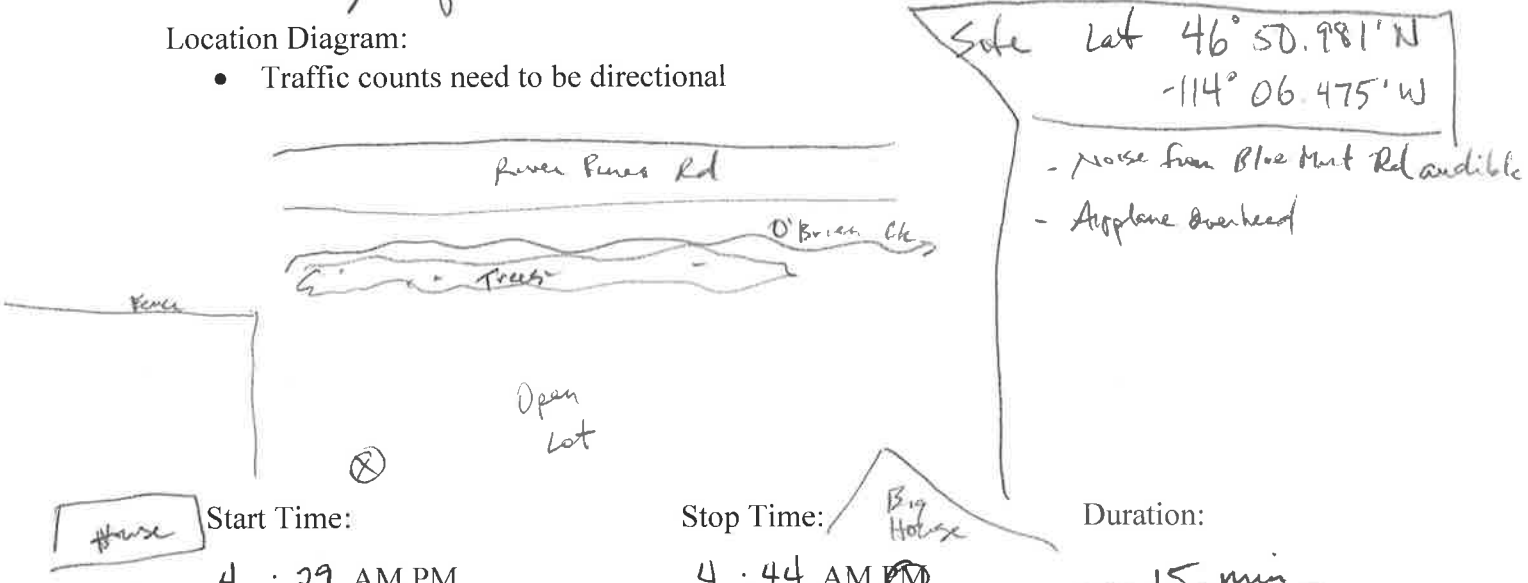
Equipment make/model/serial # 0221 Larson Davis 812 Data File: —

Location Description: Bruce Barrett property Site 6 2363 Blue Mnt Rd

Reading 1 of 3

Location Diagram:

- Traffic counts need to be directional



Start Time: 4 : 29 AM PM Stop Time: 4 : 44 AM PM Duration: 15 min

Wind Speed: <10 mph Wind Direction: N

Temperature: 68° F Humidity: 11%

Calibration results before: 114.1 dBA and after 114.2 dBA

Leq 45.8 dBA Lmin 35.3 dBA Lmax 57.6 dBA L5 = 50.9

L10 48.7 dBA L50 43.1 dBA L90 45.0 dBA

Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles
WB ← to Blue Mnt Rd: 42				
EB → To Mackay Br.: 19				

Traffic counts need to be directional

TRAFFIC NOISE MONITORING LOG SHEET

Project Description: South Ave Bridge

Job Number: 251333 Noise Source: Autos

Date: 4-18-16 By: Jon Schick

Equipment make/model/serial # 0201 Larson Davis 812 Data File: –

Location Description: Barnett Property Site 6 2363 Blue Mt Rd Reading 2 of 3

Location Diagram:

- Traffic counts need to be directional

- Airplane overhead
- One full semi truck w/ trailer

Start Time: 4 : 46 AM (PM) Stop Time: 5 : 02 AM (PM) Duration: 15 min

Wind Speed: < 5 mph Wind Direction: N

Temperature: 68° F Humidity: 11%

Calibration results before: 114.1 dBA and after 114.2 dBA

Leq 45.2 dBA Lmin 35.8 dBA Lmax 57.3 dBA L5 50.2

L10 49.1 dBA L50 41.7 dBA L~~90~~ 33 44.7 dBA

Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles
EB → 20				
WB ← 36				1 / 1

Traffic counts need to be directional

TRAFFIC NOISE MONITORING LOG SHEET

Project Description: South Ave Bridge

Job Number: 251333 Noise Source: Autos

Date: 4-18-16 By: Jon Schmitt

Equipment make/model/serial # 0221
Larson Davis 812 Data File: –

Location Description: Bancroft Property Site 6 2363 Blue Mt Rd.
Reading 3 of 3

Location Diagram:

- Traffic counts need to be directional

• Truck w/ trailer

Start Time: 5 : 02 AM (PM)

Stop Time: 5 : 17 AM (PM)

Duration: 15 min.

Wind Speed: < 5 mph

Wind Direction: N

Temperature: 68°F

Humidity: 11 %

Calibration results before: 114.1 dBA and after 114.2 dBA checked at end of day

Leq 46.8 dBA Lmin 36.4 dBA Lmax 58.2 dBA L5 51.9

L10 50.2 dBA L50 44.1 dBA L~~90~~ 33 46.5 dBA

Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles
WB ← 51				1
EB → 24				1

Traffic counts need to be directional