Noise Technical Memorandum
South Kelso Railroad Crossing Project

Cowlitz County, Washington

HMMH Report No. 309500
December 2018

Prepared for:

HDR Engineering
and
City of Kelso

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Executive Summary

Project noise levels were predicted to identify potential long-term (operational) and short-term (construction) effects. Operational noise levels were compared to existing measured noise levels for the peak traffic hour of analysis (4:00 p.m. to 5:00 p.m.). Project peak traffic noise levels in 2040 would range from 39 A-weighted (human response) decibels (dBA) equivalent hourly (L_{eq}) to 61 dBA L_{eq}. Cumulatively, when these project peak traffic noise levels are added to existing noise levels, future cumulative noise levels would range from 52 dBA L_{eq} to 62 dBA L_{eq}. Relative to the measured existing sound levels in the project area an increase of up to an 9 dB increase. No exceedances of the Washington State Department of Transportation (WSDOT) noise abatement criteria (NAC) are predicted at any of the noise sensitive receptors and no substantial increases, defined by WSDOT as being an increase of 10 dB or greater, would occur. Therefore, no long term operational noise affects would result from the project. Temporary construction related noise affects would occur from the project; however, these noise levels would be reduced using a variety of mitigation measures including restricting construction to daytime periods and ensuring that equipment are utilizing properly functioning mufflers.

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1 Introduction

This Noise Discipline Report presents the results of the noise impact and mitigation analysis performed in support of Cowlitz County's proposed improvements to the South Kelso Railroad Crossing Project.

The Federal Highway Administration (FHWA) regulations for mitigation of highway traffic noise in the planning and design of federally aided highway projects are contained in Title 23 of the United States Code of Federal Regulations Part 772 (23 CFR 772). These regulations state that a "Type I" traffic noise impact analysis is required when there is the addition of through-traffic lanes, a new roadway where none existed previously, or ramps in an interchange. The methods and procedures used in this preliminary noise impact evaluation are consistent with the latest noise assessment policies issued by FHWA and the Washington State Department of Transportation (WSDOT); WSDOT's Traffic Noise Policy and Procedures were updated most recently in October 2012.

This report presents a summary of the roadway improvements under study, discussion of existing baseline conditions, an overview of noise terminology and the applicable standards and criteria, a description of the computation methodology for existing and future noise levels, a description of the noise effects on the affected environment, the long-term and short-term environmental consequences, an evaluation of potential noise abatement measures, construction noise mitigation, and information for local government officials. Appendix A presents the noise monitoring data, Appendix B presents the electronic TNM files, Appendix C tabulates the traffic data used in the noise modeling, and Appendix D presents the detailed noise mitigation results.

2 Project Description and Background

Rail improvements and capacity expansion to the rail network linking Seattle and Portland were recently completed as part of the federally funded High-Speed Rail (HSR) Program. A significant portion of the HSR improvements occurred in Cowlitz County with the construction of the Kelso to Martin's Bluff Project (KMB). KMB added a third main track, new signal improvements, new railroad bridges, and maintenance access roads. With these Kelso-area rail improvements, existing at-grade crossings at Mill Street and Yew Street within the KMB project area have been identified for removal and replacement with a grade separation.

In anticipation of closing the crossings at Mill and Yew Streets, the City of Kelso completed the City of Kelso Railroad Crossing Study in 2013 that evaluated grade separation options resulting in the selection of Hazel Street Option 2A as the preferred alternative. Option 2A would revise the Hazel Street alignment just east of the tracks and construct a new bridged portion of the street to cross over South Pacific Avenue and the tracks at an approximate 90-degree angle; the elevated bridge crossing is approximately 400 feet in length. Hazel Street would be extended west to an intersection with South River Road.

The existing connection between South Pacific Avenue and Hazel Street would be closed with a new connection provided via Douglas Street and a newly constructed extension of 3rd Avenue South. The Douglas Street and South Pacific Avenue intersection would be improved to accommodate the increased traffic, and Douglas Street would be widened to include bike lanes and sidewalks. The extension and improvement of 3rd Avenue South between Douglas Street and Hazel Street would complete the connection. Improvements to Hazel Street, Douglas Street and 3rd Avenue South will require property acquisition from adjacent landowners. With the construction of the grade separation at Hazel Street complete, the City would move forward with closure of the existing at-grade crossings at Mill and Yew Streets to vehicle traffic. The existing crossing arms will be removed. Access control measures will be installed and a cul-de-sac or hammer head will be constructed to facilitate vehicle turnaround on the west side of the closed crossings.

3 Baseline Conditions

3.1 Land Use

Land uses in the vicinity of the project are a mix of rural residential, a golf course, a railroad mainline, an airport, and some light industrial uses. From a noise perspective, the sensitive land uses are only associated with the residential uses (yards) and the golf course.

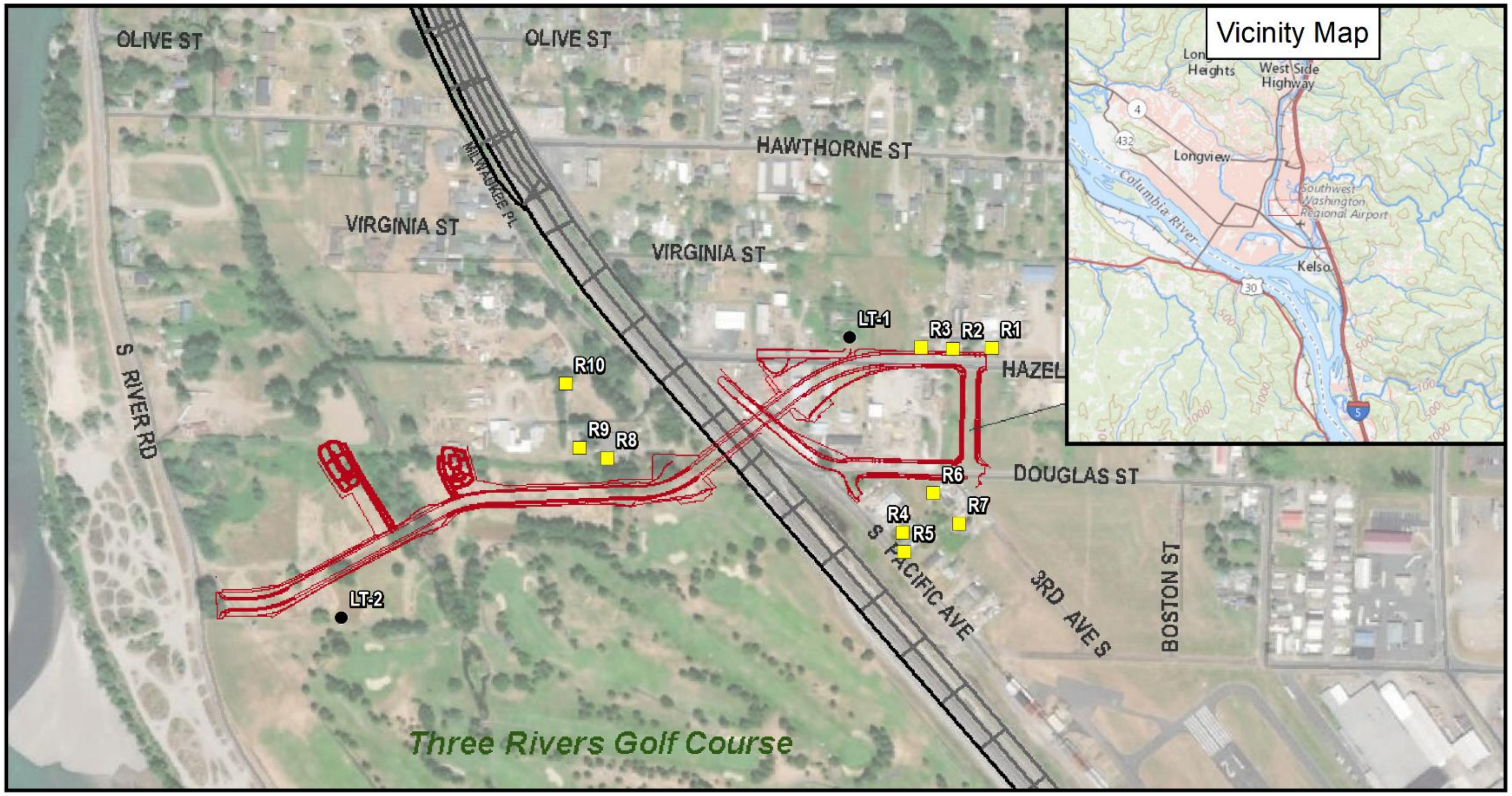
3.2 Topography

The topography of the area is generally flat except for where the railroad is elevated on fill by approximately 10 to 15 feet above the surrounding lands.

3.3 Existing Noise Sources

Several sound sources are present throughout the analysis area; however, traffic noise on area roadways is not dominant. Instead, dominant sound sources include those from trains using the BNSF Railroad, the Southwest Washington Regional Airport (Kelso Airport) located about 1,000 feet to the south, and the sounds of noises from light industrial uses in the area such as a concrete batch plant. In order to properly characterize the existing acoustic environment two 24-hour sound level measurements were completed. The measurements were completed on August 8, 2018 and August 9, 2018 at measurement location LT-1 and on August 9, 2018 and August 10, 2018 at measurement location LT-2. Measurement location LT-1 was conducted at a residence located along Hazel Street and measurement location LT-2 was conducted about 500 feet west of River Road north of the Three Rivers Golf Course. Figure 1 is a map of the measurement and noise sensitive receptor locations.

Figure 1 Vicinity Map with Noise Measurement and Noise Sensitive Receptor Locations with Build Alternative Alignment



● Measurement Location
■ Noise Sensitive Receptor

0 300 600 Feet

City of Kelso
Washington

Vicinity Map with Build Alternative Alignment

4 Methodology and Data Sources

4.1 Noise Characteristics

Noise is generally defined as unwanted sound. The loudness of sound is quantified in terms of sound pressure level, expressed in decibels (dB).Sound is a fluctuating air pressure wave, with the number of fluctuation cycles, or pressure pulses per second of a particular sound, is called the sound's frequency. The human ear is less sensitive to higher and lower frequencies than it is to mid-range frequencies, and human speech communication is also in the middle frequency range. Therefore, sound level meters used to measure environmental noise normally incorporate a filtering system that discriminates slightly against higher and significantly against lower frequencies in a manner similar to the human ear and human speech. The filtering produces noise measurements that best represent human perception of noisiness and interference with speech communication. Measurements made using this filtering system are termed "A-weighted decibels," abbreviated as dB(A) or dBA.

Most environmental noise (and the A-weighted sound level) fluctuates from moment to moment, and it is common practice to characterize the fluctuating level by a single number called the equivalent sound level (L_{eq}). The L_{eq} is the value or level of a steady, non-fluctuating sound that represents the same sound energy as the actual time-varying sound evaluated over the same time period. For traffic noise assessment, L_{eq} is typically evaluated over a one-hour period, and may be denoted as L_{eq}(h), and is in terms of dBA.

Noise levels decrease with distance from a noise source. The L_{eq} noise level from a line source, such as a road, will typically decrease by 3 to 4.5 dBA for every doubling of distance between the source and the receiver. Decibels are logarithmic quantities, so changes in sound levels are heard differently from what one might expect. Subjectively, a 10-dBA change in noise levels is perceived by most people to be approximately a twofold change in loudness (e.g., an increase from 50 dBA to 60 dBA causes the perceived loudness to double). Generally, a change in sound level of 5 dBA or more is needed for most people to perceive a noticeable change. Common indoor and outdoor sound levels in dBA are given in Figure 2.

4.2 Applicable Traffic Noise Impact and Abatement Criteria

The noise impact analysis was performed in compliance with the WSDOT 2012 Traffic Noise Policy and Procedures (WSDOT 2012).

Pursuant to the Federal Highway Administration's (FHWA) regulation 23 CFR 772, WSDOT has identified that traffic noise impacts occur at noise-sensitive receptors when the predicted noise levels approach within 1 dBA of the FHWA Noise Abatement Criteria (NAC). The FHWA NAC and the WSDOT NAC are shown in Table 1. For the project area, the applicable NAC levels for exterior areas of frequent human use at residences and recreation areas are 66 dBA, and 71 dBA for commercial properties.

WSDOT has also identified that noise impacts can also occur if noise levels substantially exceed existing levels. An increase of 10 dBA or more is considered a substantial exceedance according to WSDOT.

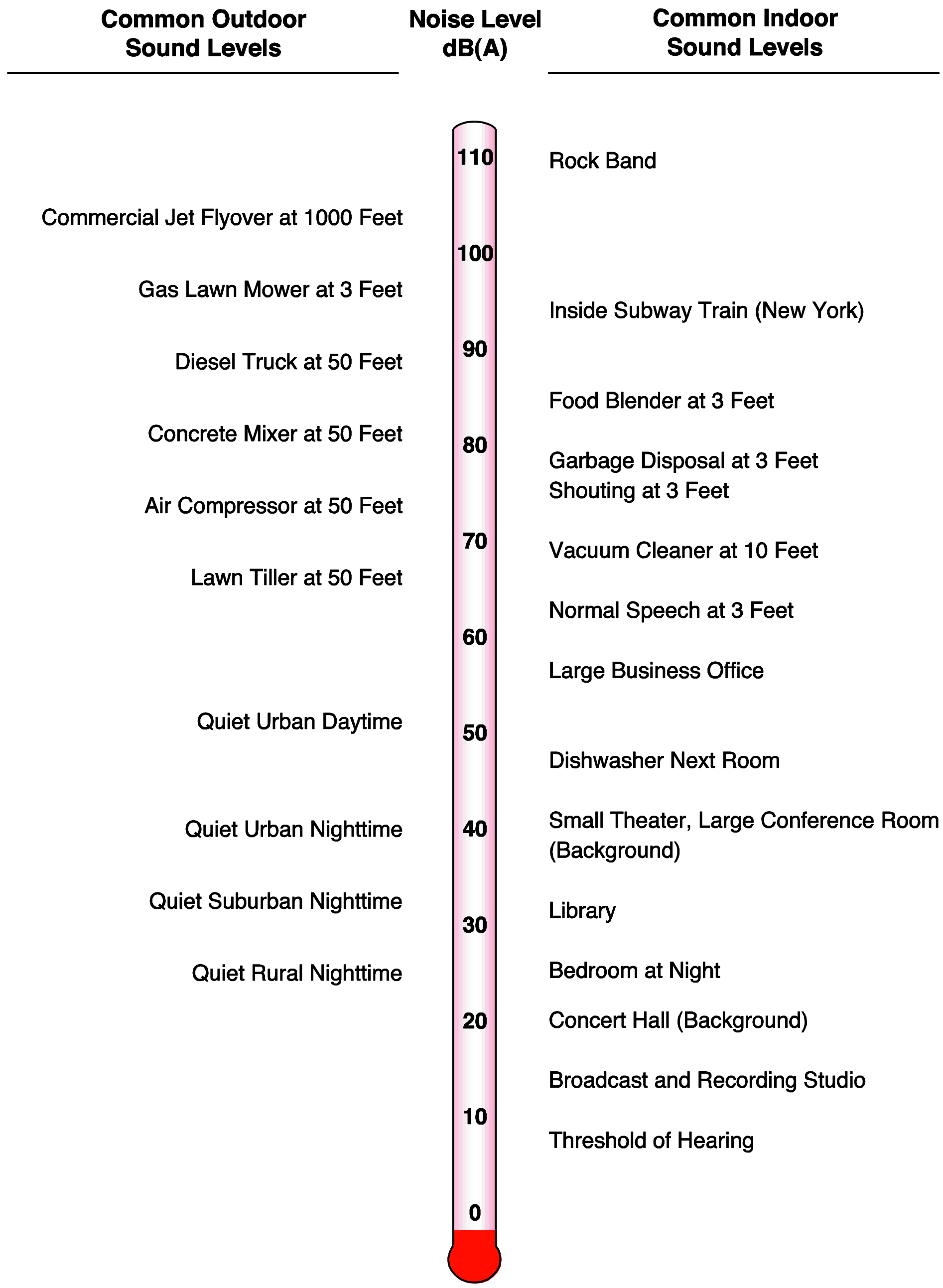


Figure 2 Common Indoor and Outdoor Sound Levels

Table 1 Federal and WSDOT Traffic Noise Abatement Criteria

Land Use Primary Activity Category	Activity Category Leq(h)[1]		Evaluation Location	Land Use Activity Description
	FHWA Noise Abatement Criteria	WSDOT Noise Abatement Criteria[2]		
A	57	56	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve as important need, and where preserving those qualities is essential if the area is to continue to serve its intended purpose.
B[3]	67	66	Exterior	Residential
C[3]	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, recreation 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[3]	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.

1. The Leq (h) activity criteria values are for impact determination only and are not design standards for noise abatement measures.
2. WSDOT noise abatement “approach” criteria.
3. Includes undeveloped lands permitted for this activity category.

When the predicted design-year Build case noise levels approach or exceed the NAC during the loudest hour of the day or cause a substantial increase in existing noise, consideration of traffic noise reduction measures is warranted and necessary. The peak hour roadway traffic condition was identified in a project memo titled “*Signal Warrant and Turn Lane Warrant Analysis within Project Area*” (HDR 2018) as being the PM peak hour, which corresponds to the hour from 4:00 p.m. to 5:00 p.m. If it is found that such mitigation measures will cause adverse social, economic or environmental effects that outweigh the benefits received, they may be dismissed from consideration. For this study, noise levels throughout the study area were determined for Existing (2018) conditions and the design-year (2040) No-Build and Build alternatives.

4.3 Methodology

As described earlier in this report, this analysis follows the WSDOT Traffic Noise Policy and Procedures (WSDOT 2012). Traffic noise levels were calculated using FHWA's Traffic Noise Model (TNM® Version 2.5). TNM computes highway traffic noise at nearby receivers and aids in the design of mitigation measures. TNM incorporates state-of-the-art sound emissions and sound propagation algorithms, based on well-established theory or on accepted international standards. The acoustical algorithms contained within the FHWA TNM have been validated with respect to carefully conducted noise measurement programs, and show excellent agreement in most cases for sites with and without noise barriers. Inputs to TNM include three dimensional descriptions of road alignments, vehicle volumes in defined vehicle classes, vehicle speeds, and data on the characteristics and locations of specific ground types, topographical features, and other features likely to influence the propagation of vehicle noise between the roadway and the receiver.

As indicated in Section 3 of this report, the dominant sound source in the project area is not from roadway traffic. Therefore, to identify the existing conditions (2018) sound levels were measured for 24-hour periods at two locations. For the No-Build Alternative (2040) conditions it is conservatively assumed that sound levels would remain as they are for the existing conditions (2018). This is considered conservative because it could be argued that moderate increases in railroad, aircraft, and roadway traffic would result in a slightly higher sound level in the future, regardless of whether or not the project is constructed. Section 5 of this report summarizes the results of the measurement effort.

The TNM for the project are provided electronically in Appendix B and the traffic volumes for the peak noise hour (i.e., PM peak traffic conditions) are provided in Appendix C.

5 Affected Environment

The affected environment was identified via two 24-hour noise measurements because traffic noise on area roadways is not the dominant source of noise. Dominant sound sources are those from trains operating on the BNSF Railway, aircraft operations at the Kelso Airport 1,000 feet south of the nearest residences, and light industrial noise, such as that from a concrete batch plant located nearby. Peak hour roadway traffic noise levels sound levels would occur during the hour from 4:00 p.m. to 5:00 p.m. according to the traffic analysis for the project. Therefore, the measured existing sound level from this same time period was assigned to receptors that share a common acoustic environment with a given measurement location, LT-1 or LT-2. In the case of the project the common acoustic environments are defined by the east and west sides of the BNSF Railway. Noise sensitive receptors include 11 residential uses (Activity Category B) and one golf course (Activity Category C). The peak traffic hour (4:00 p.m. to 5:00 p.m.) measured noise level as well as the daytime (7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) noise levels are provided in Table 2. Daytime and nighttime noise levels are provided for contextual purposes. Additional measurement data such as photographs and field data sheets are provided in Appendix A.

Table 2 Existing (2018) Measured Noise Levels (dBA L_{eq})

Measurement Location or Receptor ID	PM Peak Hour Traffic Noise Level	Daytime (7:00 a.m. to 10:00 p.m.) Noise Level	Nighttime (10:00 p.m. to 7:00 a.m.) Noise Level
LT-1	53	56	52
LT-2	51	50	48
R1	53	56	52
R2	53	56	52
R3	53	56	52
R4	53	56	52
R5	53	56	52
R6	53	56	52
R7	53	56	52
R8	51	50	48
R9	51	50	48
R10	51	50	48

6 Environmental Consequences

Environmental consequences for the project may result from long-term operation of the project and short-term construction of the project. These affects were considered for the Build and No-Build alternatives.

6.1 No-Build Alternative

Under the No-Build alternative the roadway network would remain the same and no changes would occur to the project area. Noise levels under the No-Build alternative would remain the same or increase slightly due to small increases in roadway traffic, rail traffic, or aircraft operations. For the purposes of identifying potential affects from the project noise levels for the No-Build alternative are conservatively assumed to remain unchanged relative to existing conditions. Therefore there would be no affects from the No-Build alternative.

6.2 Build Alternative Long-Term Operational Noise Levels

Traffic noise levels associated with the Build alternative (2040) roadways were modeled using TNM and the methods identified in Section 4. Project traffic noise levels would range from 39 dBA L_{eq} to 61 dBA L_{eq}. As the values in Table 3 indicate, traffic noise levels in many areas would be less than the measured levels during the peak traffic noise hour. This indicates that for those areas sounds associated with other sources, such as railroad traffic or aircraft, would continue to be the dominant noise source. To be conservative, future traffic noise levels were added to the existing noise levels using decibel addition to identify a “cumulative” noise level under future conditions. Cumulatively, increases in noise levels would range from 1 dB to 9 dB. No exceedances of the NAC (i.e., peak hour traffic noise) are predicted at any of the receptors and no substantial increases (i.e., 10 dB or greater increases cumulative) are predicted. Therefore, no long term operational noise affects would occur as a result of the project. Table 3 provides the TNM predicted noise levels relative to the existing peak traffic hour noise levels (4:00 p.m. to 5:00 p.m.).

It should be noted that traffic volumes at the intersection of Hazel Street and South River Road are significantly lower than those analyzed on the east side of the railroad tracks. Even with seasonal spikes in traffic volumes due to the Three Rivers Golf Course at the southern end of River Road, the volumes along South River Road are still much lower than those on the east side of the new crossing.

The project area for the South Kelso Railroad Crossing is being reconfigured to address existing safety and operational issues. The proposed improvements include a grade-separated rail crossing at Hazel Street that would change the flow of traffic in the area. With an assumed annual growth rate of two (2) percent per year projected upward for the design year of 2040.

At some locations, traffic noise on the new roadway would be much lower than the existing measured noise levels in the area. For these locations, roadway noise may be audible, but not of sufficient strength to be the dominant source of noise relative to other sources previously discussed. Traffic noise levels are low because the worst case projection of traffic volumes on the roadway, inclusive of land use changes anticipated in the area by 2040, are not sufficient to result in noise impacts. For example, at sites R8, R9, and R10, existing noise exposure is similar to what was measured at LT-2 which is dominated by the sounds emanating from a mill across the river from the area, railroad traffic, and aviation activity. According to the 2040 traffic projections for the project the new roadway that would be near R8, R9, and R10 would have a total of 75 vehicles during the peak hour. Table 3 provides the results of noise from this scenario at these receptors, but for reference, even at 50 feet from the center of the new roadway this would represent a sound level of only 51 dBA L_{eq}. R8, R9, and R10 are much further away from the future roadway than this distance; therefore, the resulting relatively low traffic noise levels in the future are the result of setback distance and low traffic volumes during the 2040 peak hour conditions.

One benefit of the project from a noise perspective is that at the Mill Street and Yew Street at-grade crossings, trains will no longer need to use their horns. These crossings are approximately 1-mile north of the new roadway; while this change may be noticeable for area residents it would have amount to a negligible change in project area sound levels because the two at grade crossings are approximately 1-mile away and as a result, train horn noise is not dominant in the area.

Table 3 Build Alternative (2040) Noise Levels Compared to Existing (2018) Noise Levels

Measurement Location or Receptor ID	Existing Noise Level (dBA L_{eq})	Future PM Peak Hour Traffic Noise Level (dBA L_{eq})	Cumulative with Project Noise Level (dBA L_{eq})	Change in Noise Level (dB)*
LT-1	53	49	54	1
LT-2	51	42	52	1
R1	53	57	58	5
R2	53	61	62	9
R3	53	59	60	7
R4	53	53	56	3
R5	53	52	56	3
R6	53	61	62	9
R7	53	53	56	3
R8	51	43	52	1
R9	51	45	52	1
R10	51	51	54	3

Note: *Indicates that there would be no change in sound level if Build Alternative (2040) traffic noise is less than the existing measured noise level.

6.3 Build Alternative Short-Term (Construction) Noise and Vibration Levels

Construction of the project can be expected to cause short-term noise impacts in areas directly adjacent to construction activity. Construction equipment noise levels are usually measured 50 feet from the source, and some typical levels are listed in Table 4.

Construction equipment noise levels decrease by 6 dBA per doubling of distance because of geometric divergence (i.e., the spreading of noise from a source) alone, provided there is a clear line of sight to the equipment. For example, the noise of a bulldozer creating 80 dBA at 50 feet will have a value of 74 dBA at 100 feet and 68 dBA at 200 feet.

Drilled shafts for bridge structure support would be similar to that of an auger drill. As with other construction noise, the noise from drilled shafts will be short term in duration and be performed during daytime hours. Assuming a noise level of 85 dBA at 50 feet this noise would attenuate to 79 dBA at 100 feet and 73 dBA at 200 feet.

Using standard specifications for control of noise sources during construction can minimize construction impacts. The noise control specifications are described in Section 7.

Table 4 Typical Construction Equipment Noise Emissions

Types of Activities	Types of Equipment	Range of Noise levels at 50 feet (dBA)
Bridge Structure Support	Auger Drill	80-85
Materials Handling	Concrete mixers	75-87
	Concrete pumps	81-83
	Cranes (movable)	76-87
	Cranes (derrick)	86-88
Stationary Equipment	Pumps	69-71
	Generators	71-82
	Compressors	74-87
Impact Equipment	Pneumatic wrenches	83-88
	Rock drills	81-98
Land Clearing	Bulldozer	77-96
	Dump truck	82-94
Grading	Scraper	80-93
	Bulldozer	77-96
Paving	Paver	86-88
	Dump truck	82-94

Source: U. S. Environmental Protection Agency (1971)

7 Mitigation

7.1 Traffic Noise Abatement Policy

WSDOT's Traffic Noise Policy and Procedures (WSDOT 2012) state that noise abatement will be considered only where noise impacts have been identified. Since no long-term operational noise affects were identified, operational mitigation measures are not necessary. Short-term construction noise mitigation measures were evaluated and are described in Section 7.2.

7.2 Construction Noise Mitigation

Construction noise can be reduced by using enclosures or walls to surround noisy equipment, installing mufflers on engines, substituting quieter equipment or construction methods, minimizing time of operation, and locating equipment farther from sensitive receptors. To reduce construction noise at nearby receptors, the following mitigation measures could be incorporated into construction plans and contractor specifications.

- Erecting noise berms and barriers as early as possible would provide noise shielding of construction activities.
- Limiting construction activities to between 7 a.m. and 10 p.m. would reduce construction noise levels during sensitive nighttime hours.
- Equipping construction equipment engines with adequate mufflers, intake silencers, and engine enclosures typically reduces their noise levels by 5 to 10 dBA.
- Specifying the quietest equipment available would reduce noise by 5 to 10 dBA.
- Turning off construction equipment during prolonged periods of nonuse would eliminate noise from construction equipment during those periods.
- Requiring contractors to maintain all equipment and train their equipment operators would reduce noise levels and increase efficiency of operation.
- Locating stationary equipment away from receiving properties would decrease noise from that equipment due to the increased distance.
- Constructing temporary noise barriers or curtains around stationary equipment that must be located close to residences would decrease noise levels at nearby sensitive receptors.

8 Coordination with Local Officials

One of the requirements of WSDOT's Traffic Noise Policy and Procedures is to supply information to local governments on existing and future noise levels, so that the information can be used in guiding local land use decisions. Because traffic volumes are low on area roadways the Activity Category limits are not exceeded outside of the roadway rights of way. See Table 5 for the specific distances to these noise impact thresholds from Hazel Street. Cowlitz County should consider the information in this report regarding traffic noise levels within the project area.

Table 5 Distances (feet) to Activity Category B, C and E Noise Impact Thresholds

Roadway	Distance to Residential and Public Use (Activity Category B and C) NAC Threshold (feet)	Distance to Commercial (Activity Category E) NAC Threshold (feet)
Hazel Street	12	3

Note: The Activity Category B and C NAC is 66 dBA; the Activity Category E NAC is 71 dBA

9 Conclusion

Long-term (operational) and short-term (construction) noise levels were predicted for the project. Operational noise levels were compared to applicable WSDOT limits and no exceedances were identified; therefore, no operational mitigation is required. Short-term construction noise levels would result from the project; however, various construction noise mitigation measures would be implemented to limit these effects.

10 References

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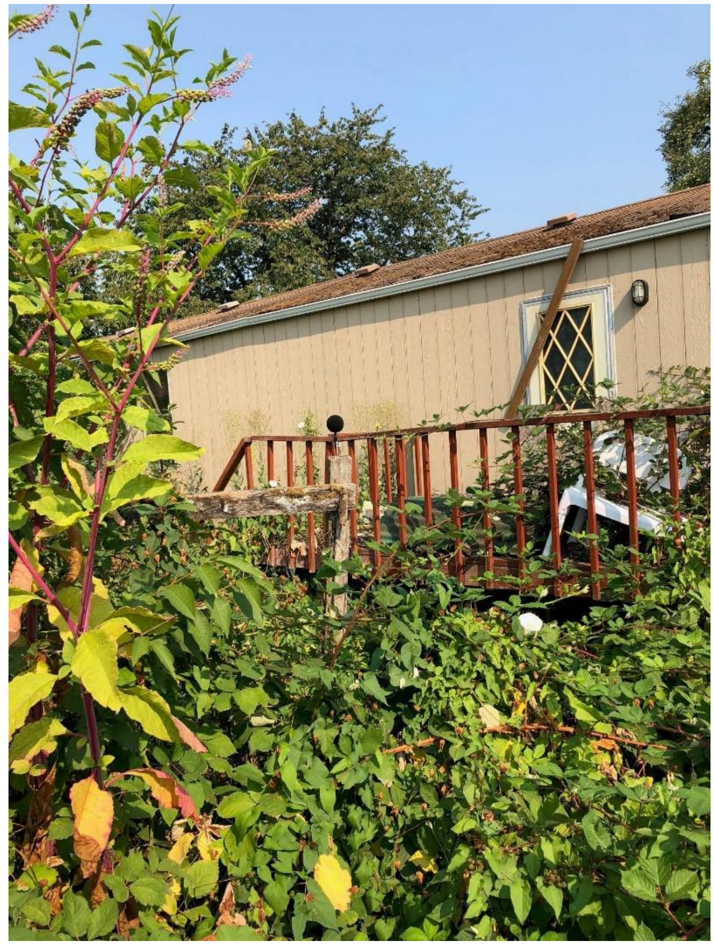
Appendix A Noise Monitoring Data

LT Site 1: 303 Hazel Street
Picture 1 East



LT Site 1: 303 Hazel Street
Picture 2 West

HARRIS MILLER MILLER & HANSON INC.

Project: Kelso Grade Separation
Proj. #: 309500
Personnel: Dillon Tannler

Long Term Noise Monitoring Site Log

Site #: LT1
Address: 303 Hazel Street Kelso, WA 98626
Owner/Description: Single-family residential trailer that is empty and soon to be rebuilt with new housing
Noise Sources: Concrete batch plant across the street, airplanes from the Kelso Airport, train noise, residential activity and traffic noise.

Noise Monitor: B&K 2250 #3A S/N: 31061
Microphone: B&K 4180 S/N: 2246115
Calibrator: 1253 Norsonic S/N: 28326
Start Date: 8/8/2018 End Date: 8/9/2018
Start Time: 1100 End Time: 1100
Metrics Stored: Leq, Lmax, Lmin Sync w/ Hrs? Yes
Exceedance Threshold: Duration: 24-hours
Calibration: PRE: 114 POST: 114 Coordinates:

Site Sketch:

Avg. Temperature: 70 °F Weather Conditions: Partly cloudy upon deployment, sunny/warm throughout measurement

LT Site 2: 3 Rivers Golf Course
Picture 1 North

LT Site 2: 3 Rivers Golf Course
Picture 2 South

HARRIS MILLER MILLER & HANSON INC.

Project: Kelso Grade Separation
Proj. #: 309500
Personnel: Dillon Tannler

Long Term Noise Monitoring Site Log

Site #: LT-2

Address: 222 S. River Road Kelso, WA 98626

Owner/Description: The backside of 3 Rivers Golf Course

Noise Sources: Roadway noise, airplanes from Kelso airport, railroad noise, boat noise from the Cowlitz River, noise from the golf course, and noise from nearby residential activity.

Noise Monitor: B&K2250 #3A S/N: 31061

Microphone: B&K 4180 S/N: 2246115

Calibrator: 1253 Norsonic S/N: 28326

Start Date: 8/9/2018 End Date: 8/9/2018

Start Time: 1215 End Time: 1215

Metrics Stored: Leq, Lmax, Lmin Sync w/ Hrs? Yes

Exceedance Threshold: Duration: 24-hrs

Calibration: PRE: 114 POST: 114 Coordinates:

Site Sketch:

Avg. Temperature: 75 °F Weather Conditions: sunny and warm throughout measurement

Appendix B Electronic TNM Files

Provided electronically.

Appendix C Traffic Data Used in Noise Analysis

Roadway	Vehicle Type	Northbound/Westbound		Southbound/Eastbound	
		Traffic	Speed	Traffic	Speed
Pacific Ave south of Yew St	Total	197		185	
	Automobiles	193	35	181	35
	Medium Trucks	2	35	2	35
	Heavy Trucks	2	35	2	35
Hazel St east of 3rd Ave	Total	144		21	
	Automobiles	142	35	21	35
	Medium Trucks	1	35	0	35
	Heavy Trucks	1	35	0	35
Hazel St west of 3rd Ave	Total	32		12	
	Automobiles	32	35	12	35
	Medium Trucks	0	35	0	35
	Heavy Trucks	0	35	0	35
Pacific Ave South of (future) Douglas St	Total	6		7	
	Automobiles	6	35	7	35
	Medium Trucks	0	35	0	35
	Heavy Trucks	0	35	0	35
Douglas St west of 3rd Ave (future)	Total	199		170	
	Automobiles	195	35	166	35
	Medium Trucks	2	35	2	35
	Heavy Trucks	2	35	2	35
3rd Ave between Douglas St and Hazel St (future)	Total	57		166	
	Automobiles	55	35	162	35

Roadway	Vehicle Type	Northbound/Westbound		Southbound/Eastbound	
		Traffic	Speed	Traffic	Speed
	Medium Trucks	1	35	2	35
	Heavy Trucks	1	35	2	35
Douglas St east of 3rd Ave (future)	Total	37		118	
	Automobiles	37	35	116	35
	Medium Trucks	0	35	1	35
	Heavy Trucks	0	35	1	35

Source: HDR 2018