APPENDIX L
NOISE STUDY

Capitol Boulevard –
M Street to Israel Road Feasibility
Federal Aid #: STPUS-5235(015)

Phase 1 – Capitol Boulevard/
Trosper Road Intersection Improvements
Tumwater, Washington

Noise Discipline Report

July 27, 2017

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Executive Summary

Project Objectives

The City of Tumwater, Washington (City) is proposing the first phase of improvements to the Capitol Boulevard corridor (Capitol Boulevard/Trosper Road Intersection Improvements). The Capitol Boulevard/Trosper Road Intersection Improvements will construct the following:

- A new local street, 6th Avenue, connecting Trosper Road SW and Lee Street SW
- A two-lane roundabout at the intersection of 6th Avenue/Trosper Road
- A two-lane roundabout at Capitol Boulevard SE and Trosper Road SW
- A one-lane roundabout at the ramp terminal on 6th Avenue
- A new local street, Trosper Road SE, extending Trosper Road east of Capitol Boulevard.

The project will realign the Interstate 5 (I-5) northbound off-ramp to Trosper Road SW and northbound I-5 on-ramp from eastbound Trosper Road SW to intersect 6th Avenue. In addition, Linda Street will be repurposed for local access only and will include driveway aprons at either end to discourage through traffic. The purpose of the project is to improve traffic circulation through the Capitol Boulevard corridor.

Current Noise Environment

Land use within the project area consists primarily of commercial and residential properties, and a City-owned property with trails (i.e., recreational land use). Residences are located at the east end of Linda Street SE. The western segment of Lee Street SW includes a motel and apartment complexes. Commercial properties include fast-food restaurants, a coffee shop, and banks. The coffee shop (i.e., Starbucks) on the southeast corner of Capitol Boulevard and Linda Street has an outdoor seating area on the southern side.

Of the modeled receivers, the predicted noise levels for the Existing scenario range between 55 A-weighted decibels (dBA) and 69 dBA. None of the 11 receivers currently experience traffic noise levels above the applicable Noise Abatement Criteria (NAC) for Category B, Category C, or Category E land uses in the study area.

Noise Impacts of Alternatives

The City has considered only one action alternative for this project. This noise report evaluates the existing conditions and future noise impacts for the year 2040 for the No-Build condition and the Future Build condition. For this study, the project design years are 2022 (Existing Year) and 2040 (Build/No-Build).

Of the modeled receivers, the predicted noise levels for the No-Build scenario range between 57 dBA and 70 dBA. None of the 11 receivers experience traffic noise levels above the applicable NAC for Category B, Category C, Category E, or Category F land uses in the study area under the No-Build scenario.

Of the modeled receivers, the predicted noise levels for the Future Build scenario range between 57 dBA and 69 dBA. None of the 11 receivers experience traffic noise levels above the applicable NAC for Category B, Category C, Category E, or Category F land uses in the study area under the No-Build scenario.

Abatement (Not Recommended)

Abatement was not considered for this project because there are no traffic noise impacts. Modeled noise levels are below the Federal Highway Administration (FHWA) NAC levels and no substantial noise increases were modeled between the Existing and Build conditions.

Introduction

Project Description

The City of Tumwater, Washington (City) is proposing the first phase of improvements to the Capitol Boulevard corridor (Capitol Boulevard/Trosper Road Intersection Improvements). The Capitol Boulevard/Trosper Road Intersection improvements will construct the following:

- A new local street, 6th Avenue, connecting Trosper Road SW and Lee Street SW
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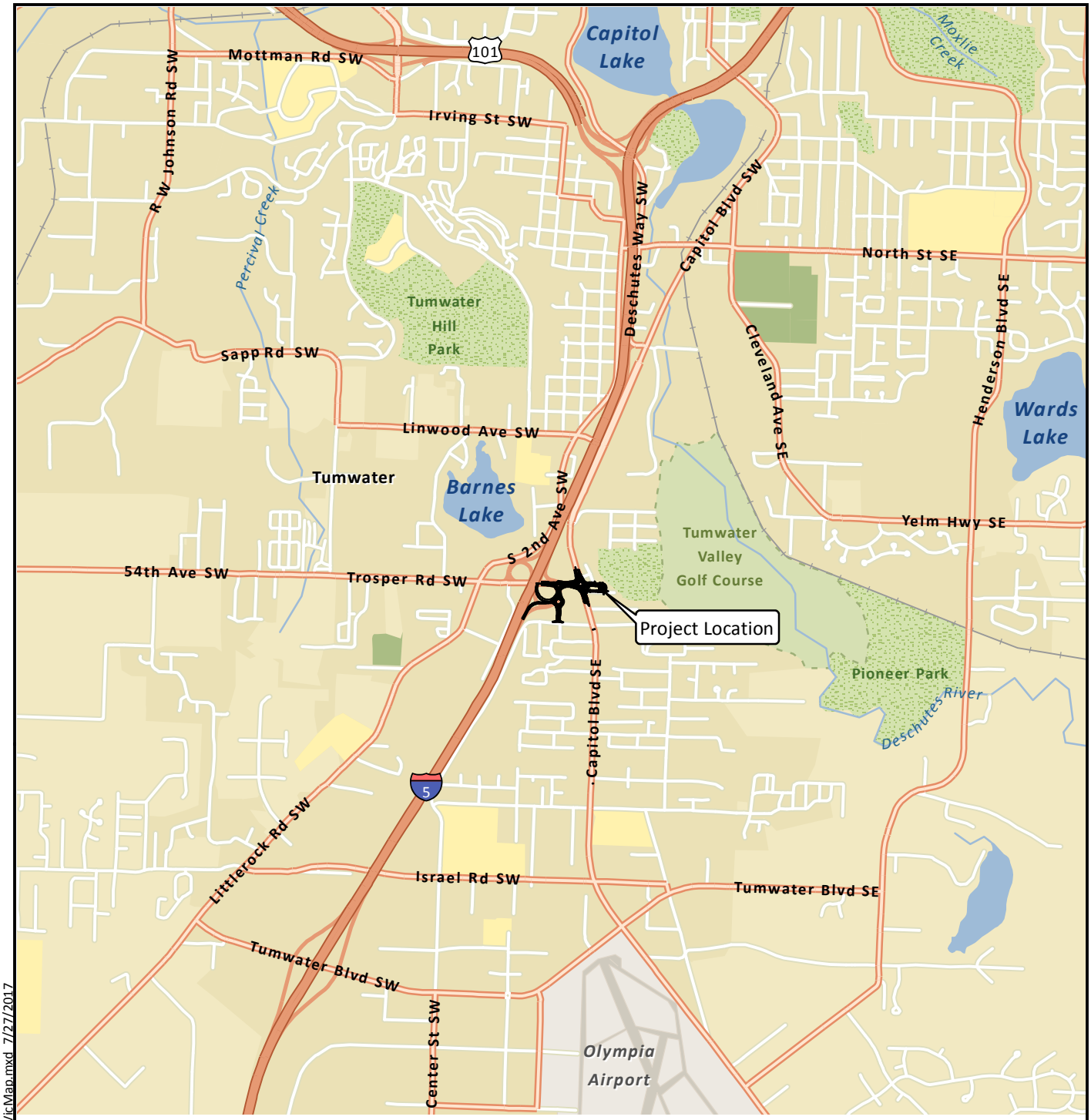
The project will realign the Interstate 5 (I-5) northbound off-ramp to Trosper Road SW and northbound I-5 on-ramp from eastbound Trosper Road SW to intersect 6th Avenue. In addition, Linda Street will be repurposed for local access only and will include driveway aprons at either end to discourage through traffic. The purpose of the project is to improve traffic circulation through the Capitol Boulevard corridor.

The project will add new roadways in portions of the project area; however, the entire project corridor was evaluated according to this Type 1 analysis,[1] including existing roadway segments.

The project is located in the City of Tumwater, Thurston County, Washington (Figure 1). The project corridor is situated in Sections 34, 35, and 65 of Township 18 North, Range 2 West. The project area includes the existing City and Washington State Department of Transportation (WSDOT) right-of-way and some adjacent land, which will be acquired as right-of-way, and improvements that extend onto arterial roads, including Trosper Road SE, Capitol Boulevard SE, and Linda Street SE (Figure 2).

This report was prepared using a template obtained from the WSDOT website.

[1] Type 1 projects have the potential to increase traffic noise levels and/or create traffic noise impacts for noise-sensitive receptors.



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Phase 1 - Capitol Boulevard/Trosper Road Intersection Improvements Tumwater, Washington	**Vicinity Map**	Figure 1

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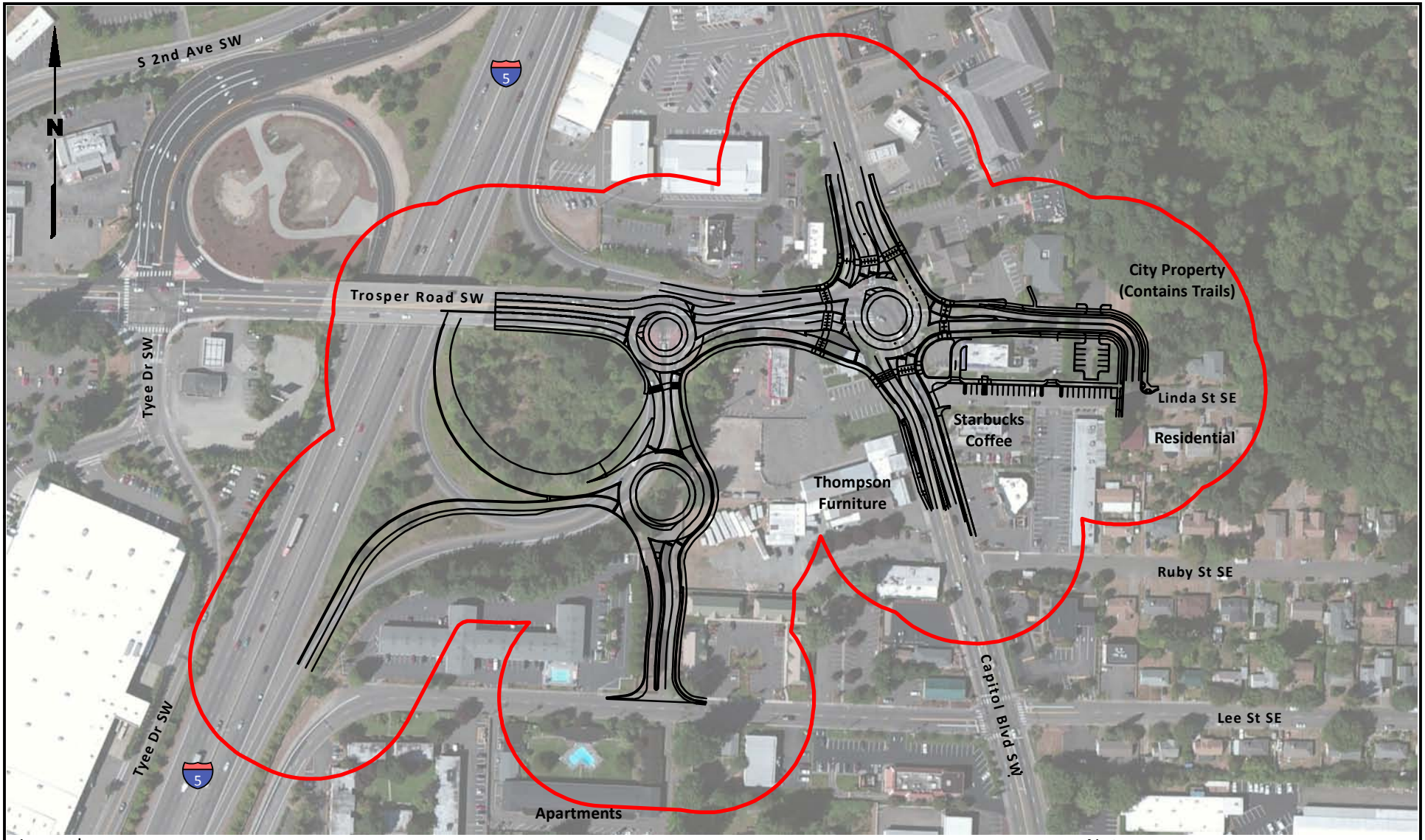

Legend

Project Improvements

Study Area

Note

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Data Source: Esri World Imagery.

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Scale in Feet

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Phase 1 -
Capitol Boulevard/Trosper Road
Intersection Improvements
Tumwater, Washington

Proposed Site Improvements Plan

Figure
2

Type 1 Trigger for Noise Analysis

A traffic noise analysis is required by law[2] and required by state policy[3] for federally funded project because it will add new roadways in portions of the project area, including 6th Avenue SW extending between Lee Street SW and the proposed roundabout, and an extension of Trosper Road to Linda Street SE. The entire project corridor was evaluated according to this Type 1 analysis, including existing roadway segments.

Noise Relevant Project Information

As shown on Figure 2, land use within the project area consists primarily of urban residences and commercial properties. The Capitol Boulevard/Trosper Road Improvements will consist of:

- Construction of 6th Avenue SW and a roundabout between Trosper Road SW and Lee Street SW. 6th Avenue SW will be a three-lane roadway (two northbound, one southbound) south of the proposed roundabout. The roundabout will also include realignment of the I-5 northbound off-ramp to Trosper Road SW and northbound I-5 on-ramp from eastbound Trosper Road SW to intersect with the 6th Avenue roundabout. Noise-sensitive receptor locations in this section of the project include Motel 6 with an outdoor use area (i.e., swimming pool) immediately adjacent to the proposed section of 6th Avenue SW, and apartments on the opposite side of Lee Street SW.
- Construction of a roundabout at Capitol Boulevard SE and Trosper Road SW, including channelization improvements to Capitol Boulevard SE and Trosper Road SW approaching the proposed roundabout. The intersection is signalized. Both Trosper Road SW west of the intersection and Capitol Boulevard SE north and south of the intersection have two travel lanes in each direction, which will be maintained with the completed project. Noise-sensitive receptor locations in this section of the project include Thompson Furniture store with outdoor retail use, and Starbucks Coffee with an area of outdoor seating.
- Extension of Trosper Road SE east of the Capitol Boulevard intersection, connecting to Linda Street SE to the south. Trosper Road SW ends at Capitol Boulevard, and there is a private access easement east of the intersection that aligns with Trosper Road SW. The private access easement will be converted into a City street, Trosper Road SE. The project will provide one travel lane in each direction of Trosper Road SE east of the proposed roundabout. Noise-sensitive receptor locations in this section of the project include five single-family residences east of the proposed improvements, and City-owned property with trails connecting to Palermo Pocket Park.

[2] 23 CFR 772, "Procedures for Abatement of Highway Traffic Noise and Construction Noise"

[3] 2011 WSDOT Traffic Noise Policy and Procedures, WSDOT

- Reconfiguration of Linda Street SE to provide perpendicular parking between the proposed Trosper Road SE extension and Capitol Boulevard SE. Linda Street SE is currently an unchannelized roadway with width allowing for parallel parking on either side. Noise-sensitive receptor locations in this section of the project include the five single-family residences east of the proposed improvements, as mentioned above.
- Construction of a roundabout at 6th Avenue SW and Trosper Road SW. 6th Avenue SW will be a two-lane roadway (one northbound, one southbound) south of the proposed roundabout. The roundabout will also include realignment of Trosper Road SW adjacent to the roundabout. There are no noise-sensitive receptor locations in this section of the project.

All project roadways are currently at-grade, and will remain at-grade with the proposed project. Posted speed limits on Capitol Boulevard (35 mph), Lee Street (25 mph), and Trosper Road (25 mph) will be unchanged with the proposed project. New roadway segments will be posted at 25 mph.

For this study, the project design years are 2022 (Existing Year) and 2040 (Build/No-Build).

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Characteristics of Sound and Noise

Definition of Sound

Sound is created when objects vibrate, resulting in a minute variation in surrounding atmospheric pressure, called sound pressure. The human response to sound depends on the magnitude of a sound as a function of its frequency and time pattern (EPA, 1974). Magnitude is a measure of the physical sound energy in the air. The range of magnitude the ear can hear, from the faintest to the loudest sound, is so large that sound pressure is expressed on a logarithmic scale in units called decibels (dB). Loudness refers to how people subjectively judge a sound and varies between people.

Sound is measured using the logarithmic decibel scale, so doubling the number of noise sources, such as the number of cars on a roadway, increases noise levels by 3 A-weighted decibels (dBA). Therefore, when you combine two noise sources emitting 60 dBA, the combined noise level is 63 dBA, not 120 dBA. The human ear can barely perceive a 3 dBA increase, while a 5 dBA increase is about one and one-half times as loud. A 10 dBA increase appears to be a doubling in noise level to most listeners. A tenfold increase in the number of noise sources will add 10 dBA.

In addition to magnitude, humans also respond to a sound's frequency or pitch. The human ear is very effective at perceiving frequencies between 1,000 and 5,000 hertz (Hz), with less efficiency outside this range. Environmental noise is composed of many frequencies. A-weighting (dBA) of sound levels is applied electronically by a sound level meter and combines the many frequencies into one sound level that simulates how an average person hears sounds of low to moderate magnitude.

Definition of Noise

Noise is unwanted or unpleasant sound. Noise is a subjective term because, as described above, sound levels are perceived differently by different people. Magnitudes of typical noise levels are presented in Table 1.

Traffic Noise Sources

An increase in traffic volumes, vehicle speeds, or the number of heavy trucks will increase traffic noise levels. Traffic noise is a combination of noises from the engine, exhaust, and tires. Defective mufflers, truck compression braking, steep grades, the terrain and vegetation near the roadway, shielding by barriers and buildings, and the distance from the road can also contribute to the traffic noise heard at the roadside.

Table 1: Typical Noise Levels

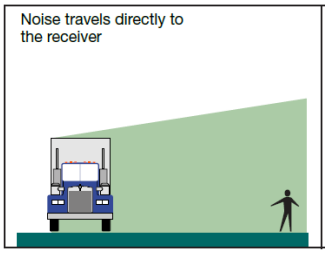
NOISE SOURCE OR ACTIVITY		SUBJECTIVE IMPRESSION	RELATIVE LOUDNESS (human judgment of different sound levels)
Jet aircraft takeoff from carrier (50 feet)	140	Threshold of pain	64 times as loud
50-horsepower siren (100 feet)	130		32 times as loud
Loud rock concert near stage Jet takeoff (200 feet)	120	Uncomfortably loud	16 times as loud
Float plane takeoff (100 feet)	110		8 times as loud
Jet takeoff (2,000 feet)	100	Very loud	4 times as loud
Heavy truck or motorcycle (25 feet)*	90		2 times as loud
Garbage disposal (2 feet) **Pneumatic drill (50 feet)**	80	**Moderately loud**	**Reference loudness**
Vacuum cleaner (10 feet) Passenger car at 65 mph (25 feet)*	70		1/2 as loud
Typical office environment	60		1/4 as loud
Light auto traffic (100 feet)*	50	Quiet	1/8 as loud
Bedroom or quiet living room Bird calls	40		1/16 as loud
Quiet library, soft whisper (15 feet)	30	Very quiet	
High quality recording studio	20		
Acoustic test chamber	10	Just audible	
	0	Threshold of hearing	

Sources: Beranek (1988) and U.S. EPA (1974)

Sound Propagation

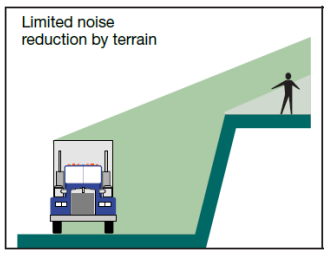
Sound propagation, or how far the sound travels, is affected by the terrain and the elevation of the receiver relative to the noise source. Noise levels can be reduced by breaking the line of sight between the receiver and the noise source.

- Level ground: noise travels in a straight path between the source and receiver.



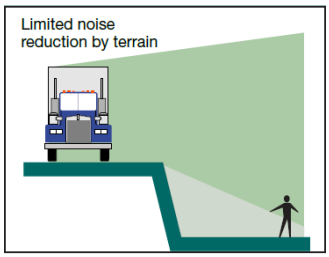
Level Ground

- Depressed source/elevated receiver: terrain may act like a partial noise barrier and reduce noise levels if it crests between the source and receiver.



Depressed source/elevated receiver

- Elevated source/depressed receiver: the edge of the roadway acts as a partial noise barrier. Even a short barrier, like a concrete safety barrier, can reduce noise levels at the subgrade receiver.



Elevated source/depressed receiver

Line and Point Sources

Noise levels decrease with distance from the noise source. For a line source, like a highway, noise levels decrease 3 dBA for every doubling of distance, e.g., from 50' to 100', between the source and the receiver over hard ground (concrete, pavement) or 4.5 dBA over soft ground (grass). For point sources, like most construction noise, the levels decrease between 6 and 7.5 dBA for every doubling of distance.

Effects of Noise

The FHWA noise abatement criteria are based on speech interference, which is a well-documented impact that is relatively reproducible in human response studies. Environmental noise indirectly affects human welfare by interfering with sleep, thought, and conversation. Prolonged exposure to very high levels of environmental noise can cause hearing loss and the U.S. Environmental Protection Agency (EPA) has established a protective level 70 dBA $L_{eq}(24)$[4] for hearing loss. Noise also can affect some types of wildlife during certain activities.

[4] U.S. EPA, 1974

Noise Level Descriptors

The equivalent sound level (L_{eq}) is a measure of the average noise level during a specified period of time. A one-hour period, or hourly L_{eq} [$L_{eq}(h)$], is used to measure highway noise. L_{eq} is a measure of total noise during a time period that places more emphasis on occasional high noise levels that accompany general background noise levels. For example, if you have two different sounds, and one contains twice as much energy, but lasts only half as long as the other, the two would have the same L_{eq} noise levels.

Either the total noise energy or the highest instantaneous noise level can describe short-term noise levels, such as those from a single truck passing by. The sound exposure level (SEL) is a measure of total sound energy from an event, and is useful in determining what the L_{eq} would be over a period of time when several noise events occur. L_{max} is the maximum sound level that occurs during a single event and is related to impacts on speech interference and sleep disruption. L_{min} is the minimum sound level during a period of time.

With L_n, "n" is the percent of time that a sound level is exceeded and is used to describe the range of sound levels recorded during the measurement period. For example, the L_{10} level is the noise level that is exceeded 10% of the time. Sound varies in the environment and people will generally find a higher, but constant, sound level more tolerable than a quiet background level interrupted by higher sound level events. For example, steady traffic noise from a highway is normally less bothersome than occasional aircraft flyovers in an otherwise quiet area.

Noise Regulations and Impact Criteria

Traffic noise impacts occur when predicted $L_{eq}(h)$ noise levels approach or exceed noise abatement criteria (NAC) established by the FHWA, or substantially exceed existing noise levels.[5] WSDOT considers a noise impact to occur if predicted $L_{eq}(h)$ noise levels approach within 1 dBA of the NAC. The FHWA NAC specify exterior $L_{eq}(h)$ noise levels for various land activity categories as described in Table 2. WSDOT also considers an increase of 10 dBA or more between the Existing and Build conditions to be a substantial increase and a traffic noise impact.

[5] U.S. Department of Transportation, 1982, Noise Abatement Council

Table 2: Federal Highway Administration Noise Abatement Criteria by Land Use

Activity Category	$L_{eq}(h)$ at Evaluation Location (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 (single and multi-family units).
C	67 (exterior)	Active sport 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 (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 A-D or F. Includes undeveloped land permitted for these activities.
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: 23 CFR Part 772.

Land use within the Capitol Boulevard/Trosper Road Intersection Improvements project area consists primarily of residences (Category B), motel and restaurants (Category E), and retail (Thompson Furniture) (Category F). According to WSDOT guidance, the following types of noise-sensitive receiver locations and their noise impact thresholds were considered:

- Category B: The outdoor yards of existing and permitted single-family dwellings, and associated outdoor balconies/pools at the existing apartment complex in the study area. The WSDOT noise impact threshold is 66 dBA.
- Category C: The outdoor trails on existing City-owned property (i.e., recreation area) connecting to Palermo Pocket Park. The WSDOT noise impact threshold is 66 dBA.
- Category E: Outdoor use area at one existing coffee shop (i.e., Starbucks) and pool area associated with Motel 6. The WSDOT noise impact threshold is 71 dBA.
- Category F: The outdoor use area for staging furniture sales at Thompson Furniture. A WSDOT noise impact threshold is not assigned; only an increase of 10 dBA or more is used to identify a traffic noise impact.

Traffic Noise Analysis Methodology

Determination of the Traffic Noise Study Area

Following WSDOT guidance (WSDOT, 2011), the noise study area included for Traffic Noise Model (TNM) modeling must be large enough to include all receptor locations between the project limits that may experience traffic noise impacts, including non-residential land uses described in the NAC table (see Table 2). This may require the analyst to collect model validation measurements and/or model receivers at regular distance increments to validate the FHWA TNM and determine the approximate distance that noise impacts will extend out from the road for all modeled scenarios. Modeled receivers shall extend beyond the distance where impacts can be modeled to verify that the full impacted area is captured, which was estimated to be the 65 dBA contour.

To determine the "study area," a simplified linear roadway model was developed in TNM. Using Build year traffic volumes for the project roadway segment with the highest volume, and receivers located at intervals perpendicular to the roadway, the approximate distance of the 65-dBA contour was identified. The 65-dBA contour was estimated to extend approximately 190 feet from the edge of Capitol Boulevard SE (see Figure 3). Then, after the study area was defined, measurements and detailed TNM modeling completed as part of this project were recorded at first-row receivers (i.e., those closest to the roadway), which were within approximately 120 feet or less from project roadways.

Traffic Noise Measurement

Ambient noise levels were measured to identify major noise sources in the project area and validate the noise model. Traffic noise measurements are not used to describe Existing conditions, which are modeled after the noise model has been validated.

During free-flowing traffic conditions, 15-minute L_{eq} measurements were taken at locations representative of all sound level environments within the study area. The FHWA allows 15-minute L_{eq} measurements to represent the $L_{eq}(h)$. These traffic noise measurements are not representative of "average" existing noise levels.

Field measurements were taken on May 17, 2017 between 11:30 and 13:45 using a Norsonic Nor118 (make/model) Class 1 sound level meter. During noise measurements, corresponding traffic counts and estimates of traffic speeds were recorded for use in model validation (see below). Field data sheets and site photographs are provided in Appendix A and Appendix B, respectively.

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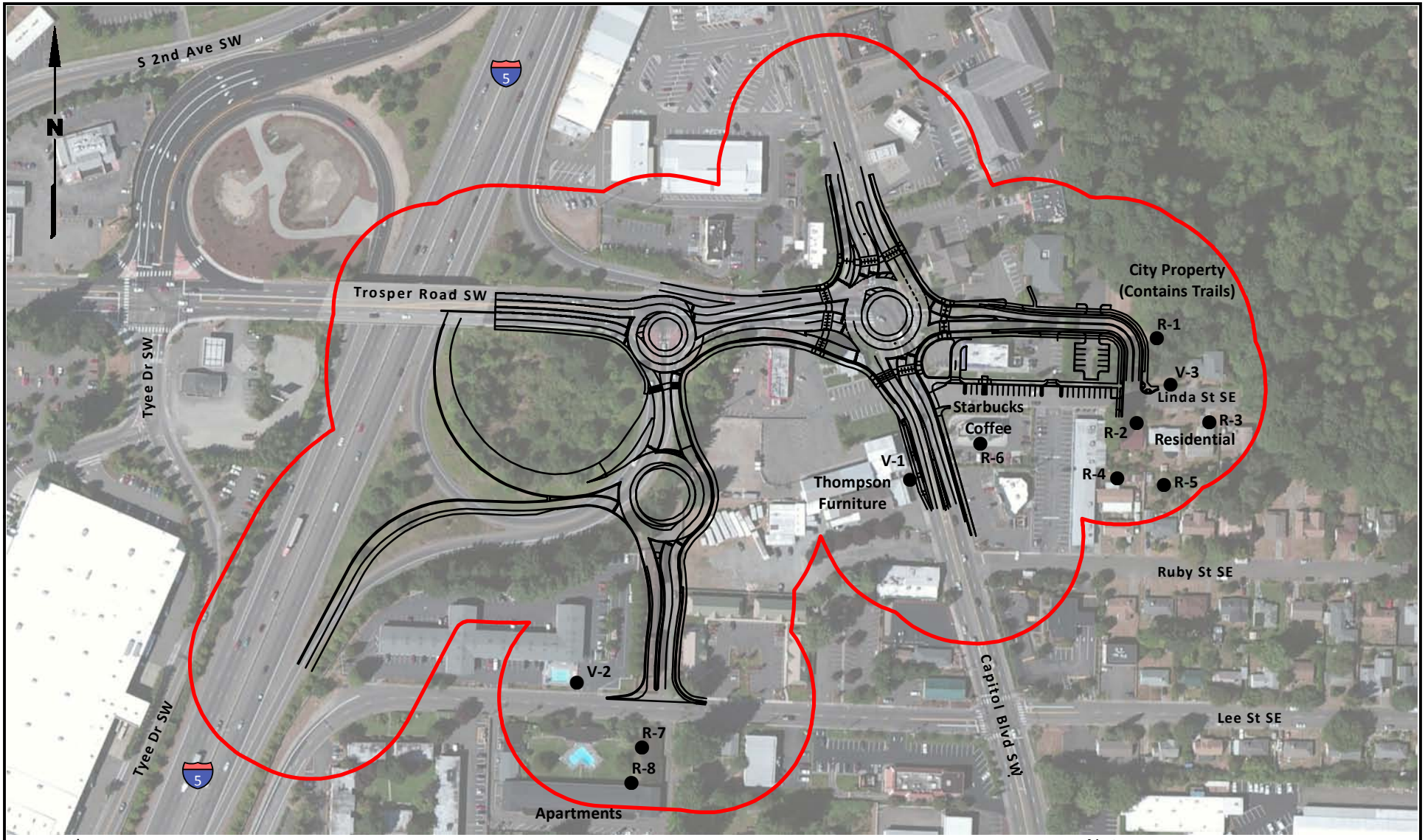

Legend

- Noise Modeling Locations
- Project Improvements
- Study Area

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Scale in Feet

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Esri World Imagery.

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Capitol Boulevard/Trosper Road
Intersection Improvements
Tumwater, Washington

Traffic Noise Modeling Locations

Figure
3

Traffic Noise Model Validation

To ensure that the noise model used to predict traffic noise impacts accurately reflects the sound levels in the noise study area, a model was constructed using the same traffic volumes, speed, and vehicle types that were present during the sound level measurements. Modeled values must be within ±2.0 dBA of the measured levels for the model to be validated.

FHWA's TNM Version 2.5 (FHWA, 2004) was used for validation and to predict future $L_{eq}(h)$ traffic noise levels. TNM calculates precise estimates of noise levels at discrete points. The model estimates the sound levels from a series of straight-line roadway segments. TNM also considers the effects of existing barriers, topography, vegetation, and atmospheric absorption. Noise from sources other than traffic is not included so when non-traffic noise is present, such as aircraft noise, TNM will under-predict the actual noise level. To create the model, design files outlining major roadways, topographical features, and sensitive receptors were imported into the TNM model as background features and the corresponding values were entered manually. Aerial photographs and site visits were used to verify site conditions.

Table 3 describes the validation locations and compares measured to model values. Recorded traffic information during the measurements is included in Appendix C. Figure 4 shows the validation receiver locations. Receivers used for validation purposes were also used in predicting noise levels in Existing and Build/No-Build Years (see below). TNM model data are provided in Appendix D.

Table 3: Noise Model Validation

Receptor	Location	Date	Start Time	Measured L_{eq} (dBA)	Modeled L_{eq} (dBA)	Difference (dBA)
V-1	5407 Capitol Boulevard SE (Thompson Furniture)	05/17/17	11:30	71.5	69.5	–2.0
V-2	400 Lee Street SW (Motel 6)	05/17/17	12:15	64.6	62.6	–2.0
V-3	130 Linda Street SE (Single Family Residence)	05/17/17	13:30	55.4	57.1	1.7

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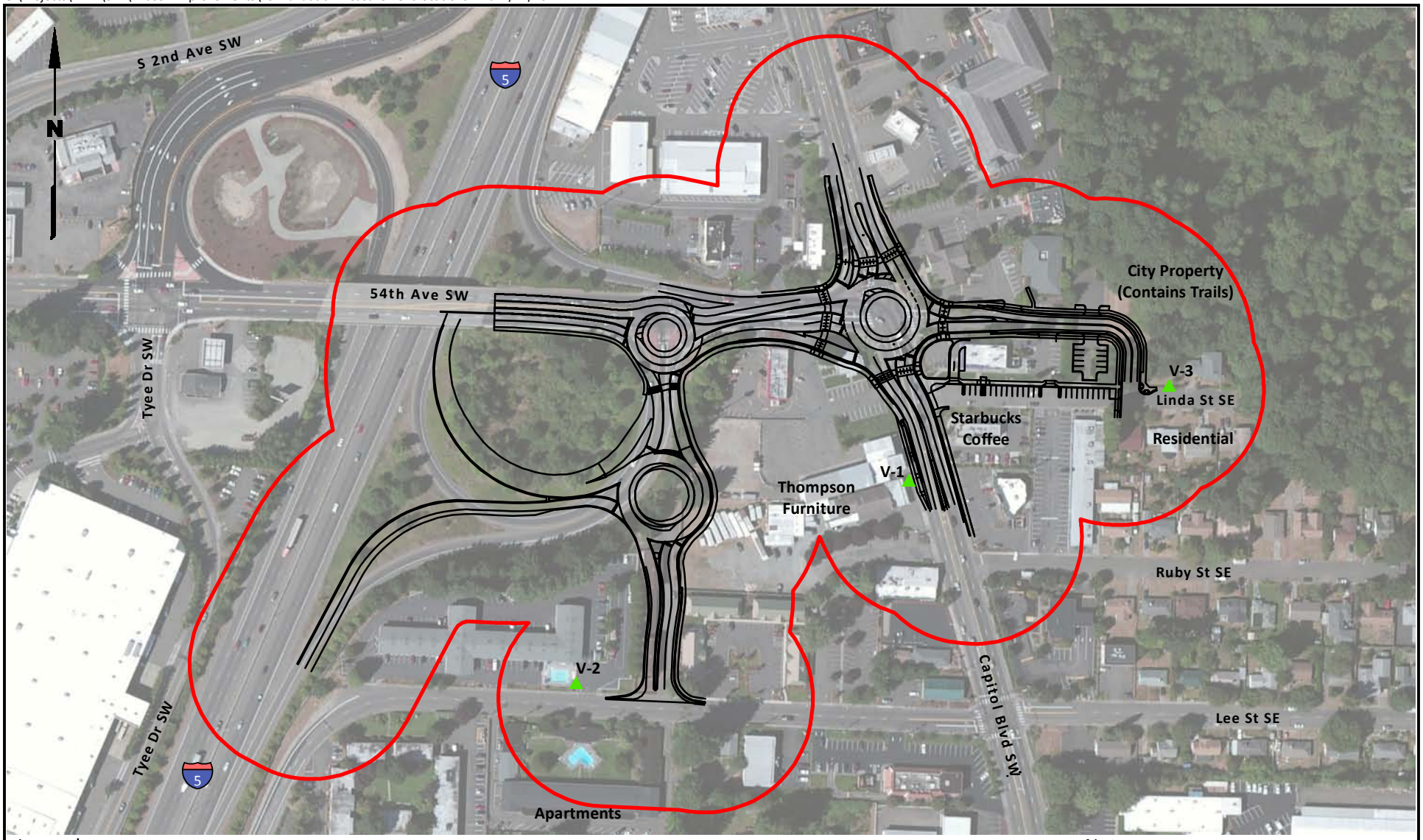

Legend

- Validation Measurement Locations
- Project Improvements
- Study Area

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Data Source: Esri World Imagery.

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Phase 1 -
Capitol Boulevard/Trosper Road
Intersection Improvements
Tumwater, Washington

Validation Measurement Location Map

Figure
4

Traffic Noise Modeling – Predicted Traffic Noise Levels

Additional receivers were added to the model to represent the outdoor use areas for all noise-sensitive receptor locations within the study area. The modeled receiver locations are shown on Figure 3, and descriptions of each modeling receiver are included in Table 4.

Predicted noise levels were based on peak-hour traffic volumes to estimate existing and future noise levels (Appendix C) for the Existing year (2022) and the future design year (2040*)* traffic with (Build) and without the project (No-Build). TNM model data are included in Appendix D. Traffic volumes prepared by SCJ Alliance were used for this noise analysis. The PM peak volumes represented the highest volume when compared to the AM peak hour; however, it was determined that the worst hourly noise level on Lee Street occurs during the AM peak hour due to higher truck volumes during that time. As a result, the TNM modeling noise analysis applied the AM-peak hour to Lee Street and PM peak-hour traffic volumes for the other project roadways.

Table 4: Modeled Noise Levels

Site and Land Use Category	NAC (L_{eq}) (dBA)	Dwelling Units	Existing (L_{eq}) (dBA)	No-Build – Year (L_{eq}) (dBA)	Build – Year (L_{eq}) (dBA)
V-1 (F; Retail)	N/A	N/A	69	70	69
V-2 (E; Motel)	72	N/A	65	67	66
V-3 (B; Single Family Residential)	67	1	60	61	61
R-1 (C; Trail)	67	N/A	59	60	60
R-2 (B; Single Family Residential)	67	2	58	59	61
R-3 (B; Single Family Residential)	67	2	57	58	58
R-4 (B; Single Family Residential)	67	1	55	57	57
R-5 (B; Single Family Residential)	67	1	57	58	58
R-6 (E; Restaurant)	72	N/A	67	68	67
R-7 (B; Multifamily Residential 1st Floor)	67	32	61	63	62
R-8 (B; Multifamily Residential 2nd Floor)	67		62	64	63

Traffic Noise Levels

Description of Study Area

Modeled noise-sensitive receivers are shown on Figure 3.

The study area consists primarily of residential and commercial properties, and includes a City-owned property with trails (i.e., recreational land use):

- Along Lee Street SE, noise-sensitive receptor locations include an apartment complex with outdoor use areas (pool and decks; Category B), and Motel 6 with an outdoor pool area (Category E).
- Along Capitol Boulevard, noise-sensitive receptor locations include an outdoor seating area associated with Starbucks Coffee (Category E) and outdoor staging associated with Thompson Furniture (Category F).
- Along Linda Street SE, noise-sensitive receptor locations include five single-family residences (Category B) and City-owned property with trails (Category C) connecting to Palermo Pocket Park outside the study area.

Operational Traffic Noise

The following provides a summary of model results for the Existing, Future No-Build, and Future Build scenarios. Noise levels are also presented in Table 4.

Existing Noise Levels

The predicted noise levels for the Existing scenario range between 55 dBA and 69 dBA (see Table 4). None of the 11 receivers currently experience traffic noise levels above the applicable NAC for Category B, Category C, or Category E land uses in the study area.

Design Year Traffic Noise Levels – No Build

The predicted noise levels for the No-Build scenario range between 57 dBA and 70 dBA (see Table 4). The results indicate an increase of impacts from the Existing scenario at all 11 receivers, but the maximum Future No-Build noise increase is only 2 dBA, which is less than WSDOT's noise impact criterion of a 10 dBA increase. None of the 11 receivers experience traffic noise levels above the applicable NAC for Category B, Category C, Category E, or Category F land uses in the study area under the No-Build scenario.

Design Year Traffic Noise Levels –Build

The predicted noise levels for the Build scenario range between 57 dBA and 69 dBA (see Table 4). The results indicate an increase of impacts from the Existing scenario at all 11

receivers, but the maximum Build noise increase is only 3 dBA, which is less than WSDOT's noise impact criterion of a 10 dBA increase. None of the 11 receivers experience traffic noise levels above the applicable NAC for Category B, Category C, Category E, or Category F land uses in the study area under the Build scenario.

Traffic Noise Abatement

Abatement was not considered for this project because there are no traffic noise impacts. Modeled noise levels are below the FHWA NAC levels and no substantial noise increases were modeled between the Existing and Build conditions.

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Construction Noise

Construction Noise Background

Construction creates temporary noise. Construction is usually carried out in reasonably discrete steps, each with its own mix of equipment and noise characteristics. For example, roadway construction involves demolition, construction, and paving.

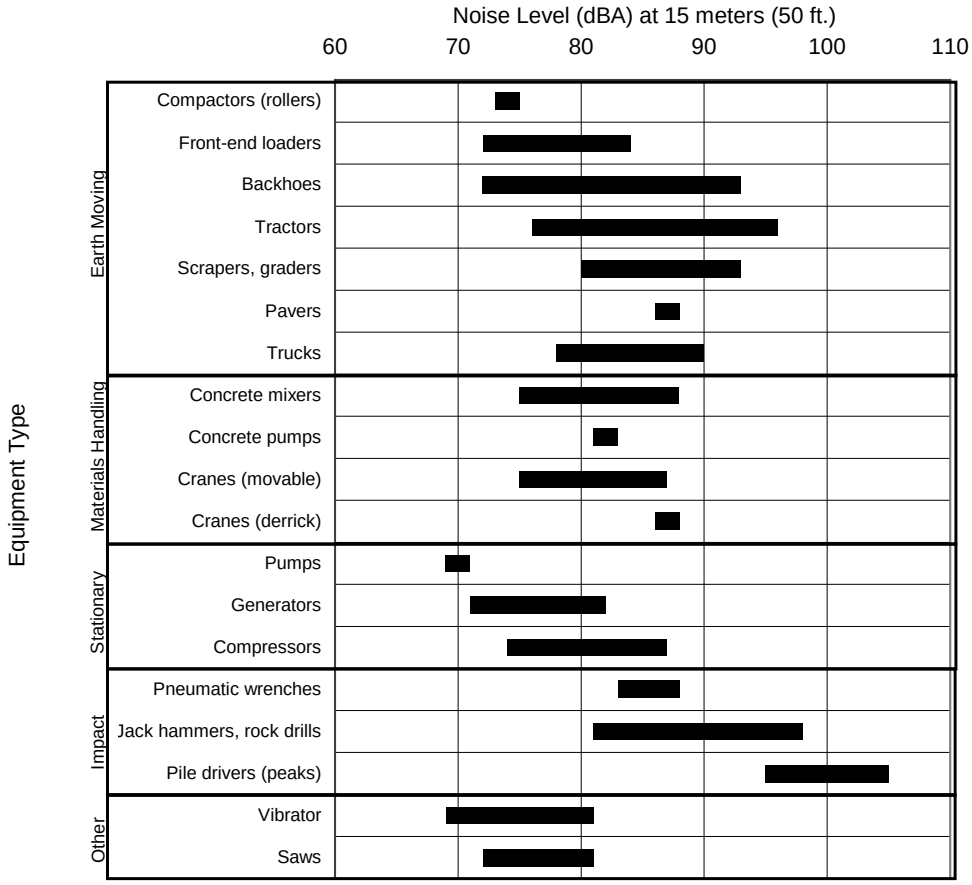
The most constant noise source at construction sites is usually engine noise. Mobile equipment generally operates intermittently or in cycles of operation, while stationary equipment, such as generators and compressors, generally operates at fairly constant sound levels. Trucks are present during most phases of construction and are not confined to the project site, so noise from trucks may affect more receivers than other construction noise. Other common noise sources include impact equipment, which could be pneumatic, hydraulic, or electric-powered.

Noise levels during the construction period depend on the type, amount/duration, and location of construction activities.

- The type of construction methods establishes the maximum noise levels.
- The amount of construction activity establishes how often certain construction noises occur throughout the day.
- The location of construction equipment relative to adjacent properties determines the effect of distance in reducing construction noise levels.

The maximum noise levels of construction equipment will be similar to the maximum construction equipment noise levels presented on Figure 5 and typically range from 69 to 106 dBA at 50 feet. As a point source, construction noise decreases by 6 dBA per doubling of distance from the source moving away from the equipment. The various pieces of equipment are almost never operating simultaneously at full-power and some will be turned off, idling, or operating at less than full power at any time. Therefore, the average L_{eq} noise levels will be less than the aggregate of the maximum noise levels shown on Figure 5.

Figure 5: Construction Equipment Noise Ranges



Source: EPA, 1971 and WSDOT, 1991.

Construction Noise Levels Limits

Traffic noise and construction noise are exempt from the property line noise limits during daytime hours, but noise limits still apply to construction noise at night. Noise levels shown in Table 5 apply only to construction noise at residential properties at night: between 10 p.m. and 7 a.m. At night, construction noise must meet Washington State Department of Ecology property line regulations[6] that set limits based on the Environmental Designation for Noise Abatement (EDNA) of the land use: residential (Class A), commercial (Class B), and industrial (Class C).

Allowable nighttime (10:00 p.m. to 7:00 a.m.) noise levels at Class A receiving properties (residential) are reduced by 10 dBA.

[6] Chapter 173-40 Washington Administrative Code (WAC).

Table 5: Maximum Permissible Environmental Noise Levels

EDNA of Noise Source	EDNA of Receiving Property (dBA)		
	Class A	Class B	Class C
Class A	55	57	60
Class B	57	60	65
Class C	60	65	70

Short-term exceedance of the sound levels in Table 5 is allowed. During any one-hour period, the maximum level may be exceeded by:

- 5 dBA for a total of 15 minutes,
- 10 dBA for a total of 5 minutes, or
- 15 dBA for a total of 1.5 minutes[7].

The allowed exceptions are defined by the percentage of time a given noise level is exceeded. For example, L_{25} is the noise level exceeded 15 minutes during an hour. Therefore, the permissible L_{25} would be 5 dBA greater than the values in Table 5, provided that the noise level is below the permissible level for the rest of the hour and never exceeds the permissible level by more than 5 dBA.

An hourly L_{eq} of approximately 2 dBA higher than the values in Table 5 is an equivalent sound level to the permissible levels, including the short term exceedances. An $L_{eq}(h)$ of 59 dBA corresponds approximately to a noise level of 57 dBA for 45 minutes and 62 dBA for 15 minutes, which are the maximum permissible noise levels created by a commercial source (Class B) and received by a residential property (Class A).

Construction Noise Assessment

Depending on the activity, peak noise levels from equipment associated with construction would most likely range from 69 to 96 dBA at 50 feet (no pile driving is anticipated as part of proposed project construction). Construction noise at receivers farther away would decrease at a rate of approximately 6 dBA per doubled distance from the source. Because construction equipment would not constantly operate at distances of 50 feet, average L_{eq} noise levels during the day would be less than the noise levels presented on Figure 5.

[7] WAC 173-60-040.

Construction Noise Variance for Night Work

Construction noise is exempt from local property line regulations during daytime hours. If nighttime construction is required for this project, the City will apply for variances or exemptions from local noise ordinances for the night work. Noise variances or exemptions require construction noise abatement measures that vary by jurisdiction. If night work is necessary for this project, noise variances are also needed from the City.

Construction Noise Abatement

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 away from noise-sensitive receivers (e.g., homes). To reduce construction noise at nearby receptor locations, the following abatement measures can be incorporated into construction plans and contractor specifications:

- Limiting construction activities to between 7 a.m. and 10 p.m. would reduce construction noise levels during sensitive nighttime hours.
- Using haul vehicles with rubber bed-liners would reduce noise from loading trucks.
- Equipping trucks with ambient backup alarms would reduce the noise for equipment backing.
- Equipping construction equipment engines with adequate mufflers, intake silencers, and engine enclosures would reduce their noise by 5 to 10 dBA (U.S. EPA, 1971).
- Constructing temporary noise barriers or curtains around stationary equipment that must be located close to residences would decrease noise levels at nearby sensitive receptor locations.

Additional methods for reducing construction noise levels that may be incorporated by the project engineering office or required by a jurisdiction include the following:

- Specifying the quietest equipment available would reduce noise by 5 to 10 dBA.
- Turning off construction equipment during prolonged periods of non-use 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 in relation to the increased distance.

References

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U.S. Environmental Protection Agency, 1971. Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances. Washington, D.C.

U.S. Environmental Protection Agency, 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. Report Number 550/9-74-004.

Washington State Department of Transportation, July 2011. Traffic Noise Policy and Procedures. Olympia, Washington.

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Appendix A – FIELD DATA SHEETS

LANDAU ASSOCIATES

Field Noise Measurement Data Sheet

Project Name: Capitol Blvd Phase I
Project No. 1174017
Location: Thompson Farm
Site No. V-1
Date/Time: 5/17/17 ; 11:30
Norsonic File No. 170517-002
Data Collected By: SDG

Equipment Information

Sound Meter/Microphone: Norsonic 116
Weighting: A
Response Time: Fast ☐ Slow ☒
Microphone Height: 5ft

Site Information

Wind Speed/Direction: None
Ground Cover: Pavement ☒ Soft/Grass ☐ Mixed/Other:
Road Conditions: Busy
Posted MPH/Actual MPH: 35 / 40

Results

Interval Length: 15 min
Leq: 71.5
Lmax: 81.5
Lmin: 58.4
L5: 75.3
L10: 74.4
L90: 64.5

Traffic Data

Roadway: Video Recorded
Direction
Hrly

Vehicles		
Medium Trucks		
Large Trucks		
Buses		
Motorcycles		

Roadway
Direction
Hrly

Vehicles		
Medium Trucks		
Large Trucks		
Buses		
Motorcycles		

Roadway
Direction
Hrly

Vehicles		
Medium Trucks		
Large Trucks		
Buses		
Motorcycles		

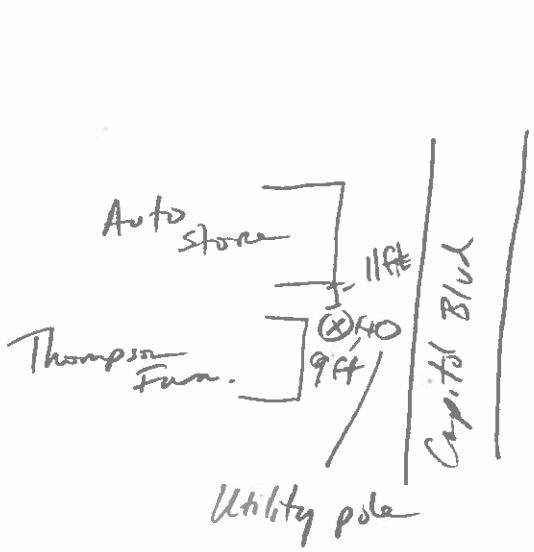
Roadway
Direction
Hrly

Vehicles		
Medium Trucks		
Large Trucks		
Buses		
Motorcycles		

Field Noise Measurement Data Sheet

Diagram:

Site No. V-1



Site Notes:

Traffic is constant

I-5 does not appear to be audible

Traffic Counts:

Roadway/Direction:

Cars	Med Trucks	Heavy Trucks	Cars	Med Trucks	Heavy Trucks
	Motorcycles	Buses		Motorcycles	Buses

LANDAU ASSOCIATES

Field Noise Measurement Data Sheet

Project Name:	Capitol Blvd Phase I	Project No.	1174017
Location:	Motel 6 pool	Site No.	V-2
Date/Time:	5/17/17 ; 12:15	Norsonic File No.	170517_005
Data Collected By:	SDQ		

Equipment Information

Sound Meter/Microphone: Norsonic 118

Weighting: A

Response Time: Fast ☐ Slow ☒

Microphone Height: 5 ft

Site Information

Wind Speed/Direction: slight NNE

Ground Cover: Pavement ☒ Soft/Grass ☐ Mixed/Other: _____

Road Conditions: light traffic

Posted MPH/Actual MPH: 25

Results

Interval Length:	15 min
Leq:	69.6
Lmax:	76.4
Lmin:	57.8
L5:	69.3
L10:	68.1
L90:	59.1

Traffic Data

Roadway	Lee		Roadway	Lee	
Direction	EB	Hrly	Direction	WB	Hrly
Vehicles	48		Vehicles	50	
Medium Trucks	2		Medium Trucks	2	
Large Trucks			Large Trucks		
Buses			Buses		
Motorcycles			Motorcycles		

Roadway			Roadway		
Direction		Hrly	Direction		Hrly
Vehicles			Vehicles		
Medium Trucks			Medium Trucks		
Large Trucks			Large Trucks		
Buses			Buses		
Motorcycles			Motorcycles		

Field Noise Measurement Data Sheet

Diagram:

Site No. V-2

N

Site Notes:

I-5 audible

leaf blower in distance

Traffic Counts:

Roadway/Direction:

Cars	Med Trucks	Heavy Trucks	Cars	Med Trucks	Heavy Trucks
	Motorcycles	Buses		Motorcycles	Buses

LANDAU ASSOCIATES

Field Noise Measurement Data Sheet

Project Name:	Capitol Blvd Phase I	Project No.	174017
Location:	130 Linda Street	Site No.	V-3
Date/Time:	5/17/17 ; 1:30	Norsonic File No.	170517-0016
Data Collected By:	SJR		

Equipment Information

Sound Meter/Microphone:	Norsonic 118
Weighting:	A
Response Time:	Fast ☐ Slow ☒
Microphone Height:	5 ft

Site Information

Wind Speed/Direction:	None
Ground Cover:	Pavement ☐ Soft/Grass ☒ Mixed/Other:
Road Conditions:	Light traffic into commercial areas
Posted MPH/Actual MPH:	25

Results

Interval Length:	15 min
Leq:	55.4
Lmax:	59.6
Lmin:	51.4
L5:	57.9
L10:	57.1
L90:	53.1

Traffic Data

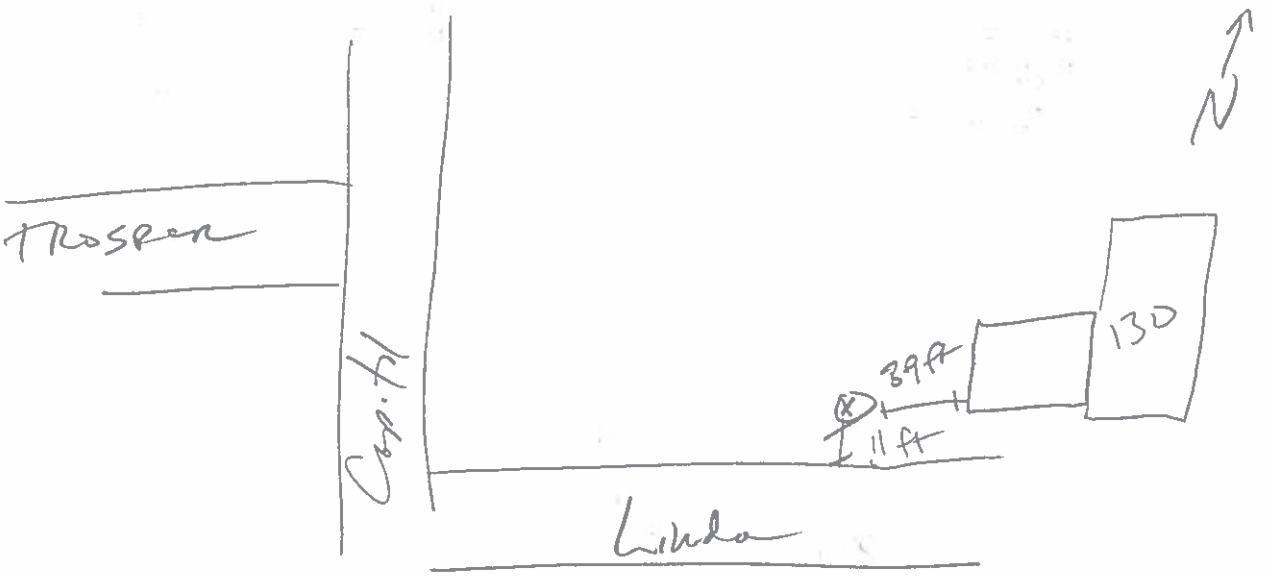
Roadway	Linda		Roadway	Linda	
Direction	WB	Hrly	Direction	EB	Hrly
Vehicles	11		Vehicles	10	
Medium Trucks			Medium Trucks		
Large Trucks			Large Trucks		
Buses			Buses		
Motorcycles			Motorcycles		

Roadway			Roadway		
Direction		Hrly	Direction		Hrly
Vehicles			Vehicles		
Medium Trucks			Medium Trucks		
Large Trucks			Large Trucks		
Buses			Buses		
Motorcycles			Motorcycles		

Field Noise Measurement Data Sheet

Diagram:

Site No. V-3



Site Notes:

I-5 appears to be audible.

Traffic on Linda turns into commercial area before reaching residential area.

Traffic Counts:

Roadway/Direction:

Cars	Med Trucks	Heavy Trucks	Cars	Med Trucks	Heavy Trucks
	Motorcycles	Buses		Motorcycles	Buses

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Appendix B – Selected Site Photographs

1. V-1, Thompson Furniture facing west.

2. V-1, Thompson Furniture facing east toward Capitol Boulevard.

LANDAU ASSOCIATES

Capitol Boulevard Phase 1 Improvements Tumwater, Washington	**Selected Site Photographs**	Figure B-1

3. V-2, Motel 6 pool area facing south toward Lee Street.

4. V-2, Motel 6 pool area facing north.

LANDAU ASSOCIATES

Capitol Boulevard Phase 1 Improvements Tumwater, Washington	**Selected Site Photographs**	Figure B-2

5. V-3, Residence at 130 Linda Street facing west.

6. V-3, Residence at 130 Linda Street facing east.

LANDAU ASSOCIATES	Capitol Boulevard Phase 1 Improvements Tumwater, Washington	**Selected Site Photographs**

Figure
B-3

Appendix C – Traffic Data

Projected 2022 AM Peak Hour Link Volumes
Without Project

Projected 2022 AM Peak Hour Link Volumes
With Project

Projected 2022 PM Peak Hour Link Volumes
Without Project

Projected 2022 PM Peak Hour Link Volumes
With Project

Projected 2040 AM Peak Hour Link Volumes
Without Project

Projected 2040 AM Peak Hour Link Volumes
With Project

Projected 2040 PM Peak Hour Link Volumes
Without Project

Projected 2040 PM Peak Hour Link Volumes
With Project

AM Peak Hour Truck Percentages

2040

	NB	SB
North of Trosper		
Existing 2014	**3,835**	**4,055**
2040 Baseline	**6,585**	**6,410**
2040 Ruby Ramps	**6,650**	**6,409**
South of Trosper		
Existing 2014	**3,116**	**3,396**
2040 Baseline	**5,174**	**5,365**
2040 Ruby Ramps	**5,207**	**5,338**
Between Trosper		
Existing 2014	**2,865**	**2,891**
2040 Baseline	**4,776**	**4,565**
2040 Ruby Ramps	**4,875**	**4,546**

2022

	NB	SB
North of Trosper		
Existing 2014	**3,835**	**4,055**
2022 Baseline	**4,800**	**4,780**
2022 Ruby Ramps	**4,917**	**4,797**
South of Trosper		
2022 Baseline	**3,750**	**4,001**
2022 Ruby Ramps	**3,897**	**3,991**
Between Trosper		
2022 Baseline	**3,454**	**3,406**
2022 Ruby Ramps	**3,709**	**3,412**

PM Peak Hour Truck Percentages

Table C-1
Noise Validation Traffic Data
Capitol Boulevard/Trosper Road Intersection Improvements
Tumwater, Washington

V-1 (Thompson Furniture)

Capitol Blvd NB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	278	1,112	40
Medium Truck	7	28	40
Heavy Truck		0	
Buses	3	12	40
Motorcycle		0	

Capitol Blvd SB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	211	844	40
Medium Truck	6	24	40
Heavy Truck	1	4	40
Buses	1	4	40
Motorcycle		0	

I-5 NB south of offramp

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	602	2,408	60
Medium Truck	30	120	60
Heavy Truck	98	392	60
Buses	2	8	60
Motorcycle	0	0	

I-5 SB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	532	2,128	60
Medium Truck	20	80	60
Heavy Truck	107	428	60
Buses	4	16	60
Motorcycle		0	

I-5 NB north of offramp

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	533	2,132	60
Medium Truck	27	108	60
Heavy Truck	98	392	60
Buses	2	8	60
Motorcycle		0	

I-5 NB Offramp

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	69	276	30
Medium Truck	3	12	30
Heavy Truck		0	
Buses		0	
Motorcycle		0	

I-5 NB Onramp

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	145	580	20
Medium Truck	1	4	20
Heavy Truck		0	
Buses		0	
Motorcycle		0	

Trosper EB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	208	832	25
Medium Truck	3	12	25
Heavy Truck	2	8	25
Buses		0	
Motorcycle		0	

Trosper WB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	174	696	25
Medium Truck	3	12	25
Heavy Truck	3	12	25
Buses	1	4	25
Motorcycle		0	

Table C-1
Noise Validation Traffic Data
Capitol Boulevard/Trosper Road Intersection Improvements
Tumwater, Washington

V-2 (Motel 6)

Lee Street EB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	50	200	25
Medium Truck	2	8	25
Heavy Truck		0	
Buses		0	
Motorcycle		0	

Lee Street WB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	48	192	25
Medium Truck	2	8	25
Heavy Truck		0	
Buses		0	
Motorcycle		0	

I-5 NB south of offramp

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	327	1,308	60
Medium Truck	38	152	60
Heavy Truck	69	276	60
Buses	2	8	60
Motorcycle	0	0	60

I-5 SB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	515	2,060	60
Medium Truck	25	100	60
Heavy Truck	123	492	60
Buses		0	
Motorcycle		0	

I-5 NB north of offramp

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	263	1,052	60
Medium Truck	37	148	60
Heavy Truck	69	276	60
Buses	2	8	60
Motorcycle	0	0	60

I-5 NB Offramp

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	64	256	30
Medium Truck	1	4	30
Heavy Truck		0	
Buses		0	
Motorcycle		0	

I-5 NB Onramp

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	154	616	20
Medium Truck	6	24	20
Heavy Truck		0	
Buses		0	
Motorcycle	1	4	20

Capitol Blvd NB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	244	976	40
Medium Truck	4	16	40
Heavy Truck	1	4	40
Buses	1	4	40
Motorcycle		0	

Capitol Blvd SB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	265	1,060	40
Medium Truck	4	16	40
Heavy Truck		0	
Buses	1	4	40
Motorcycle	2	8	40

Table C-1
Noise Validation Traffic Data
Capitol Boulevard/Trosper Road Intersection Improvements
Tumwater, Washington

V-3 (130 Linda St)

Capitol Blvd NB, south of Trosper

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	217	868	40
Medium Truck	7	28	40
Heavy Truck		0	
Buses	1	4	40
Motorcycle	1	4	40

Capitol Blvd SB south of Trosper

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	240	960	40
Medium Truck	7	28	40
Heavy Truck		0	
Buses	1	4	40
Motorcycle		0	

Capitol Blvd NB, north of Trosper

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	159	636	40
Medium Truck	1	4	40
Heavy Truck		0	
Buses	1	4	40
Motorcycle	2	8	40

Capitol Blvd SB north of Trosper

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	114	456	40
Medium Truck	2	8	40
Heavy Truck		0	
Buses	1	4	40
Motorcycle		0	

I-5 NB south of offram

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	398	1,592	60
Medium Truck	17	68	60
Heavy Truck	90	360	60
Buses	0	0	60
Motorcycle	0	0	60

I-5 SB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	622	2,488	60
Medium Truck	28	112	60
Heavy Truck	100	400	60
Buses	1	4	60
Motorcycle	3	12	60

I-5 NB north of offramp

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	326	1,304	60
Medium Truck	16	64	60
Heavy Truck	89	356	60
Buses	0	0	60
Motorcycle	0	0	60

I-5 NB Offramp

Vehicle Type	15-min count	Veh/hr	Speed (mph)	OK
Auto	72	288	30	
Medium Truck	1	4	30	
Heavy Truck	1	4	30	
Buses		0		
Motorcycle		0		

I-5 NB Onramp

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	185	740	20
Medium Truck	4	16	20
Heavy Truck	2	8	20
Buses	1	4	20
Motorcycle	1	4	20

Table C-1
Noise Validation Traffic Data
Capitol Boulevard/Trosper Road Intersection Improvements
Tumwater, Washington

Trosper EB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	233	932	25
Medium Truck	2	8	25
Heavy Truck	1	4	25
Buses		0	
Motorcycle	1	4	25

Trosper WB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	167	668	25
Medium Truck	3	12	25
Heavy Truck		0	
Buses		0	
Motorcycle		0	

Linda Street EB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	10	40	25
Medium Truck		0	
Heavy Truck		0	
Buses		0	
Motorcycle		0	

Linda Street WB

Vehicle Type	15-min count	Veh/hr	Speed (mph)
Auto	11	44	25
Medium Truck		0	
Heavy Truck		0	
Buses		0	
Motorcycle		0	

Table C-2
2022 Existing Conditions Traffic
Capitol Boulevard/Trosper Road Intersection Improvements
Tumwater, Washington

2022 EXISTING CONDITIONS TRAFFIC (PM PEAK HOUR)

Trosper Road EB - Capitol to I-5 Ramps			**Trosper Road WB - Capitol to I-5 Ramps**		
Total Volume =	1,070		**Total Volume =**	1,420	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	1,055	25	Auto	1,398	25
Medium Truck	11	25	Medium Truck	12	25
Heavy Truck	0	0	Heavy Truck	2	25
Buses	1	25	Buses	3	25
Motorcycle	3	25	Motorcycle	5	25

Trosper Road EB - West of I-5 Ramps			**Trosper Road WB - West of I5 Ramps**		
Total Volume =	1,580		**Total Volume =**	895	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	1,558	25	Auto	880	25
Medium Truck	13	25	Medium Truck	9	25
Heavy Truck	3	25	Heavy Truck	0	0
Buses	2	25	Buses	1	25
Motorcycle	4	25	Motorcycle	5	25

Ramp - S Cloverleaf from Trosper EB to I-5 N			**Ramp - NB from I-5 to Trosper EB**		
Total Volume =	620		**Total Volume =**	295	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	609	20	Auto	291	30
Medium Truck	4	20	Medium Truck	2	30
Heavy Truck	2	20	Heavy Truck	1	30
Buses	2	20	Buses	0	0
Motorcycle	3	20	Motorcycle	1	30

I-5 NB S of Offramp			**I-5 NB N of Offramp**		
Total Volume =	3,750		**Total Volume =**	3,454	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	2,726	60	Auto	2,556	60
Medium Truck	161	60	Medium Truck	138	60
Heavy Truck	863	60	Heavy Truck	760	60
Buses	0	60	Buses	0	60
Motorcycle	0	60	Motorcycle	0	60

Table C-2
2022 Existing Conditions Traffic
Capitol Boulevard/Trosper Road Intersection Improvements
Tumwater, Washington

2022 EXISTING CONDITIONS TRAFFIC (PM PEAK HOUR)

Capitol Blvd SB - North of Trosper			**Capitol Blvd NB - North of Trosper**		
Total Volume =	975		**Total Volume =**	1,050	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	954	35	Auto	1,033	35
Medium Truck	7	35	Medium Truck	5	35
Heavy Truck	3	35	Heavy Truck	6	35
Buses	6	35	Buses	5	35
Motorcycle	5	35	Motorcycle	2	35

Capitol Blvd SB - Trosper to Lee			**Capitol Blvd NB - Lee to Trosper**		
Total Volume =	1,265		**Total Volume =**	1,600	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	1,241	35	Auto	1,577	35
Medium Truck	9	35	Medium Truck	7	35
Heavy Truck	4	35	Heavy Truck	9	35
Buses	6	35	Buses	5	35
Motorcycle	5	35	Motorcycle	2	35

Capitol Blvd SB - South of Lee			**Capitol Blvd NB - South of Lee**		
Total Volume =	1,025		**Total Volume =**	1,260	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	1,004	35	Auto	1,240	35
Medium Truck	7	35	Medium Truck	5	35
Heavy Truck	3	35	Heavy Truck	7	35
Buses	6	35	Buses	5	35
Motorcycle	5	35	Motorcycle	2	35

Ramp - From Trosper WB to I-5N		
Total Volume =	730	
Vehicle Type	Veh/hr	Speed (mph)
Auto	701	20
Medium Truck	15	20
Heavy Truck	7	20
Buses	4	20
Motorcycle	4	20

I-5 SB		
Total Volume =	4,780	
Vehicle Type	Veh/hr	Speed (mph)
Auto	3,494	60
Medium Truck	215	60
Heavy Truck	765	60
Buses	76	60
Motorcycle	229	60

Table C-2
2022 Existing Conditions Traffic
Capitol Boulevard/Trosper Road Intersection Improvements
Tumwater, Washington

2022 EXISTING CONDITIONS TRAFFIC (AM PEAK HOUR)

Lee St EB - West of Capitol			**Lee Street WB - West of Capitol**		
Total Volume =	190		**Total Volume =**	355	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	180	25	Auto	340	25
Medium Truck	8	25	Medium Truck	14	25
Heavy Truck	0	0	Heavy Truck	0	0
Buses	0	0	Buses	0	0
Motorcycle	2	25	Motorcycle	1	25

Table C-3
2040 No-Building Traffic
Capitol Boulevard/Trosper Road Intersection Improvements
Tumwater, Washington

2040 NO BUILD TRAFFIC (PM PEAK HOUR)

Trosper Road EB - Capitol to I-5 Ramps			**Trosper Road WB - Capitol to I-5 Ramps**		
Total Volume =	1,440		**Total Volume =**	1,910	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	1,422	25	Auto	1,883	25
Medium Truck	14	25	Medium Truck	16	25
Heavy Truck	0	0	Heavy Truck	3	25
Buses	1	25	Buses	3	25
Motorcycle	3	25	Motorcycle	5	25

Trosper Road EB - West of I-5 Ramps			**Trosper Road WB - West of I5 Ramps**		
Total Volume =	2,125		**Total Volume =**	1,205	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	2,098	25	Auto	1,187	25
Medium Truck	17	25	Medium Truck	12	25
Heavy Truck	4	25	Heavy Truck	0	0
Buses	2	25	Buses	1	25
Motorcycle	4	25	Motorcycle	5	25

Ramp - S Cloverleaf from Trosper EB to I-5 N			**Ramp - NB from I-5 to Trosper EB**		
Total Volume =	830		**Total Volume =**	400	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	817	20	Auto	395	30
Medium Truck	6	20	Medium Truck	3	30
Heavy Truck	2	20	Heavy Truck	1	30
Buses	2	20	Buses	0	0
Motorcycle	3	20	Motorcycle	1	30

I-5 NB S of Offramp			**I-5 NB N of Offramp**		
Total Volume =	5,174		**Total Volume =**	4,776	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	3,761	60	Auto	3,534	60
Medium Truck	222	60	Medium Truck	191	60
Heavy Truck	1,190	60	Heavy Truck	1,051	60
Buses	0	0	Buses	0	0
Motorcycle	0	0	Motorcycle	0	0

Table C-3
2040 No-Building Traffic
Capitol Boulevard/Trosper Road Intersection Improvements
Tumwater, Washington

2040 NO BUILD TRAFFIC (PM PEAK HOUR)

Capitol Blvd SB - North of Trosper			**Capitol Blvd NB - North of Trosper**		
Total Volume =	1,310		**Total Volume =**	1,410	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	1,286	35	Auto	1,389	35
Medium Truck	9	35	Medium Truck	6	35
Heavy Truck	4	35	Heavy Truck	8	35
Buses	6	35	Buses	5	35
Motorcycle	5	35	Motorcycle	2	35

Capitol Blvd SB - Trosper to Lee			**Capitol Blvd NB - Lee to Trosper**		
Total Volume =	1,665		**Total Volume =**	1,995	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	1,637	35	Auto	1,968	35
Medium Truck	12	35	Medium Truck	9	35
Heavy Truck	5	35	Heavy Truck	11	35
Buses	6	35	Buses	5	35
Motorcycle	5	35	Motorcycle	2	35

Capitol Blvd SB - South of Lee			**Capitol Blvd NB - South of Lee**		
Total Volume =	1,375		**Total Volume =**	1,695	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	1,350	35	Auto	1,671	35
Medium Truck	10	35	Medium Truck	7	35
Heavy Truck	4	35	Heavy Truck	10	35
Buses	6	35	Buses	5	35
Motorcycle	5	35	Motorcycle	2	35

Ramp - From Trosper WB to I-5N		
Total Volume =	980	
Vehicle Type	Veh/hr	Speed (mph)
Auto	941	20
Medium Truck	20	20
Heavy Truck	10	20
Buses	5	20
Motorcycle	5	20

I-5 SB		
Total Volume =	6,410	
Vehicle Type	Veh/hr	Speed (mph)
Auto	4,686	60
Medium Truck	288	60
Heavy Truck	1,026	60
Buses	103	60
Motorcycle	308	60

Table C-3
2040 No-Building Traffic
Capitol Boulevard/Trosper Road Intersection Improvements
Tumwater, Washington

2040 NO BUILD TRAFFIC (AM PEAK HOUR)

Lee St EB - West of Capitol			**Lee Street WB - West of Capitol**		
Total Volume =	255		**Total Volume =**	480	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	242	25	Auto	460	25
Medium Truck	10	25	Medium Truck	19	25
Heavy Truck	0	0	Heavy Truck	0	0
Buses	1	25	Buses	0	0
Motorcycle	2	25	Motorcycle	1	25

Table C-4
2040 Build Traffic
Capitol Boulevard/Trosper Road Intersection Improvements
Tumwater, Washington

2040 BUILD TRAFFIC (PM PEAK HOUR)

Trosper Road EB - East of Capitol			**Trosper Road WB - East of Capitol**		
Total Volume =	150		**Total Volume =**	365	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	150	25	Auto	365	25
Medium Truck	0	0	Medium Truck	0	0
Heavy Truck	0	0	Heavy Truck	0	0
Buses	0	0	Buses	0	0
Motorcycle	0	0	Motorcycle	0	0

Trosper Road EB - Capitol to I-5 Ramps			**Trosper Road WB - Capitol to I-5 Ramps**		
Total Volume =	1,285		**Total Volume =**	1,430	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	1,268	25	Auto	1,408	25
Medium Truck	13	25	Medium Truck	12	25
Heavy Truck	0	25	Heavy Truck	2	25
Buses	1	25	Buses	3	25
Motorcycle	3	25	Motorcycle	5	25

Trosper Road EB - West of I-5 Ramps			**Trosper Road WB - West of I-5 Ramps**		
Total Volume =	2,175		**Total Volume =**	1,105	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	2,147	25	Auto	1,088	25
Medium Truck	17	25	Medium Truck	11	25
Heavy Truck	4	25	Heavy Truck	0	25
Buses	2	25	Buses	1	25
Motorcycle	4	25	Motorcycle	5	25

6th Ave SB S of Trosper			**6th Ave NB - N of Round**		
Total Volume =	1,060		**Total Volume =**	300	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	1,044	25	Auto	296	25
Medium Truck	8	25	Medium Truck	2	25
Heavy Truck	3	25	Heavy Truck	1	25
Buses	2	25	Buses	0	0
Motorcycle	3	25	Motorcycle	1	25

Table C-4
2040 Build Traffic
Capitol Boulevard/Trosper Road Intersection Improvements
Tumwater, Washington

2040 BUILD TRAFFIC (PM PEAK HOUR)

6th Ave SB - from circle to Lee			**6th Ave NB - S of round**		
Total Volume =	410		**Total Volume =**	620	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	401	25	Auto	613	25
Medium Truck	3	25	Medium Truck	5	25
Heavy Truck	1	25	Heavy Truck	1	25
Buses	2	25	Buses	0	25
Motorcycle	3	25	Motorcycle	1	25

I-5 NB onramp from 6th Ave			**I-5 NB Offramp to 6th Ave**		
Total Volume =	1,305		**Total Volume =**	330	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	1,287	20	Auto	326	30
Medium Truck	9	20	Medium Truck	3	30
Heavy Truck	4	20	Heavy Truck	1	30
Buses	2	20	Buses	0	0
Motorcycle	3	20	Motorcycle	1	30

I-5 NB S of Offramp			**I-5 NB N of Offramp**		
Total Volume =	5,207		**Total Volume =**	4,875	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	3,785	60	Auto	3,608	60
Medium Truck	224	60	Medium Truck	195	60
Heavy Truck	1,198	60	Heavy Truck	1,073	60
Buses	0	0	Buses	0	0
Motorcycle	0	0	Motorcycle	0	0

Capitol Blvd SB - North of Trosper			**Capitol Blvd NB - North of Trosper**		
Total Volume =	1,335		**Total Volume =**	1,385	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	1,311	35	Auto	1,364	35
Medium Truck	10	35	Medium Truck	6	35
Heavy Truck	4	35	Heavy Truck	8	35
Buses	6	35	Buses	5	35
Motorcycle	5	35	Motorcycle	2	35

Table C-4
2040 Build Traffic
Capitol Boulevard/Trosper Road Intersection Improvements
Tumwater, Washington

2040 BUILD TRAFFIC (PM PEAK HOUR)

Capitol Blvd SB - Trosper to Lee			**Capitol Blvd NB - Lee to Trosper**		
Total Volume =	1,455		**Total Volume =**	1,540	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	1,429	35	Auto	1,518	35
Medium Truck	10	35	Medium Truck	7	35
Heavy Truck	4	35	Heavy Truck	9	35
Buses	6	35	Buses	5	35
Motorcycle	5	35	Motorcycle	2	35

Capitol Blvd SB - South of Lee			**Capitol Blvd NB - South of Lee**		
Total Volume =	1,405		**Total Volume =**	1,725	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	1,380	35	Auto	1,701	35
Medium Truck	10	35	Medium Truck	7	35
Heavy Truck	4	35	Heavy Truck	10	35
Buses	6	35	Buses	5	35
Motorcycle	5	35	Motorcycle	2	35

Ramp - From Trosper WB to I-5N		
Total Volume =	470	
Vehicle Type	Veh/hr	Speed (mph)
Auto	451	25
Medium Truck	9	25
Heavy Truck	5	25
Buses	2	25
Motorcycle	2	25

I-5 SB		
Total Volume =	6,409	
Vehicle Type	Veh/hr	Speed (mph)
Auto	5,095	60
Medium Truck	288	60
Heavy Truck	1,025	60
Buses	0	0
Motorcycle	0	0

Table C-4
2040 Build Traffic
Capitol Boulevard/Trosper Road Intersection Improvements
Tumwater, Washington

2040 BUILD TRAFFIC (AM PEAK HOUR)

Lee St EB - Capitol to 6th			**Lee Street WB - Capitol to 6th**		
Total Volume =	325		**Total Volume =**	575	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	309	25	Auto	551	25
Medium Truck	13	25	Medium Truck	23	25
Heavy Truck	0	0	Heavy Truck	0	0
Buses	1	25	Buses	0	0
Motorcycle	2	25	Motorcycle	1	25

Lee St EB - West of 6th			**Lee Street WB - West of 6th**		
Total Volume =	140		**Total Volume =**	190	
Vehicle Type	Veh/hr	Speed (mph)	Vehicle Type	Veh/hr	Speed (mph)
Auto	132	25	Auto	181	25
Medium Truck	6	25	Medium Truck	8	25
Heavy Truck	0	0	Heavy Truck	0	0
Buses	0	0	Buses	0	0
Motorcycle	2	25	Motorcycle	1	25

Appendix D – Traffic Noise Model Data
(Provided Electronically)