Table 5. Summary of Noise Analysis Results for Design Year (2020)

Freeway Segment	Measured Background (dBA)	Roadway Type	Distance to 66-dBA Contour Meters (feet)	Distance to 10-dBA Substantial Increase Meters (feet)	Number of Affected Buildings		
					> 66 dBA	Between 66 dBA and Substantial Increase	Total
8C (Shady Slope neighborhood)	53						
Impacts from NSC main line		At grade roadway with elevated receivers					
Impacts from NSC-US2RAMP		Below grade on east end; above grade at west end					
Total receivers affected by combined two roadways			90 (300)	240 (800)	0	5	5
8C (southwest side) Shady Slope Road to US 2	51	At grade, with natural shielding by overpass embankment	45 (150)	180 (600)	0	1	1
8C (northeast side) US 2 to Farwell Road	51	Elevated roadway on embankment ramp	90 (300)	210 (700)	0	1	1
8C (southwest side) US 2 to Farwell Road	54	Elevated roadway on embankment ramp	180 (600)	270 (900)	0	1 (church)	1

3.2 Sub-Segment 8C (Southwest Side of NSC; Shady Slope Road to Farwell Road)

As shown in Figure 2, a residential development is between the school and the NSC alignment. However, most of the development will be effectively shielded from freeway noise by the embankments for the Shady Slope Road overpass. Much of the noise impact at this neighborhood is expected to be caused by the elevated section of the NSC overpass on the south side of US 2.

3.3 Sub-Segment 8C (Northeast side of NSC; US 2 to Farwell Road)

As shown in Figure 1, there are few homes east of the NSC alignment between US 2 and Farwell Road. They could be affected by noise from the elevated section of the NSC overpass on the south side of US 2, and by the connecting ramp between NSC and US 2. Most of the connecting ramp is in a depressed roadway, 20 feet below grade where it passes near existing homes and businesses. One home is affected, mostly by noise from the elevated section of the NSC on the south side of US 2.

4 NOISE ABATEMENT MEASURES

4.1 Noise Abatement Criteria

The following is a discussion of methods to abate operational traffic noise impacts identified in the previous section. According to the Code of Federal Regulation (23 CFR Chapter 1, Part 772), the following noise abatement measures may be evaluated and incorporated into this project to reduce traffic noise impacts:

- traffic management measures;
- alteration of horizontal and vertical alignments;
- construction of noise barriers;
- acquisition of real property or interests therein to serve as a buffer zone to preempt development which would be adversely affected by traffic; and
- installation of noise insulation in public use or nonprofit institutional structures.

It is WSDOT's policy to make final decisions on the construction of noise barriers (including the type of material to be used for construction of the barrier) after final horizontal and vertical alignments are determined and a detailed engineering analysis of the feasibility and reasonability of noise abatement measures can be made.

This section focuses on the consideration of noise barriers as a primary means of abating project-related noise impacts. A number of factors are used to determine whether noise abatement measures are reasonable and feasible as a means of abating noise impacts. These factors include:

- noise abatement benefits;
- cost of abatement;
- views of affected residents;
- absolute sound levels;
- changes in noise levels;
- development along the highway; and
- environmental effects of abatement construction.

4.1.1 Feasibility

For a noise barrier to be considered feasible, it must be constructable and provide a minimum of 5-dBA reduction for the first row of receivers with at least one receiver having a 7-dBA reduction. Reasonable efforts must also be made to attain a 10-dBA or greater reduction in sound levels at the first row of receivers.

4.1.2 Reasonableness

Once the construction of a noise barrier has been determined feasible, WSDOT will then determine whether construction of the barrier is reasonable by thoroughly considering a wide range of criteria, such as:

- whether noise levels in the design year approach or exceed the noise abatement criteria in Table 2 or qualify as a substantial increase over existing noise levels;

- whether a majority of the first row of receivers obtain a minimum 5-dBA benefit from the sound wall with at least one receiver attaining a 7-dBA reduction;

- whether the noise mitigation cost per residence is at or less than that indicated in Table 6; this is determined by counting all residences benefited by the noise barrier and dividing that number into the total cost of the noise abatement measure; and

- determining the most suitable material for construction of the noise barrier depending on location of barrier and availability of right-of-way for construction of barrier (e.g., earth berms can be effective noise abatement measures in those locations where sufficient right-of-way exists for construction).

Table 6. Allowance for Abatement of Impacts Caused by Total Traffic Noise Level

Design Year Traffic Noise Decibel Level	Allowed Cost Per Household*	Equivalent Sound Wall Surface Area Per Household Square Meters (Square Feet)
66 dBA	$15,500	65.0 (700)
67 dBA	$17,000	71.5 (770)
68 dBA	$18,500	77.7 (836)
69 dBA	$20,000	84.0 (904)
70 dBA	$21,500	90.5 (974)
71 dBA	$23,000	96.7 (1,041)
72 dBA	$24,500	103.0 (1,109)
73 dBA	$26,000	109.2 (1,175)
74 dBA	$27,500	115.5 (1,243)

* Reevaluated in January of each year. Based on $22.10 per square foot constructed cost of concrete sound wall.

Source: Washington State Department of Transportation 1999.

4.2 Noise Abatement at the NSC-US 2 Interchange

This section summarizes the noise abatement analysis for all areas potentially affected by project-related noise. For each segment of the proposed interchange, noise barriers were evaluated for various heights between 2 meters (6.6 feet) and 4.9 meters (16 feet). Within each segment, each barrier height was evaluated against WSDOT's feasibility criteria to determine if the noise barrier provided the minimum 5-dBA benefit with at least one receiver attaining a 7-dBA reduction. For those barrier heights that met the WSDOT feasibility criteria, a reasonableness determination was then made based on the estimated cost of a concrete sound wall using cost criteria provided by WSDOT and the number of benefiting residences (the number of residences within 152 meters [approximately 500 feet] of the right-of-way receiving at least a 3-dBA reduction in noise levels as a result of the barrier). If a concrete sound wall was determined to be both feasible and reasonable, then additional barrier heights were evaluated up to a maximum height of 4.9 meters (16 feet) to determine if a 10-dBA insertion loss could be attained at the first row of receivers.

As noted above, a final decision on noise barrier location and material type will be made by WSDOT after final horizontal and vertical alignments have been determined.

Table 7 summarizes noise abatement measures for the proposed project. For each segment of the alignment discussed below, sound walls of various heights were evaluated to determine if the barrier would meet the WSDOT feasibility and reasonableness criteria by providing a minimum 5-dBA noise benefit to the first row of receivers with at least one receiver in the first row of residences attaining at least a 7-dBA reduction.