Traffic Noise Abatement

Traffic Noise Abatement - Background

Noise abatement is considered only where there is an expected noise level of 66 dBA or higher in the design year Build scenario or an increase of 10 dBA over existing conditions for Exhibit 5 land use categories A, B, C, D and E. If such a situation exists, abatement is considered only where frequent human use occurs and where a lower noise level would have benefits (U.S. DOT, 1982). Noise levels can be reduced by the following types of abatement: (1) traffic management, such as restrictions on the types of vehicles and the time they may use a certain roadway; (2) change in vertical or horizontal alignment of the roadway; (3) acquisition of property; and (4) construction of noise barriers, such as noise walls.

Abatement was considered for this project's traffic noise impacts. Some of the modeled noise levels approach or exceed the WSDOT and FHWA NAC levels. Increases were modeled between the existing and Build conditions.

Abatement must be both feasible and reasonable for it to be recommended.

Feasibility

Feasibility is a combination of acoustic and engineering considerations. All of the following must occur for abatement (e.g., noise barrier) to be considered feasible.

- Abatement must be physically constructible.
- The majority first row impacted receivers must obtain a minimum 5 dBA of noise reduction as a result of abatement (insertion loss); assuring that every reasonable effort will be made to assess outdoor use areas as appropriate.

For this project, noise barriers were evaluated at two locations to determine whether abatement could sufficiently reduce traffic noise levels. The two locations were found to be feasible. At these locations, where noise walls were found to be feasible, barriers of up to 14 feet hieght will reduce traffic noise level by at least 5 dBA for a majority of the first row residents in the noise study area. (See Exhibits 15 and 16).

Noise wall 1 along the proposed alignment to protect the properties shown in Exhibit 17 was found feasible. At this location, an average of 11 foot wall was able to reduce traffic noise level by at least 5 dBA for the majority of the first row residens. Noise wall 1 appears to be physically constructible. Once this wall is found reasonable, verification of constructability will be confirmed.

Exhibit 15: Feasibility Analysis for 8-14 foot Wall 1

Site and Land Use Category	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	1st Row?	Min. Design Goal: Insertion Loss (dBA)	Min. Design Goal: % 1st Row ≥ 5 dBA
R1 (B)	71.20	71.7	Yes	3.0	
R2- M1 (B)	72.60	73.0	Yes	6.0	
R3-M2 (B)	66.40	67.4	No	2.8	
R4-M3 (B)	71.40	72.1	Yes	7.5	
R5 (B)	71.70	72.8	Yes	9.5	
R6-M4 (B)	63.9	72.8	No	6.3	
R7-M5 (B)	71.70	65.9	Yes	8.9	
R8 (B)	67.60	72.4	No	6.8	
R9-M6 (B)	65.2	69.1	No	6.2	
R10 (B)	70.10	66.0	Yes	7.3	
R11 (B)	69.20	71.3	Yes	6.3	67 %
R12 (B)	64.1	70.1	No	5.7	
R13 (B)	68.60	65.0	Yes	6.0	
R14 (B)	65.0	69.1	Yes	0.1	
R15 (B)	62.2	65.6	Yes	4.2	
R16 (B)	68.70	63.2	Yes	4.4	
R17-M9 (B)	68.60	69.1	No	6.2	
R18 (B)	65.60	69.1	No	5.4	
R19 (B)	67.10	66.0	Yes	6.3	
R20	65.0	68.3	No	4.7	

References

1. U.S. Department of Transportation, Federal Highway Administration directive "Highway Traffic Noise: Analysis and Abatement," Revised December 2010.
2. U.S. Department of Transportation, Federal Highway Administration "Highway Traffic Noise: Analysis and Abatement Guidance," Revised December 2010.
3. United States Code of Federal Regulations (CFR) Part 772 (23 CFR Part 772), July 2010
4. U.S. Department of Transportation, Federal Highway Administration, 1996. *Measurement of Highway-Related Noise*. Washington D.C.
5. U.S. Department of Transportation, Federal Highway Administration, 1998. *FHWA Traffic Noise Model User's Guide*. Washington D.C.
6. U.S. Department of Transportation, Federal Transit Administration, 1995. *Transit Noise and Vibration Impact Assessment*. Washington D.C.
7. U.S. Environmental Protection Agency, 1971. Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances. Washington, D.C.
8. 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.
9. Washington Administrative Code, 1989. Chapter 173-60. *Maximum Environnemental Noise Levels*. Olympia, Washington.
10. Washington State Department of Transportation, July 2011. Traffic Noise Policy and Procedures. Olympia, Washington.
11. Traffic Noise Analysis Technical Report, SR 167 – 8th Street E Vic to S277th Street Vic. Southbound HOT Lane, SR 167 – 8th Street E Vic. to 15th Street SW Vic Northbound HOT Lane. August 2008.

Site and Land Use Category	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	1st Row?	Min. Design Goal: Insertion Loss (dBA)	Min. Design Goal: % 1st Row ≥ 5 dBA
(B)					
R21 (B)	64.0	66.1	No	5.1	
R22 (B)	62.2	64.8	No	5.3	
R23 (B)	63.0	63.4	Yes	4.5	
R24 (B)	61.5	66.9	No	2.1	
R56 (B)	63.9	63.0	Yes	4.7	
R62 (B)	64.6	65.4	No	4.7	
R64 (B)	65.6	65.8	Yes	4.8	100%
R65 (B)	65.2	66.7	Yes	5.5	
R67 (B)	66.1	65.9	Yes	5.5	
R68 (B)	67.3	71.7	Yes	6.0	
R69 (B)	62.8	73.0	No	5.9	
R71 (B)	67.7	68.0	Yes	6.0	
R72 (B)	65.3	66.2	No	6.1	
R74 (B)	66.1	66.9	No	4.2	
R75 (B)	65.0	65.9	No	4.9	
R76 (B)	65.8	66.6	Yes	4.8	
R78 (B)	68.5	69.3	Yes	6.1	
R79 (B)	65.7	66.1	No	5.1	
R80 (B)	69.3	70.1	No	6.3	
R81	67.4	68.0	No	5.7	

Site and Land Use Category	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	1st Row?	Min. Design Goal: Insertion Loss (dBA)	Min. Design Goal: % 1st Row ≥ 5 dBA
(B)					
R82 (B)	66.8	67.3	No	5.4	
R84 (B)	64.3	65.1	No	5.7	
R86 (B)	67.2	68.1	No	5.8	
R88 (B)	70.1	71.3	Yes	6.8	
R89 (B)	69.8	71.2	Yes	6.7	
R90 (B)	68.0	69.0	No	6.1	
R91 (B)	68.4	69.4	No	6.2	
R93 (B)	68.4	69.5	Yes	6.1	100%
R94 (B)	72.0	72.9	Yes	9.1	
R95 (B)	73.1	74.4	Yes	9.5	
R97 (B)	72.1	72.7	Yes	9.2	
R98 (B)	66.6	67.6	No	7.0	
R99 (B)	65.3	66.4	No	6.9	
R100 (B)	71.7	71.6	Yes	8.6	
R101 (B)	66.5	68.4	Yes	7.5	
R102 (B)	67.0	69.2	Yes	7.9	
R103 (B)	68.7	70.6	Yes	8.5	
R104 (B)	70.2	71.6	Yes	9.0	
R105 (B)	68.4	70.5	Yes	8.5	
R106	69.3	71.2	Yes	8.9	

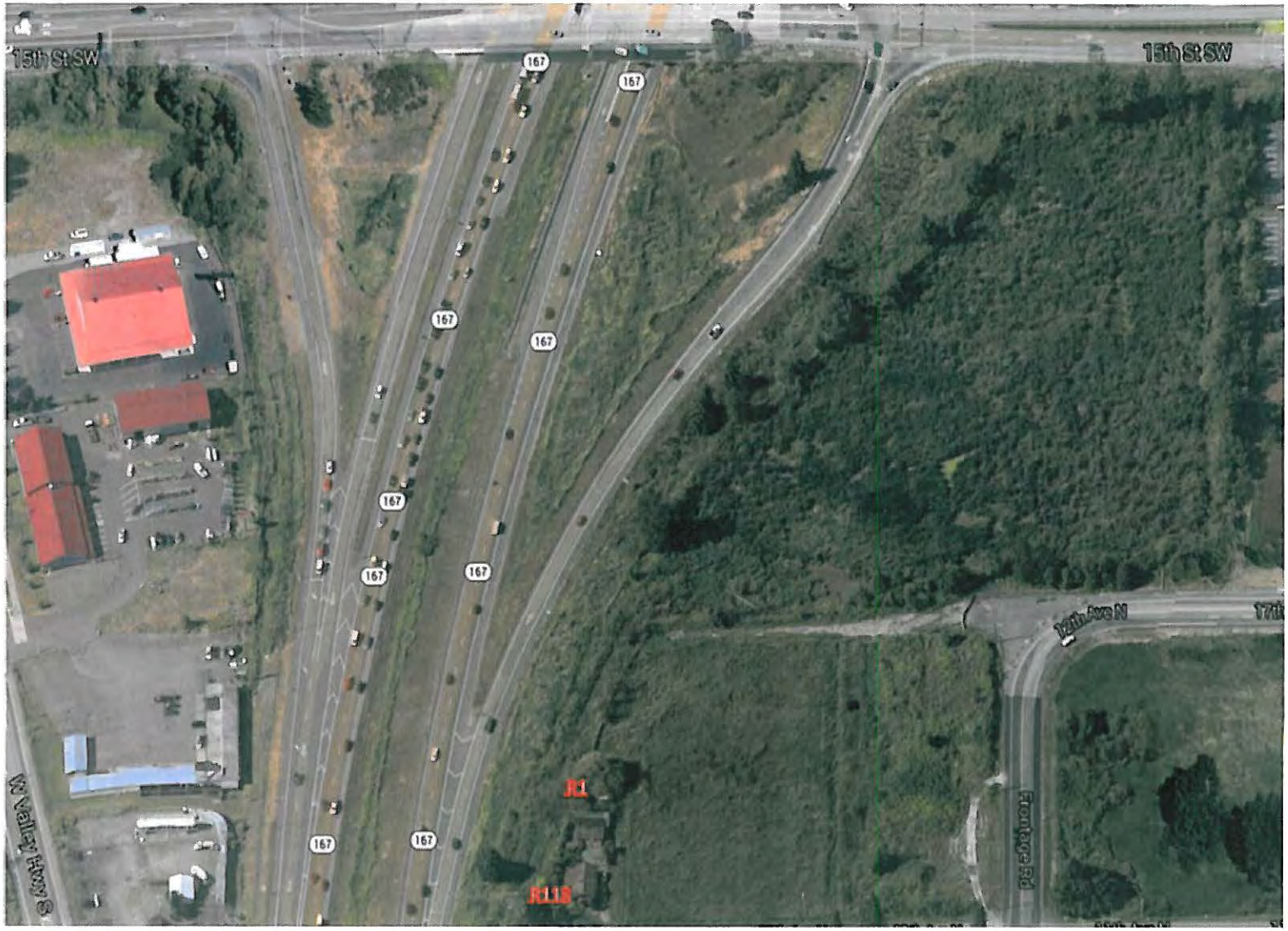
Site and Land Use Category	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	1st Row?	Min. Design Goal: Insertion Loss (dBA)	Min. Design Goal: % 1st Row ≥ 5 dBA
(B)					
R107 (B)	69.9	71.6	Yes	9.0	
R108 (B)	72.2	73.2	Yes	9.6	
R109 (B)	70.5	71.4	Yes	8.4	
R111 (B)	72.4	73.0	Yes	8.7	
R112 (B)	67.4	68.8	Yes	6.7	
R114 (B)	73.3	73.8	Yes	7.0	
R115 (B)	68.9	70.1	No	5.7	
R116 (B)	72.7	73.0	Yes	6.4	100%
R118 (B)	72.0	72.6	Yes	5.0	
R119 (B)	66.7	69.3	No	7.6	
R121 (B)	65.0	67.2	No	6.4	
R122 (B)	65.2	68.0	No	7.6	
R124 (B)	63.6	65.1	No	4.9	
R128 (B)	61.8	63.0	No	3.8	
R133 (B)	65.7	67.3	No	5.6	
R135 (B)	64.5	65.6	No	5.4	
				Feasible?	Yes

Noise wall 2 along the proposed alignment to protect the sensitive receivers listed in Exhibit 16 was found feasible. At this location, an average 12 foot tall wall was able to reduce traffic noise levels by at least 5 dBA for the majority of the first row residens. Noise wall 2 appears to be physically constructible. Once this wall is found reasonable, verification of constructability will be confirmed.

Exhibit 16: Feasibility Analysis for 10-14 foot Wall 2

Site and (Land Use Category)	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	1st Row?	Min Design Goal: Insertion Loss (dBA)	Min Design Goal: % 1st Row ≥ 5 dBA
R32 (B)	61.8	62.7	No	4.5	
R33-M10 (B)	63.7	65.4	Yes	5.9	
R34 (B)	64.7	66.8	Yes	6.5	
R35 (B)	65.0	66.6	Yes	4.5	
R36 (B)	62.9	63.6	No	4.9	
R150 (B)	65.0	66.8	Yes	5.2	
R151 (B)	65.0	66.8	Yes	5.7	80 %
R152 (B)	65..0	66.7	Yes	5.9	
R153 (B)	64.7	66.5	Yes	6.1	
R154 (B)	63.7	64.6	Yes	3.2	
R155 (B)	60.2	62.4	No	3.8	
R157 (B)	59.2	62.3	Yes	2.9	
R158 (B)	65.2	69.2	Yes	7.4	
				Feasible?	Yes

Exhibit 17: Traffic Noise Measurement and Modeling Locations


15th St SW
15th St SW
167
167
167
167
167
167
167
167
167
167
167
R1
R118
W Valley Hwy S
Frontage Rd


R3-M2
R2-M1
R116
R114
R115
R4-M3
R172
R111
R113
R112
11th Ave N
10th Ave N
9th Ave N
W Valley Hwy S
Frontage Rd
Algona Blvd N
167


R109
R110
R108
R113
R5
R6-M4
R107
R106
R105
R104
R103
R112
R102
R101
W Valley Hwy S
Main St
Meeker St
Auburn Blvd N
Broadway Blvd
9th Ave N
8th Ave N
7th Ave N
167


R100
R96
R97
R98
R97-R95
R9-R6
R8
R94
R95
R93
R135
R91
R139
R10
6th Ave N
6th Ave N
6th Av
Frontage Rd
Algona Blvd N
Algona Blvd N
W Valley Hwy S
W Valley Hwy S
W Valley Hwy S
W Valley Hwy S
167
167
167
167
167
167

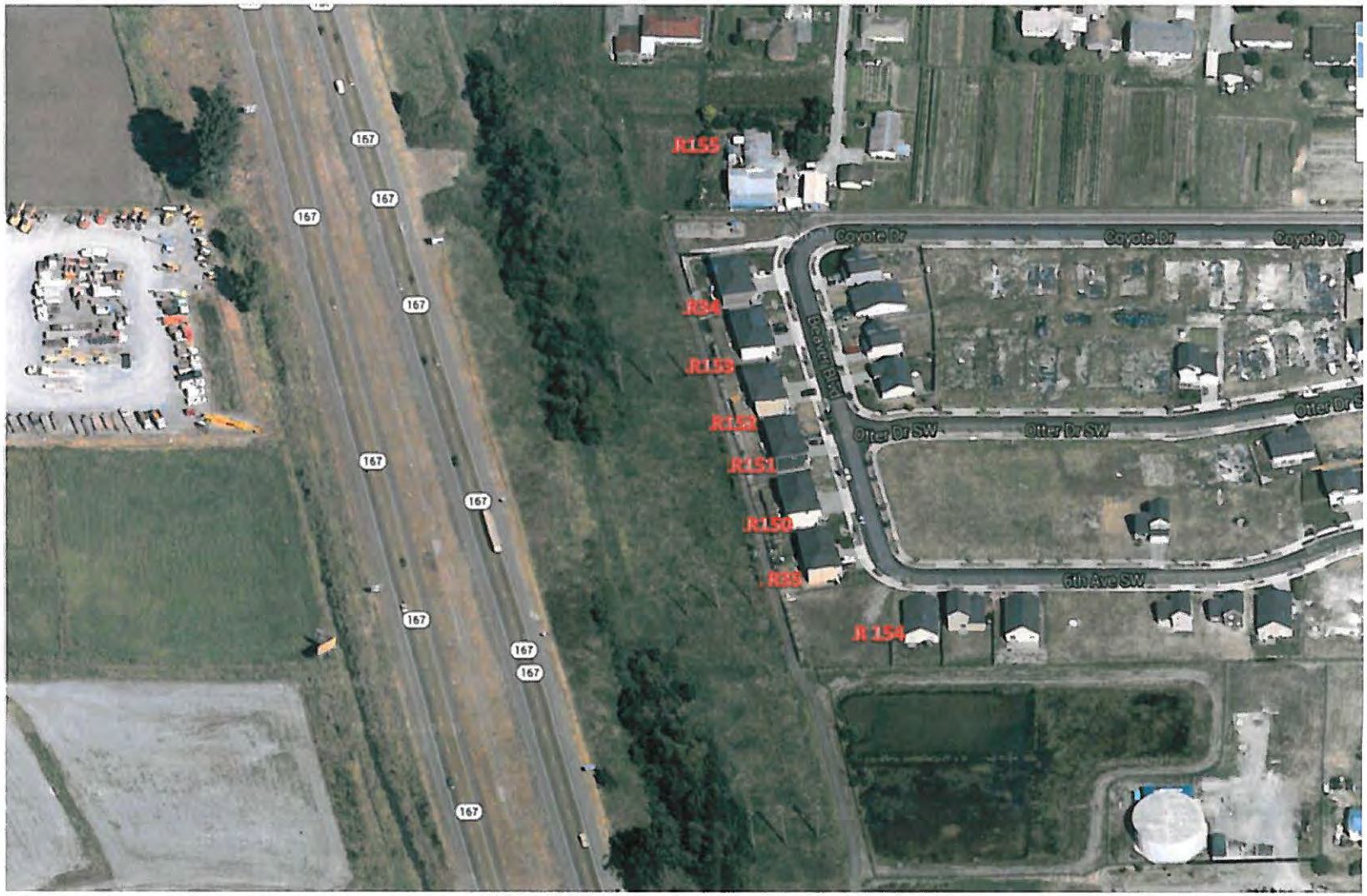

W Valley Hwy S
167
4th Ave N
Alpine Blvd N
3rd Ave N
2nd Ave N
R89
R90
R88
R86
R25
R11
R12
R80
R84
R81
R79
R75
R82
R170
R13
R14
R76


1st Ave N
1st Ave N
1st Ave N
W Valley Hwy S
W Valley Hwy S
W Valley Hwy S
W Valley Hwy S
58th Pl S
58th Pl S
167
167
167
167
R16
R74
R75
R18
R17-MB
2nd Ave S
2nd Ave S
R71
R72
R68
R69
R19
Aljoma Blvd S
Aljoma Blvd S
Aljoma Blvd S
3rd Ave S
3rd Ave S


R67
R65
R64
R21
R22
R20
R27
R62
R124
R58
R128
R23
R24
3rd Ave S
3rd Ave
4th Ave S
4th Ave S
5th Ave S
5th Ave
Agnew Blvd S
Frontage Rd
W Valley Hwy S
S 277th
S 58th
167
167
167


W Valley Hwy S
Frontage Rd S
Interurban Trail
Seattle Blvd S
3rd Ave SW
167
R162
R28
R163
R29
R161


167
Valley Hwy S
R160
R159
R36
R35
4th Ave SW
R158
R157
Tacoma Blvd S
R32
6th Ave SW
R33-M10


R155
R154
R153
R152
R151
R150
R35
Coyote Dr
Coyote Dr
Coyote Dr
Beaver Blvd
Otter Dr SW
Otter Dr SW
6th Ave SW
167
167
167
167
167
167
167
167
167


County Line Rd SE
Division St
167
R 165
Roy Rd SW
R 166

Reasonableness

For both walls reasonableness of abatement was evaluated. Additional noise wall dimensions for these locations were evaluated as part of the reasonableness determination. WSDOT will only allow construction of noise walls if determined reasonable by satisfying the two criteria below.

1. Cost Effectiveness

The cost of noise abatement sufficient to provide at least the minimum feasible noise reductions must be equal to or less than the allowable cost of abatement for each noise wall location analyzed. Based on noise wall costs from 2007-2010, the current average costs for Washington State is $51.61 per ft^2. The cost is applied to the allowed wall surface area (ft^2) to generate the allowable cost per qualified resident described in Exhibit 18.

Either wall square footage or cost can be used to evaluate cost effectiveness, unless costs for the wall will exceed the cost of a standard design noise wall, then cost must be used to compare the wall cost to the allowable cost.

For this project, a standard noise wall design was evaluated and cost is used to describe the cost effectiveness. The allowable cost per receiver, based on Build condition traffic noise level is described in Exhibit 18.

Exhibit 18: Reasonableness Allowances

Column A	Column B	Column C	Column D
Design Year Traffic Sound Decibel Level (dBA)	Noise level increase as a result of the project (dBA)[2]	Allowed Wall Surface Area Per Qualified Residence or Residential Equivalent	Allowed Cost Per Qualified Residence or Residential Equivalent[1]
66		700 Sq Feet	$36,127
67		768 Sq Feet	$39,636
68		836 Sq Feet	$43,146
69		904 Sq Feet	$46,655
70		972 Sq Feet	$50,165
71	10 (substantial, step 1) [3]	1,040 Sq Feet	$53,674
72	11 (substantial, step 1)	1,108 Sq Feet	$57,184
73	12 (substantial, step 1)	1,176 Sq Feet	$60,693
74	13 (substantial, step 1)	1,244 Sq Feet	$64,203
75	14 (substantial, step 1)	1,312 Sq Feet	$67,712
76	15 (substantial, step 2)[4]	1,380 Sq Feet	$71,222

(1) Current costs based on $51.61 per square foot constructed cost developed in 2011.
(2) If the noise level increases 10 dBA or more as the result of the project (Column B), follow the allowed wall surface and cost for the level of increase in Column C in lieu of the total design year sound decibel level in Column A. For total highway related sound levels at 76 or more dBA or the project results in an increase of 15 or more decibels, continue increasing the allowance at the rate provided in the table unless circumstances determined on a case-by case basis require an alternative methodology for determining allowance.
(3) Step 1 is when the noise levels are 10 to 14 dBA over future No Build condition traffic noise as a result of the transportation project.
(4) Step 2 is when the noise levels are 15 or more dBA over existing traffic noise as a result of the transportation project (or total highway related noise levels are between 76 and 79 decibels). Additional consideration for abatement may be considered under these circumstances.

2. Design Goal Achievement

The design goal for abatement on all projects for reasonableness, is at least 7 dBA of reduction for at least one first row receiver. Noise walls cannot be recommended if they do not achieve the design goal. In addition to the design goal requirement, WSDOT makes a reasonable effort to get 10 dBA or greater insertion loss (noise reduction) at the first row of receivers for all projects where abatement is recommended.

Exhibits 19 and 20 describe the allowable cost per receiver and the cost of the minimum wall size to achieve the design goal.

Noise Wall 1 (feasible)

A full-length wall proposed from Ellingson Road to Boundary Road was evaluated to protect the homes on the east side of SR 167. TNM modeling predicts that 67 receivers in this community experience a noise level of 66 dBA in the design year 2036, Build scenario. The major portion of the proposed noise wall was evaluated along the roadway shoulder while a section was evaluated at 18' off the roadway shoulder. Because SR 167 is higher than the residences, a shorter noise wall on the shoulder will be effective in breaking the line-of-sight. An opening in the wall would also be required at the SR 167 overpass of 1st Avenue N because installation of the noise wall along the bridge structure will add significant cost to the overall noise wall due to structure modification. Because this location meets the WSDOT noise abatement criteria of 66 dBA or greater, a noise wall was evaluated at this location. Exhibit 20 shows the areas where noise Wall 1 was evaluated

A noise wall with a height of 10 feet to 14 feet was analyzed at this location to determine WSDOT's feasibility and was found to meet the feasibility criteria. A 7,295 foot long noise wall with heights ranging between 10 feet and 14 feet would provide the required 5 dBA reduction at the majority of the proposed first row receivers which would meet WSDOT's feasibility requirement.

The proposed average height of 11.55 foot tall wall would also achieve the design goal by providing at least a 7 dBA of noise reduction for the design goal requirement. The allowable cost for Wall 1 is $5,279,238 (Exhibit 19) which is more than the actual wall cost of $4,349,128 (84,269 ft^2 @ $51.61) which meets WSDOT's reasonableness requirement.

Wall 1 meets WSDOT's feasibility and reasonableness requirements. Therefore it is recommended for construction.

Exhibit 19: Wall 1 Reasonableness Evaluation for Cost

Site and Land Use Category	Dwelling Units	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance Per Modeled Receiver		Minimum Design Goal Noise Wall Insertion Loss (dBA)	
R2-M1(B)	**1**	**72.6**	**73.0**	$60,693			6.0
R4-M3(B)	**1**	**71.4**	**72.1**	$57,184			7.5
R5(B)	**1**	**71.7**	**72.8**	$60,693			9.5
R6-M4(B)	5	63.9	**65.9**	$180,635			6.3
R7-M5(B)	1	**71.7**	**72.4**	$57,184			8.9
R8 (B)	**1**	**67.6**	**69.1**	$46,655			6.8
R9-M6(B)	**4**	65.2	**66.0**	$144,508			6.2
R10 (B)	**1**	**70.1**	**71.3**	$53,674			7.3
R11 (B)	**1**	**69.2**	**70.1**	$50,165			6.3
R12(B)	**6**	64.1	65.0	$216,726			5.7
R13(B)	**1**	**68.6**	**69.1**	$46,655			6.0
R17-M9(B)	**6**	**68..6**	**69.1**	$279,930			6.2

Site and Land Use Category	Dwelling Units	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance Per Modeled Receiver	Minimum Design Goal Noise Wall Insertion Loss (dBA)
R18(B)	1	65.6	66.0	$36,127	5.4
R19(B)	1	67.1	68.3	$43,146	6.3
R20(B)	1	65.0	66.1	$36,127	4.7
R21(B)	2	64.0	64.8	$72,254	5.1
R22(B)	4	62.2	63.4	$144,508	5.3
R23(B)	1	63.0	66.9	$43,146	4.5
R56(B)	1	63.9	65.5	$36,127	4.7
R62(B)	1	64.6	65.8	$36,127	4.7
R64(B)	1	65.9	66.7	$43,146	4.8
R65(B)	1	65.2	65.9	$36,127	5.5
R67(B)	1	66.1	67.6	$43,146	5.5
R68(B)	1	67.3	67.8	$43,146	6.0
R69(B)	4	62.8	63.8	$144,508	5.9
R71(B)	1	67.7	68.0	$43,146	6.0
R72(B)	2	65.3	66.2	$72,254	6.1
R75(B)	2	65.0	65.9	$72,254	4.9
R76(B)	1	65.8	66.2	$36,127	4.8
R78(B)	1	68.5	69.3	$46,655	6.1
R79(B)	1	65.7	66.0	$36,127	5.1
R80(B)	1	69.3	70.1	$50,165	6.3
R81(B)	1	67.4	68.0	$43,146	5.7
R82(B)	1	66.8	67.3	$39,636	5.4
R84(B)	2	64.3	65.1	$72,254	5.7
R86(B)	1	67.2	68.1	$43,146	5.8
R88(B)	1	70.1	71.3	$53,674	6.8
R89(B)	1	69.8	71.2	$53,674	6.7
R90(B)	1	68.0	69.0	$46,655	6.1
R91(B)	1	68.4	69.4	$46,655	6.2
R93(B)	1	68.4	69.5	$50,165	6.1
R94(B)	1	72.0	72.4	$57,184	9.1
R95(B)	1	73.1	74.4	$64,203	9.5
R97(C)	2	72.1	72.7	$121,386	9.2
R98(B)	1	66.6	67.6	$43,146	7.0
R99(B)	5	65.3	66.4	$180,635	6.9

Site and Land Use Category	Dwelling Units	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance Per Modeled Receiver	Minimum Design Goal Noise Wall Insertion Loss (dBA)
R100(C)	**6**	**71.7**	**71.6**	$343,104	8.6
R101(B)	**1**	**66.5**	**68.4**	$43,146	7.5
R102(B)	**1**	**67.0**	**69.2**	$46,655	7.9
R103(B)	**1**	**68.7**	**70.6**	$53,674	8.5
R104(B)	**1**	**70.2**	**71.6**	$57,184	9.0
R105(B)	**1**	**68.4**	**70.5**	$53,674	8.5
R106(B)	**1**	**69.3**	**71.2**	$53,674	8.9
R107(B)	**1**	**69.9**	**71.6**	$57,184	9.0
R108(B)	**1**	**72.2**	**73.2**	$60,693	9.6
R109(B)	**1**	**70.5**	**71.4**	$53,674	8.4
R111(B)	**1**	**72.4**	**73.0**	$60,693	8.7
R112(B)	**1**	**67.4**	**68.8**	$46,655	6.7
R113(B)	**1**	**65.8**	**67.4**	$39,636	5.9
R114(B)	**1**	**73.3**	**73.8**	$64,203	7.0
R115(B)	**1**	**68.9**	**70.1**	$50,165	5.7
R116(B)	**1**	**72.7**	**73.0**	$60,693	6.4
R118(B)	**1**	**72.0**	**72.6**	$60,693	5.0
R119(B)	**1**	**66.7**	**69.3**	$46,655	7.6
R121(B)	**3**	65.0	**67.2**	$118,908	6.4
R122(B)	**4**	65.2	**68.0**	$172,584	7.6
R124(B)	**1**	63.9	65.1	$36,127	4.9
R133(B)	**5**	**65.7**	**67.3**	$198,180	5.6
R135(B)	**6**	64.5	**65.6**	$216,762	5.4
				Total Allowable Cost	$5,279,238
				Total Acutual Cost	$4,349,128
				Design Goal Achieved?	Yes
				Cost Effective?	Yes

*Impacts are noted by **bolded** values.*
Reasonableness allowance based on $51.61/ft2

Exhibit 20: Evaluated Noise Wall Alignment – Wall1

Noise Wall 2 (feasible)

A noise wall along the shoulder of the highway was also evaluated for the noise effects identified at the east side of SR 167 south of Ellingson Road, in the vicinity of Beaver Meadows development. As with the locations north of Ellingson Road, several analyses were made to meet the feasibility and reasonableness criteria for an effective noise barrier for this location.

TNM modeling predicts that seven receivers in southeast end of the project will experience a noise level of 66 dBA or greater in the design year 2036, Build scenario. Because this location meets or exceeds the WSDOT noise abatement criteria of 66 dBA or greater, a noise wall was evaluated at this location. Exihibit 22 shows the area where noise wall 2 was evaluated.

The distance between the nearest noise sensitive receivers and SR 167 is over 300 feet. Typically receivers at this distance are second or third row receivers and achieve a benefit of 3 to 6 dBA, while closer receivers have reductions of 7 to 10 dBA. In order to provide a wall that would achieve the required 7 dBA at one receiver, while maintaining a 5 dBA at the majority of first row receivers, a noise wall was analyzed at this location to determine WSDOT's feasibility. An 1,800 foot long noise wall with a height ranging between 12 feet and 14 feet would provide the required 5 dBA reduction at the majority of the proposed first row receivers which would meet WSDOT's feasibility requirement.

The proposed average height of a 12 foot wall would also achieve the design goal by providing at least a 7 dBA of noise reduction for reasonableness requirement. The allowable cost for Wall 2 is $851,975 (Exhibit 21) which is less than the actual wall cost is $1,156,064 (22,400 Sqft @ $51.61) which did not meet WSDOT's reasonableness requirement.

Exhibit 21: Wall 2 Reasonableness Evaluation for Cost

Site and Land Use Category	**Dwelling Units**	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance	Minimum Design Goal Noise Wall
				Per Modeled Receiver	Insertion Loss (dBA)
R32(B)	6	61.8	62.7	$216,762	4.5
R33-M10(B)	1	63.7	65.4	$36,127	5.9
R34(B)	1	64.7	**66.8**	$39,636	6.5
R35(B)	1	65.0	**66.6**	$39,636	4.5
R36(B)	8	62.9	63.6	$289,016	4.9
R150(B)	1	65.0	**66.8**	$39,636	5.2
R151(B)	1	65.0	**66.8**	$39,636	5.7
R152(B)	1	65.0	**66.7**	$39,636	5.9
R153(B)	1	64.7	**66.5**	$39,636	6.1
R155(B)	1	63.8	**65.7**	$36,127	6.2
R157(B)	1	63.0	64.3	$36,127	4.8

Total Allowable Cost	**$851, 975**
Total Actual cost	**$1,156,064**
Design Goal Achieved?	Yes
Cost Effective?	No

Impacts are noted by bolded values.
Reasonableness allowance based on $51.61/ft2

Wall 2 meets WSDOT's feasibility but not reasonableness requirements. Therefore it is not recommended for construction.

Exhibit 22: Evaluated Noise Wall Alignment –Wall2

Recommendation for Traffic Noise Abatement

The proposed noise walls were both found to be feasible but only noise Wall 1 was found to be feasible and reasonable. Traffic noise abatement is recommended to build noise Wall 1 along the roadway to protect the affected sensitive recivers.

Construction of noise Wall 1 is recommended for this project. The noise wall will have an average height of 11.55 feet and a maximum height of 14 feet. The approximate length will be 7,295 feet and the surface area will be approximately 84,269 square feet. The exact location and top of wall elevations of the proposed wall will be in Appendix D of this report.