Addendum to the OR 217 Northbound and Southbound Auxiliary Lanes Project Noise Technical Report

North of North Hall Blvd Overpass

HMMH Report No. 310330.002
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Executive Summary

This report has been prepared as an addendum to the OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W Noise Technical Report (NTR) to present the modeling and analysis of the neighborhood north of the Hall Overpass on the east side of OR 217 not considered for impacts and abatement under the previous noise studies. Traffic noise levels for Existing conditions (2017) and for the No Build and Build Alternatives in the design year (2040) were predicted for the community north of the North Hall Boulevard overcrossing on the eastern side of OR 217 to Allen Boulevard with the Federal Highway Administration's Traffic Noise Model (TNM) Version 2.5. Existing noise levels in the study area are predicted to meet or exceed the Oregon Department of Transportation (ODOT) noise abatement approach criteria (NAAC) at 12 receptors. The noise levels for the No Build conditions are predicted to meet or exceed the NAAC at 14 receptors. The noise levels for the Build conditions are predicted to impact 12 receptors. The differences in noise levels from Existing to No Build conditions result from projected increases in traffic volumes on OR 217.

Noise levels predicted under the Build conditions, when compared to the Existing conditions, are predicted to increase by up to 2 dBA. Between the Existing conditions and Build Alternatives sound level changes are predicted to range from a decrease of 1 dBA up to an increase of 2 dBA. The majority of receivers, i.e., more than 50 percent of the number of residences, would experience no change in sound levels between the Build and No Build conditions. Changes in sound levels between No Build and Build conditions result from changes in OR 217 travel lane locations and other roadway alignment changes associated with the Project.

A noise wall ranging in height between 10-14 feet was found to be both feasible and reasonable per ODOT policy, providing benefit to all of the impacted receptors under the Build condition. The cost of the wall would be $479,660.

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Glossary

Activity Category B NAAC	The exterior noise impact criterion for Activity Category B is 65 dBA L_{eq}. This ODOT standard defines the noise levels constituting an impact for residences.
Activity Category C NAAC	The exterior noise impact criterion for Activity Category C is 65 dBA L_{eq}. This ODOT standard defines the noise levels constituting an impact for active sports arenas, 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 stations, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
Activity Category D NAAC	The interior noise impact criterion for Activity Category D is 50 dBA L_{eq}. This ODOT standard defines the noise levels constituting an impact for auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio stations, recording studios, schools, and television studios.
Activity Category E NAAC	The exterior noise impact criterion for Activity Category E activities is 70 dBA L_{eq}. This ODOT standard defines the noise levels constituting an impact for hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A—D or F.
Ambient Noise	The background sound of an environment in relation to which all foreground sounds are heard. Ambient noise level is a measure of the background noise of an environment over a given period of time, in decibels.
A-Weighted Decibel (dBA)	The A-weighting scale accounts for humans' ability to hear only a limited range of frequencies by filtering out those frequencies that the human ear cannot hear well.
Decibel (dB)	A unit used to measure the intensity of a sound by comparing it with a given level on a logarithmic scale.
Cumulative Impacts	The impact on the environment resulting from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions.
L_{eq}	Equivalent Sound Level. The metric for cumulative noise exposure over a specific time interval is the equivalent sound level
Receptor	An activity or unit represented by a measured or modeled receiver, also called an equivalent unit (subset of receiver).
Receiver	Modeling or measurement location that represents noise sensitive land uses; can represent multiple receptors or equivalent units.

Acronyms and Abbreviations

CFR	Code of Federal Regulations
dB	Decibel
dBA	A-Weighted Decibel
FHWA	Federal Highway Administration
NAC	Noise Abatement Criteria
NAAC	Noise Abatement Approach Criteria
NTR	Noise Technical Report
ODOT	Oregon Department of Transportation
TNM	Federal Highway Administration Traffic Noise Model

1 Introduction

The OR 217 Auxiliary Lane Project consists of two separate sub-projects in the same project area. OR 217: OR 10 – OR 99W Auxiliary Lane Project (Project) is a public safety and congestion reduction project in the southwest portion of the Portland metro area in the cities of Beaverton and Tigard. The project includes the extension of the southbound auxiliary lane from just south of the Beaverton Hillsdale Highway (OR 10)/Southern Pacific Railroad (SPRR) overcrossing structure to OR 99W and creation of a barrier-separated collector/distributor road between Allen Boulevard and Denney Road in the southbound direction. This is referred to as the "Southbound Auxiliary Lane Project." The OR 217: Progress (Scholls Ferry Road) Interchange – Tigard (OR 99W) Interchange Northbound Auxiliary Lane Project will extend the northbound auxiliary lane from the OR 99W exit to the Scholls Ferry Road Exit. An additional auxiliary lane will be created from the Northbound OR 99W loop entrance ramp to the Greenburg Road exit ramp. This is referred to as the "Northbound Auxiliary Lane Project."

The OR 217 Auxiliary Lanes Project will improve safety and help prevent bottlenecks on a four-mile stretch of OR 217 between Beaverton-Hillsdale Highway and OR 99W. Adding new auxiliary lanes, or on-ramp to off-ramp connections, reduces merging slow-downs and gives drivers more time to make lane changes. Drivers making local trips can avoid merging into highway traffic and instead use the new auxiliary lanes to reach their destinations. This reduces bottlenecks for drivers already on the highway. The project will also add a new frontage road, replace a major bridge structure and add strategic bicycle and pedestrian improvements.

This Addendum addresses the additional model validation, modeling results, and abatement analysis for the noise sensitive areas located north of the North Hall Blvd overcrossing east of the northbound (NB) lanes. The methodology, land use, traffic data, and construction abatement are the same as discussed in the OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W Noise Technical Report (NTR)[1]. The Federal Highway Administration's Traffic Noise Model (TNM). Version 2.5 was the primary analysis tool.

[1] 2018 NB/SB Auxiliary Lane Project by SLR Corporation

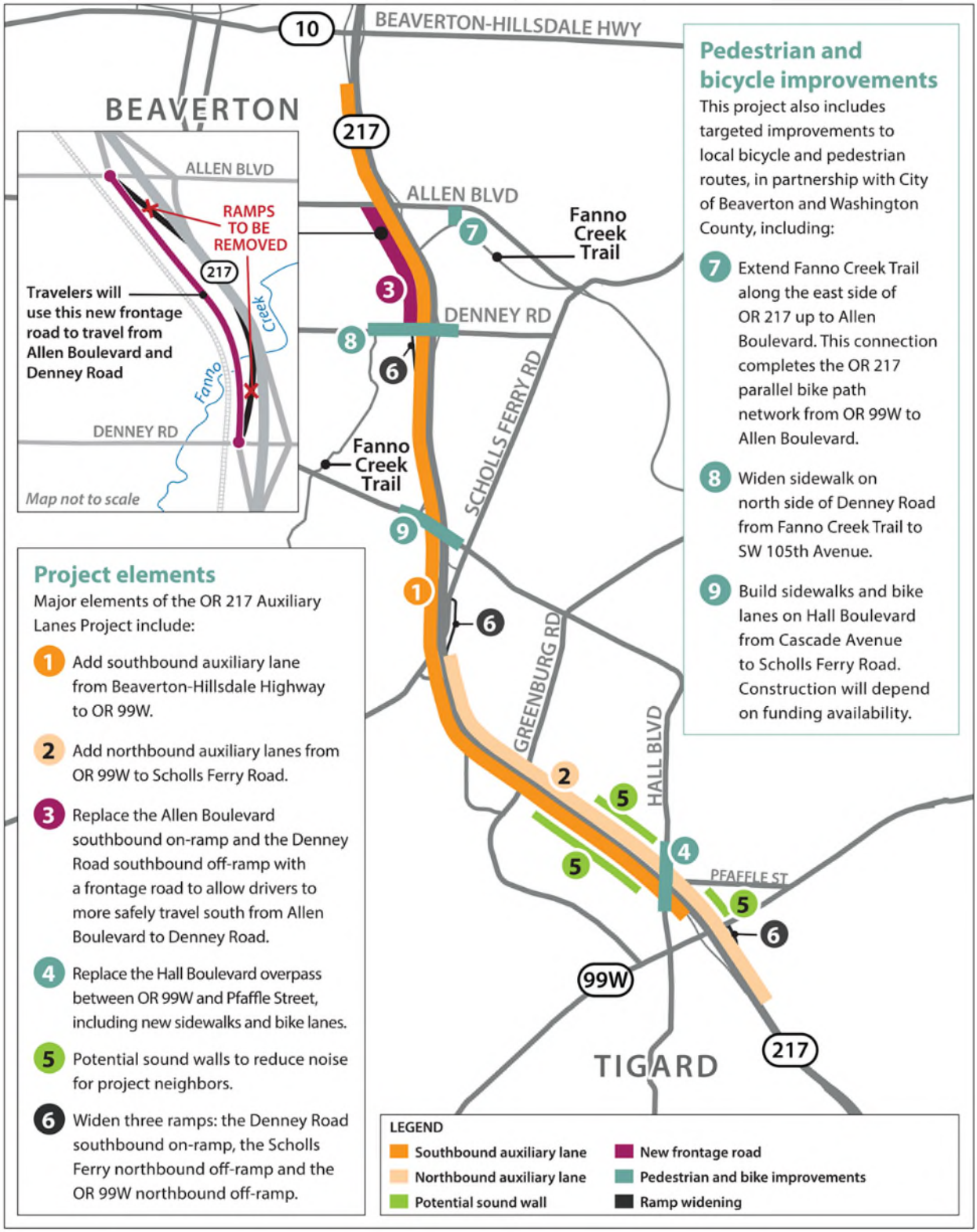

Figure 1. Project Map
(ODOT, 2017)

2 Existing Conditions and Noise Levels

Model validation was presented in Section 3, 'Project Area Existing Conditions' in the NTR. Additional validation model runs were performed for the monitoring locations at noise sensitive areas east of the OR 217 NB lanes extending from the northern Hall Boulevard overcrossing to Allen Road. The validation analysis was used to identify what additional terrain and other shielding effects are present in these areas. For example, located between the residences and OR217 near measurement location M8 is a privacy wall/sound barrier made of brick and 10-feet tall. Validation runs were performed for monitoring locations M6, M7, M8, and M9 to confirm TNM-predicted sound levels are in agreement with measured levels within ±3 dB. The monitoring locations are shown in Figures 2 through 5.

A comparison of noise levels predicted for the monitoring locations using the noise model and noise levels measured in the field is shown in Table 1. The modeled results are within ±3 dB of the measurement values, confirming the model is considered to reasonably predict noise levels for the addendum analysis area. The updated validation run TNM output files are included in Appendix A of this Addendum. Monitoring data and equipment calibration certificates are included in Appendix B of this Addendum.

Table 1. Measurement and Modeled Noise Levels in the Area North and West of the OR 217 North Hall Boulevard Overpass

Measurement Site	Location	Date	Duration (Approx.)	Distance from Closest OR 217 Main Traffic Lanes(feet)	Measured Noise Level (dBA Leq)	Modeled (TNM-Predicted) Noise Level (dBA Leq)	Difference (dB; Modeled minus Measured)
M6	10475 & 10485 SW Crestwood Dr	6/26/2019	15 minutes	110	67.1	70.0	2.9
M7	10435 SW Homestead Ln	6/14/2019	37 minutes	93	70.3	72.7	2.4
M8	7125 SW 105th Ave	6/14/2019	40 minutes	293	56.3	54.6	-1.7
M9	123 SW Heritage Pkwy, Mobile Home Unit #6	6/14/2019	30 minutes	389	56.2	54.0	-2.2

Following validation, existing sound levels were predicted at 156 receivers (representing 179 receptors). Sound levels were predicted at 5 feet above ground level for first floor residences and 15 feet for second floor residences. Existing terrain was included in the modeling and provides partial shielding for the receivers. Building rows or buildings modeled as barriers were also added to the model in areas where they shielding for residences located behind them such as the storage facility near M8. Predicted existing peak noise hour sound levels at receivers located within the project area are provided in Table 2. TNM files are provided in Appendix A.

Sound levels range from 48 dBA Leq to 76 dBA Leq and, under the peak noise hour conditions, 12 receivers representing 12 residences are predicted to meet or exceed the NAAC. These receivers are shown in Figure 4 as blue dots.

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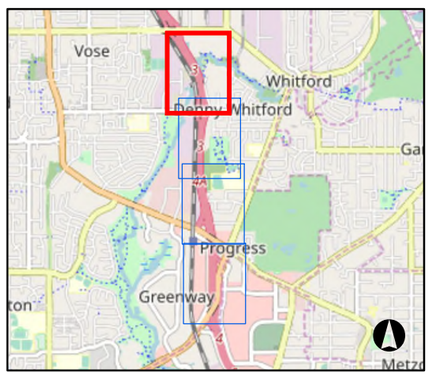
Figure 2
Existing/No Build Conditions

OR 217 Auxiliary Lanes Project
Beaverton/Tigard, OR

Receiver Site and Number
- Not Impacted in No Build and Existing
- Impacted in No Build and Existing
- Impacted in No Build and Not Impacted in Existing

▲ M-# Measurement Site

0 100 200 400
Feet



Oregon Department of Transportation

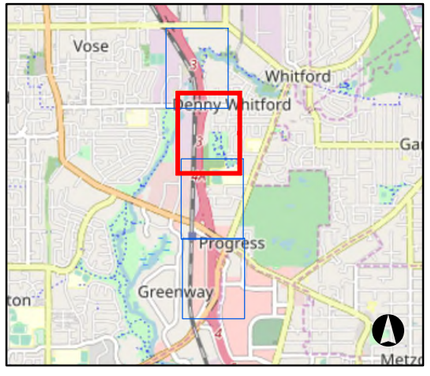
Figure 3
Existing/No Build Conditions

OR 217 Auxiliary Lanes Project
Beaverton/Tigard, OR

Receiver Site and Number
- Not Impacted in No Build and Existing
- Impacted in No Build and Existing
- Impacted in No Build and Not Impacted in Existing

▲ M-# Measurement Site

0 100 200 400
Feet



Oregon Department of Transportation

Figure 4
Existing/No Build Conditions

OR 217 Auxiliary Lanes Project
Beaverton/Tigard, OR

Receiver Site and Number
- Not Impacted in No Build and Existing
- Impacted in No Build and Existing
- Impacted in No Build and Not Impacted in Existing

▲ M-# Measurement Site

0 100 200 400
Feet

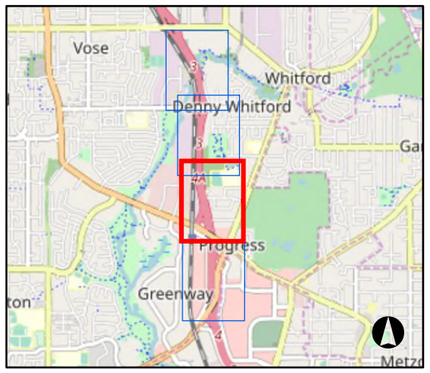


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Figure 5
Existing/No Build Conditions

OR 217 Auxiliary Lanes Project
Beaverton/Tigard, OR

Receiver Site and Number
- Not Impacted in No Build and Existing
- Impacted in No Build and Existing
- Impacted in No Build and Not Impacted in Existing

▲ M-# Measurement Site

0 100 200 400
Feet

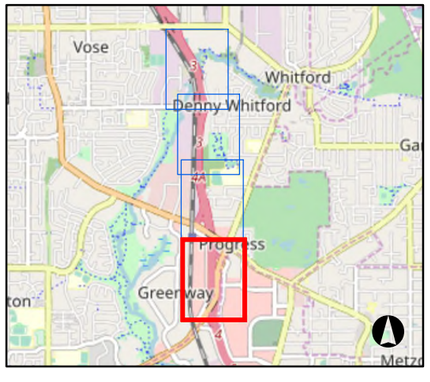


Table 2. Predicted Traffic Noise Levels

Receiver	Activity Category	Land Use Description	Oregon NAAC	Number of Receptors	Existing Noise (dBA Leq)	No Build Alternative (dBA Leq)	Change in Noise Level between Existing and No Build Alternative (dB)	Build Alternative (dBA Leq)	Change in Noise Level between Existing and Build Alternative (dB)
R-102	C	Motel Pool	65	1	54	54	0	54	0
R-103	B	SF	65	1	56	57	1	56	0
R-104	B	SF	65	1	54	55	1	55	1
R-105	B	SF	65	1	50	51	1	51	1
R-106	B	SF	65	1	51	52	1	52	1
R-107	B	SF	65	1	54	55	1	54	0
R-108	B	SF	65	1	56	57	1	56	0
R-109	B	SF	65	1	56	57	1	56	0
R-110	B	SF	65	1	56	57	1	56	0
R-111	B	SF	65	1	56	57	1	56	0
R-112	B	SF	65	1	54	55	1	56	2
R-113	B	SF	65	1	52	53	1	52	0
R-114	B	SF	65	1	50	51	1	51	1
R-115	B	SF	65	1	52	53	1	52	0
R-116	B	SF	65	1	56	57	1	55	-1
R-117	B	SF	65	1	56	57	1	57	1
R-118	B	SF	65	1	56	57	1	57	1
R-119	B	SF	65	1	56	57	1	56	0
R-120	B	SF	65	2	54	55	1	54	0
R-121	B	SF	65	1	53	54	1	55	2
R-122	B	SF	65	2	53	54	1	55	2
R-123	B	SF	65	2	53	54	1	54	1
R-124	B	SF	65	2	53	54	1	54	1
R-125	B	SF	65	2	53	54	1	54	1
R-126	B	SF	65	2	52	53	1	53	1
R-127	B	SF	65	2	52	53	1	53	1
R-128	B	SF	65	2	52	53	1	53	1
R-129	B	SF	65	2	52	53	1	53	1
R-130	C	Pool	65	1	53	54	1	53	0
R-131	B	SF	65	2	53	54	1	53	0
R-132	B	SF	65	2	53	55	2	54	1
R-133	B	SF	65	2	54	55	1	55	1

Table 2. Predicted Traffic Noise Levels

Receiver	Activity Category	Land Use Description	Oregon NAAC	Number of Receptors	Existing Noise (dBA Leq)	No Build Alternative (dBA Leq)	Change in Noise Level between Existing and No Build Alternative (dB)	Build Alternative (dBA Leq)	Change in Noise Level between Existing and Build Alternative (dB)
R-134	B	SF	65	2	54	55	1	54	0
R-135	B	SF	65	2	54	55	1	54	0
R-136	B	SF	65	1	57	58	1	57	0
R-137	E	Picnic Table with office building	70	1	66	67	1	66	0
R-138	B	SF	65	2	52	53	1	52	0
R-139	C	Outdoor Gazebo	65	1	51	52	1	52	1
R-140	B	MF Deck	65	1	53	54	1	53	0
R-141	B	MF Deck	65	1	52	53	1	52	0
R-142	B	SF	65	0	58	59	1	59	1
R-143	B	SF	65	1	57	59	2	59	2
R-144	B	SF	65	1	56	57	1	57	1
R-145	B	SF	65	1	57	58	1	58	1
R-146	B	SF	65	1	56	57	1	57	1
R-147	B	SF	65	1	54	56	2	56	2
R-148	B	SF	65	1	55	56	1	56	1
R-149	B	SF	65	1	54	55	1	55	1
R-150	B	SF	65	1	53	54	1	54	1
R-151	B	SF	65	1	52	54	2	54	2
R-152	B	SF	65	1	52	53	1	53	1
R-153	B	SF	65	1	51	52	1	52	1
R-154	B	SF	65	1	50	52	2	52	2
R-155	B	SF	65	1	60	61	1	61	1
R-156	B	SF	65	2	59	61	2	60	1
R-157	B	SF	65	2	59	61	2	60	1
R-158	B	SF	65	2	59	60	1	59	0
R-159	B	SF	65	2	51	52	1	52	1
R-160	B	SF	65	1	49	51	2	50	1
R-161	B	SF	65	1	48	49	1	49	1
R-162	B	SF	65	1	48	49	1	48	0
R-163	B	SF	65	1	49	50	1	50	1
R-164	B	SF	65	1	49	50	1	50	1

Table 2. Predicted Traffic Noise Levels

Receiver	Activity Category	Land Use Description	Oregon NAAC	Number of Receptors	Existing Noise (dBA Leq)	No Build Alternative (dBA Leq)	Change in Noise Level between Existing and No Build Alternative (dB)	Build Alternative (dBA Leq)	Change in Noise Level between Existing and Build Alternative (dB)
R-165	B	SF	65	1	49	51	2	50	1
R-167	C	Park	65	1	51	53	2	52	1
R-168	C	Rec	65	1	53	55	2	54	1
R-169	C	Rec	65	1	52	54	2	53	1
R-170	C	Tennis Courts	65	1	54	56	2	55	1
R-171	C	Baseball Fields	65	1	50	52	2	52	2
R-172	C	Baseball Field	65	1	48	49	1	49	1
R-173	C	Baseball Field	65	1	59	61	2	60	1
R-174	C	Playing field	65	1	57	59	2	58	1
R-175	C	Baseball Field	65	1	54	55	1	55	1
R-176	D	Whitford Middle School	50	1	30	31	1	31	1
R-177	B	SF	65	1	**76**	**77**	1	**76**	0
R-178	B	SF	65	1	**69**	**71**	2	**70**	1
R-179	B	SF	65	1	**66**	**67**	1	**67**	1
R-180	B	SF	65	1	**65**	**67**	2	**66**	1
R-181	B	SF	65	1	**65**	**66**	1	**66**	1
R-182	B	SF	65	1	**65**	**67**	2	**66**	1
R-183	B	SF	65	1	63	**65**	2	64	1
R-184	B	SF	65	1	61	63	2	63	2
R-185	B	SF	65	1	60	62	2	61	1
R-186	B	SF	65	1	**65**	**67**	2	**66**	1
R-187	B	SF	65	1	**65**	**67**	2	**67**	2
R-188	B	SF	65	1	60	62	2	62	2
R-189	B	SF	65	1	61	63	2	62	1
R-190	B	SF	65	1	**65**	**66**	1	**66**	1
R-191	B	SF	65	1	**65**	**67**	2	**67**	2
R-192	B	SF	65	1	59	61	2	60	1
R-193	B	SF	65	1	63	**65**	2	64	1
R-194	B	SF	65	1	59	61	2	60	1
R-195	B	SF	65	1	**65**	**66**	1	**66**	1
R-196	B	SF	65	1	58	60	2	60	2
R-197	B	SF	65	1	55	56	1	56	1
R-198	B	SF	65	1	56	58	2	57	1

Table 2. Predicted Traffic Noise Levels

Receiver	Activity Category	Land Use Description	Oregon NAAC	Number of Receptors	Existing Noise (dBA Leq)	No Build Alternative (dBA Leq)	Change in Noise Level between Existing and No Build Alternative (dB)	Build Alternative (dBA Leq)	Change in Noise Level between Existing and Build Alternative (dB)
R-199	B	SF	65	1	56	58	2	58	2
R-200	B	SF	65	1	53	54	1	54	1
R-201	B	SF	65	1	**67**	**69**	2	**69**	2
R-202	B	SF	65	1	59	60	1	60	1
R-203	B	SF	65	1	57	58	1	58	1
R-204	B	SF	65	1	56	58	2	57	1
R-205A	B	Georgetown Manor Apartments	65	1	59	60	1	59	0
R-205B	B	Georgetown Manor Apartments	65	1	62	63	1	61	-1
R-205C	B	Georgetown Manor Apartments	65	1	62	64	2	62	0
R-206A	B	Georgetown Manor Apartments	65	1	57	58	1	57	0
R-206B	B	Georgetown Manor Apartments	65	1	60	61	1	59	-1
R-206C	B	Georgetown Manor Apartments	65	1	61	62	1	60	-1
R-207A	B	Georgetown Manor Apartments	65	1	55	56	1	55	0
R-207B	B	Georgetown Manor Apartments	65	1	58	59	1	59	1
R-207C	B	Georgetown Manor Apartments	65	1	59	61	2	59	0
R-208A	B	Georgetown Manor Apartments	65	1	54	55	1	54	0

Table 2. Predicted Traffic Noise Levels

Receiver	Activity Category	Land Use Description	Oregon NAAC	Number of Receptors	Existing Noise (dBA Leq)	No Build Alternative (dBA Leq)	Change in Noise Level between Existing and No Build Alternative (dB)	Build Alternative (dBA Leq)	Change in Noise Level between Existing and Build Alternative (dB)
R-208B	B	Georgetown Manor Apartments	65	1	57	58	1	57	0
R-208C	B	Georgetown Manor Apartments	65	1	59	60	1	58	-1
R-209A	B	Georgetown Manor Apartments	65	1	61	62	1	61	0
R-209B	B	Georgetown Manor Apartments	65	1	62	63	1	63	1
R-209C	B	Georgetown Manor Apartments	65	1	63	64	1	64	1
R-210A	B	Georgetown Manor Apartments	65	1	58	59	1	59	1
R-210B	B	Georgetown Manor Apartments	65	1	60	61	1	60	0
R-210C	B	Georgetown Manor Apartments	65	1	61	62	1	61	0
R-211A	B	Georgetown Manor Apartments	65	1	56	57	1	57	1
R-211B	B	Georgetown Manor Apartments	65	1	58	58	0	58	0
R-211C	B	Georgetown Manor Apartments	65	1	59	60	1	60	1
R-212A	B	Georgetown Manor Apartments	65	1	55	56	1	55	0

Table 2. Predicted Traffic Noise Levels

Receiver	Activity Category	Land Use Description	Oregon NAAC	Number of Receptors	Existing Noise (dBA Leq)	No Build Alternative (dBA Leq)	Change in Noise Level between Existing and No Build Alternative (dB)	Build Alternative (dBA Leq)	Change in Noise Level between Existing and Build Alternative (dB)
R-212B	B	Georgetown Manor Apartments	65	1	56	57	1	57	1
R-212C	B	Georgetown Manor Apartments	65	1	57	58	1	58	1
R-213	E	Bar patio	70	1	56	58	2	57	1
R-214	B	SF	65	1	56	57	1	57	1
R-215	B	SF	65	1	56	57	1	57	1
R-216	B	SF	65	1	55	56	1	56	1
R-217	B	SF	65	1	54	56	2	55	1
R-218	B	SF	65	1	54	55	1	55	1
R-219	B	SF	65	1	53	54	1	54	1
R-220	B	SF	65	1	53	54	1	54	1
R-221	B	SF	65	1	52	53	1	53	1
R-222	B	SF	65	1	52	53	1	53	1
R-223	B	SF	65	1	51	52	1	51	0
R-224	B	SF	65	1	50	51	1	51	1
R-225	B	SF	65	1	54	55	1	55	1
R-226	B	SF	65	1	52	53	1	53	1
R-227	B	SF	65	1	51	52	1	52	1
R-228	B	SF	65	1	56	57	1	57	1
R-229	B	SF	65	1	55	56	1	56	1
R-230	B	SF	65	1	52	53	1	53	1
R-231	B	SF	65	1	58	59	1	59	1
R-232	B	SF	65	1	56	57	1	57	1
R-233	B	SF	65	1	54	56	2	56	2
R-234	B	SF	65	1	53	55	2	55	2
R-235	B	SF	65	1	52	54	2	54	2
R-236	B	SF	65	1	52	54	2	54	2
R-237	B	SF	65	2	58	59	1	59	1
R-238	B	SF	65	2	56	58	2	58	2
R-239	B	SF	65	3	53	54	1	54	1
R-240	B	SF	65	2	52	53	1	53	1

Table 2. Predicted Traffic Noise Levels

Receiver	Activity Category	Land Use Description	Oregon NAAC	Number of Receptors	Existing Noise (dBA Leq)	No Build Alternative (dBA Leq)	Change in Noise Level between Existing and No Build Alternative (dB)	Build Alternative (dBA Leq)	Change in Noise Level between Existing and Build Alternative (dB)
R-241	B	SF	65	1	52	53	1	53	1
R-242	B	SF	65	1	54	56	2	56	2
Summary									
Element					**Existing Conditions**	**No Build Alternative**		**Build Alternative**	
Number of Receptors that Meet or Exceed NAAC					12	14		12	
Range of Sound Levels (dBA Leq)[4]					48 to 76	49 to 77		48 to 76	
Range of Change in Sound Levels (dB)					N/A	0 to 2		-1 to 2	

Notes: 1. SF = Single-Family Residential; 2. **Bold Underline** indicates exceedance of NAAC. 3. Interior use calculated by subtracting FHWA.

3 Traffic Noise Analysis and Noise Impacts

Traffic noise analysis and impacts are provided for the No Build Alternative and Build Alternative in subsections 3.1 and 3.2, respectively.

3.1 No Build Alternative Noise Levels

The No Build Alternative sound levels range from 49 dBA Leq to 77 dBA Leq. An increase of up to 2 dB over existing traffic noise levels is predicted for the project. A 2 dB change in similar sound levels, such as traffic noise, is generally not perceptible to average human hearing. Fourteen receivers representing 14 residential units are predicted to meet or exceed the NAAC. Analysis locations are shown in Figures 2 through 4 and predicted sound levels at each analysis point are provided in Table 2.

3.2 Build Alternative Noise Levels

The Build Alternative sound levels range from 48 dBA Leq to 76 dBA Leq. An increase of up to 2 dB over existing traffic noise levels is predicted for the project; therefore there are no substantial noise impacts per ODOT regulations. In some areas widening of the highway shifts traffic noise for one travel lane (approximately 12 feet or greater) further away from noise sensitive receptors which is predicted to result in up to a 1 dB reduction. These types of changes in similar sound levels, such as traffic noise, are generally not perceptible to average human hearing. Twelve receivers representing 12 residential units are predicted to meet or exceed the NAAC (see Figure 8). Each of these exceedances were evaluated for noise abatement. Analysis locations are shown in Figures 6 through 9 and predicted sound levels at each analysis point are provided in Table 2.

Oregon Department of Transportation

Figure 6
Build Conditions

OR 217 Auxiliary Lanes Project
Beaverton/Tigard, OR

Receiver Site and Number

- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Benefited but Not Impacted
- Not Benefited or Impacted

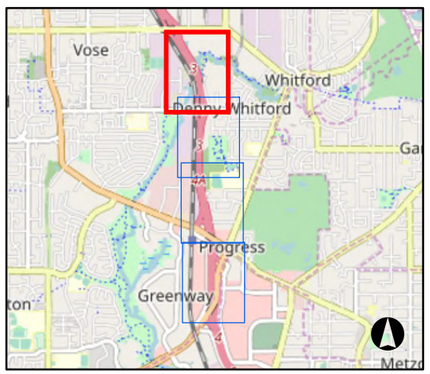
Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

Noise Barriers

- Feasible and Reasonable

M-# Measurement Site

0 100 200 400
Feet



Oregon Department of Transportation

Figure 7
Build Conditions

OR 217 Auxiliary Lanes Project
Beaverton/Tigard, OR

Receiver Site and Number

- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Benefited but Not Impacted
- Not Benefited or Impacted

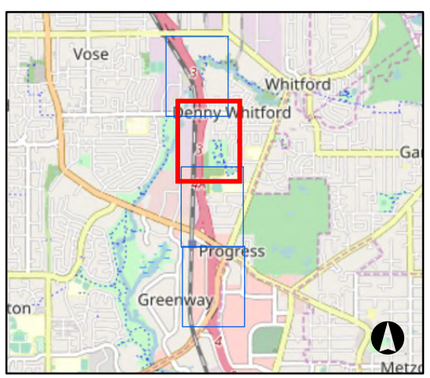
Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

Noise Barriers

- Feasible and Reasonable

M-# Measurement Site

0 100 200 400
Feet



Oregon Department of Transportation

Figure 8
Build Conditions

OR 217 Auxiliary Lanes Project
Beaverton/Tigard, OR

Receiver Site and Number

- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Benefited but Not Impacted
- Not Benefited or Impacted

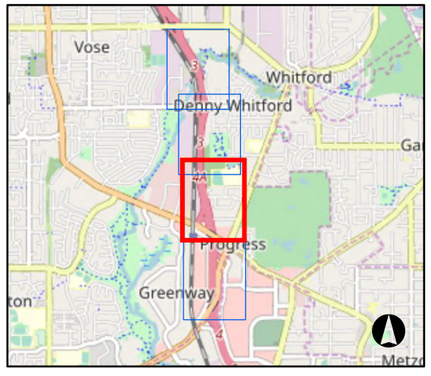
Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

Noise Barriers

- Feasible and Reasonable

M-# Measurement Site

0 100 200 400
Feet



Oregon Department of Transportation

Figure 9
Build Conditions

OR 217 Auxiliary Lanes Project
Beaverton/Tigard, OR

Receiver Site and Number

- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Benefited but Not Impacted
- Not Benefited or Impacted

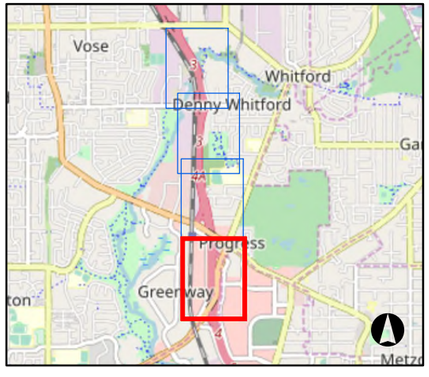
Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

Noise Barriers

- Feasible and Reasonable

▲M-# Measurement Site

0 100 200 400
Feet



4 Range of Potential Abatement Measures

Traffic noise abatement is considered for the 12 receptors that would exceed the NAAC under the Build Alternative.

4.1 Traffic Noise Abatement

The following noise abatement selection criteria are used when considering potential noise abatement for noise impacts:

- Noise abatement benefits
- Opinions of impacted property owners
- Land use and zoning
- Controlled and uncontrolled access
- Cost of abatement
- Environmental impacts
- Absolute noise levels
- Non-traffic noise

Several options were considered for traffic noise abatement including truck restrictions, speed restrictions, and alignment changes. Truck restrictions are infeasible because OR 217 is a major route for freight movement. The posted speed limit on OR 217 is 55 miles per hour, resulting in high levels of traffic noise. Reducing posted speed limits is unlikely to reduce actual travel speeds and would defeat the goal of efficient traffic movement through the project area.

Changes in alignment can be considered to prevent traffic noise impacts but generally, changes in alignment shift impacts to other properties. The prevention of impacts is an important part of noise control. In this project area the most substantial contribution of traffic noise to the nearby sensitive receptors comes from the OR 217 mainline traffic volumes. The project would result in a maximum increase over existing sound levels of 2 dB. Average human hearing cannot readily notice a change of 3 dB or less for sounds that are similar, in this case traffic noise, indicating that the project will have an imperceptible effect on sound levels. In addition, one receiver is predicted to have only a 1 dB decrease in sound levels.

Noise barriers are common considerations in project areas like the OR 217 corridor. ODOT policy states a noise barrier must meet feasibility and reasonableness criteria to be recommended for construction. Feasibility or constructability of an abatement measure includes acoustical and engineering factors. For the abatement to be feasible, ODOT requires that a simple majority of impacted receptors achieve at least a 5 dBA reduction in noise levels. ODOT also considers engineering factors such as barrier height, safety, topography, drainage, utilities, and access issues when determining feasibility. ODOT considers barriers of all heights but those exceeding 25 feet, would likely exceed the reasonable criteria for cost-effectiveness.

ODOT considers three factors to determine whether a noise barrier is reasonable:

1) Viewpoints of the residents and property owners that benefit from the proposed abatement,

2) Cost-effectiveness of the abatement measure, and

3) The ODOT noise reduction design goal for abatement.

All three criteria must be met to satisfy the reasonableness criteria.

If a barrier meets cost reasonableness and achieves the design goal, ODOT distributes a survey by mail to benefitted residents to determine the residents' desire for abatement. For this project the voting process is anticipated to take place during the summer and fall of 2019. If a majority (>50 percent) of those property owners and renters responding to the survey want the noise barrier, it would be recommended for construction. A 'no' decision means that federal funds would not be available for future abatement at that location unless there was a project near the location that was defined as Type I (as defined by 23 CFR 772 and the ODOT Noise Manual).

The second reasonableness criterion is the cost-effectiveness of the proposed abatement. All benefitted residences are considered in the calculation of cost-effectiveness. A benefitted residence is any impacted or non-impacted residence that receives a noise reduction of 5 dBA or more. A reasonable cost is considered to be a maximum of $25,000 per benefitted residence. A cost of $20 per square foot for post and panel walls is used for walls up to and including 16 feet in height. Walls taller than 16 feet have an associated cost of $25 per square foot for "post and panel" sound walls.

Noise barriers typically only meet this criterion of $25,000 maximum per benefited residence where residences are located close together such that several residences benefit from the noise barrier. Single residences or sparsely distributed residences on large lots seldom meet the cost-effectiveness criteria. If the cost of the proposed noise abatement exceeds allowable limits, a noise barrier would not be recommended.

The third reasonableness criterion is the ODOT design goal. At least one benefited receptor must achieve the noise reduction goal of 7 dBA.

ODOT will place noise barriers in the right-of-way near noise-impacted residences if the barriers are predicted to meet both the feasible and reasonableness criteria.

Abatement for the impacted residential receivers was analyzed in the form of noise barriers.

4.2 SW Crestwood Drive and SW Homestead Lane Sound Wall

A sound wall was analyzed to abate the exceedances under the Build conditions at residential receptors located on SW Crestwood Drive and SW Homestead Lane, east of OR 217. The sound wall would provide abatement for houses being represented by receivers R-174 through R-242 (see Figure 8).

As shown in Figure 8, a barrier 2,017 feet long was modeled along the edge of OR 217 right-of-way and analyzed to abate the sound levels to the impacted residences. Twelve residences were impacted in the area where the barrier was modeled. Seven individual barrier analyses representing this sound wall at uniform heights ranging from 10 to 18 feet tall were evaluated. Detailed barrier analysis are included in Appendix C. Electronic barrier TNM files are included in Appendix A.

Table 3 shows the barrier information for the SW Crestwood Drive and Homestead Lane sound wall. A 14-foot tall sound wall would benefit the 12 impacted residences and the barrier would benefit an additional 18 non-impacted residences for a total of 30 benefitted residences. The barrier would meet the noise reduction design goal, as well as being below the cost reasonable criteria at $18,787 per benefitted residence. The estimated cost of the barrier is $563,620.

Table 3. Crestwood/Homestead Sound Wall (Uniform Height)

Barrier Name	Barrier Length (ft.)	Barrier Height (ft.)	Barrier Cost ($)	Number of Impacted Residences Benefitted (>=65 dB)	Number of Benefitted Residences (5 dB)	Percent Feasible (%)	Meets Design Goal?	Cost Per Benefitted Residence ($)
SW Crestwood Drive and SW Homestead Lane Barrier	2,017	14	$563,620	12	30	100%	Yes	$18,787

4.3 Optimized Barrier SW Crestwood Drive and SW Homestead Lane Sound Wall

Due to the additional area analyzed under this Addendum being late in project scheduling, a Final Optimized Barrier was analyzed. Detailed barrier analysis are included in Appendix C. Electronic barrier TNM files are included in Appendix A. The barrier location is shown in Figure 8.

Table 4 provides the optimized barrier information for the SW Crestwood Drive and Homestead Lane Sound Wall. A variable height sound wall ranging in heights of 10 to 14 feet and of a length of 1,841 feet was found to meet the ODOT feasible and reasonable criteria. The optimized barrier would cost $479,660 with a cost benefit per benefitted receptor of $16,540.

Table 4. Crestwood/Homestead Sound Wall (Optimized Height)

Barrier Name	Barrier Length (ft.)	Barrier Height (ft.)	Barrier Cost ($)	Number of Impacted Residences Benefitted (>=65 dB)	Number of Benefitted Residences (5 dB)	Percent Feasible (%)	Meets Design Goal?	Cost Per Benefitted Residence ($)
SW Crestwood Drive and SW Homestead Lane Barrier	1,749	10-14	$479,660	12	29	100%	Yes	$16,540

Appendix A TNM Files

Provided electronically.

Appendix B Field Measurement Information and Laboratory Calibration Sheets

Table B-1. 15-Minute Traffic Counts and 1-Hour Traffic Equivalent for TNM Validation

Measurement Location	Roadway	Traffic Count (15-minute)		Traffic Volume for TNM (hour equivalent)
		Vehicle Type	Quantity	Quantity
M06	OR217 SB	Automobiles	832	3328
		Medium Trucks	21	84
		Heavy Trucks	14	56
		Buses	5	20
		Motorcycles	1	4
	OR217 NB	Automobiles	1003	4012
		Medium Trucks	29	116
		Heavy Trucks	7	28
		Buses	1	4
		Motorcycles	0	0
	OR217 SB Off-ramp to SW Hall Blvd	Automobiles	116	464
		Medium Trucks	0	0
		Heavy Trucks	0	0
		Buses	0	0
		Motorcycles	1	4
M07	OR217 SB	Automobiles	765	3060
		Medium Trucks	33	132
		Heavy Trucks	24	96
		Buses	0	0
		Motorcycles	0	0
	OR217 NB	Automobiles	870	3480
		Medium Trucks	27	108
		Heavy Trucks	3	12
		Buses	0	0
		Motorcycles	0	0
	OR217 SB Off-ramp to SW Hall Blvd	Automobiles	88	352
		Medium Trucks	9	36
		Heavy Trucks	3	12
		Buses	0	0
		Motorcycles	0	0
	OR217 SB On-ramp from SW Hall Blvd	Automobiles	48	192
		Medium Trucks	0	0
		Heavy Trucks	3	12
		Buses	0	0
		Motorcycles	0	0

Table B-1. 15-Minute Traffic Counts and 1-Hour Traffic Equivalent for TNM Validation

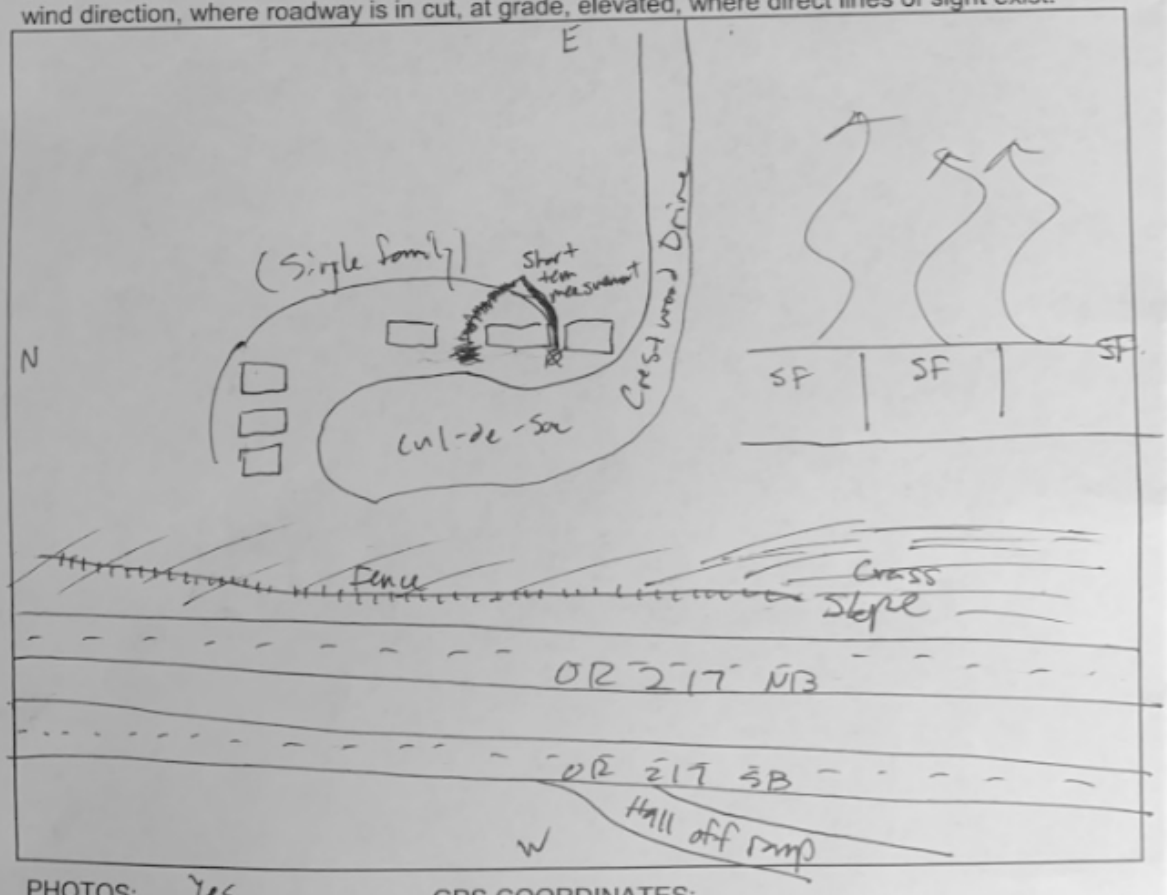
Measurement Location	Roadway	Traffic Count (15-minute)		Traffic Volume for TNM (hour equivalent)
		Vehicle Type	Quantity	Quantity
M08	OR217 SB	Automobiles	978	3912
		Medium Trucks	21	84
		Heavy Trucks	6	24
		Buses	0	0
		Motorcycles	0	0
	OR217 NB	Automobiles	1055	4220
		Medium Trucks	9	36
		Heavy Trucks	18	72
		Buses	0	0
		Motorcycles	0	0
	OR217 SB On-ramp from SW Denney Road	Automobiles	70	280
		Medium Trucks	4	16
		Heavy Trucks	0	0
		Buses	0	0
		Motorcycles	0	0
	OR217 NB Off-ramp to SW Denney Road	Automobiles	63	252
		Medium Trucks	3	12
		Heavy Trucks	0	0
		Buses	0	0
		Motorcycles	0	0
M09	OR217 SB	Automobiles	910	3640
		Medium Trucks	37	148
		Heavy Trucks	4	16
		Buses	0	0
		Motorcycles	0	0
	OR217 NB	Automobiles	951	3804
		Medium Trucks	12	48
		Heavy Trucks	4	16
		Buses	0	0
		Motorcycles	0	0
	OR217 NB On-ramp from SW Denney Road	Automobiles	77	308
		Medium Trucks	0	0
		Heavy Trucks	6	24
		Buses	0	0
		Motorcycles	0	0

PROJECT: OR217 NB
JOB NO.: 310330.002

SHORT-TERM NOISE MEASUREMENT SITE LOG

ASSESSMENT AREA: 6 MEASUREMENT SITE NO.: 6
ADDRESS: 10485 Crestwood Dr.
OWNER: NA
DESCRIPTION: SF
NOISE SOURCES: OR 217, local residential noise
NOISE MONITOR: LD 824 Kit #1 S/N:
MICROPHONE: LD Kit # 1 S/N:
CALIBRATOR: LD 250 S/N:
TEMP. RANGE (°F): 78°-82° WEATHER CONDITIONS: Sunny, warm

SITE SKETCH: Show roadway, homes, local roads, reference distances, arrows for North & wind direction, where roadway is in cut, at grade, elevated, where direct lines of sight exist.



PHOTOS: Yes GPS COORDINATES:

HARRIS MILLER MILLER & HANSON INC.

SHORT-TERM NOISE MEASUREMENT DATA SHEET

PROJECT: OR217 NB
JOB NO.: 310330.002
PERSONNEL: SRN/DST
MEASUREMENT SITE NO.: M6
DATE: 6/26/19
ADDRESS/DESCRIPTION: 10485 Crestwood Drive

#	__ Minute Period Starting	Meas'd Leq (dBA)	√ or X	Autos	Medium Trucks	Heavy Trucks	Other Noise Sources	COMMENTS (Include Calibration Data)
1	2:45	67.1						
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

TOTAL Leq = SUBSET Leq =

√ = Other sources contributed to Leq X = Exclude period - contaminated by non-characteristic sources

>> ADD SKETCH AND WEATHER CONDITIONS TO REVERSE OR OTHER SHEET <<

HARRIS MILLER MILLER & HANSON INC.

PROJECT: OR217 NB
JOB NO.: 310330.002

TRAFFIC VOLUME COUNT DATA SHEET

ASSESSMENT AREA: M6
MEASUREMENT SITE NO.: 6
ADDRESS/DESCRIPTION: 10485 Gesture Dr

START TIME: 2:45
END TIME: 3:00
DATE: 6-26-19
PERSONNEL: SRN/DST

ROADWAY:	OR 217	DIRECTION 1: SB	DIRECTION 2: NB
First Sample: 15 minutes **Start Time: 2:45**			
Automobiles		832	1003
Medium Trucks (6 Tires)		21	29
Heavy Trucks (>6 Tires)		14	7
Average speed (mph)		45-60	55-60
		(Bus 5, mo to 1)	(Bus 1)
Second Sample: 15 minutes **Start Time: 2:45**		SB tail of ramp	SB
Automobiles		116	
Medium Trucks (6 Tires)			
Heavy Trucks (>6 Tires)			
Average speed (mph)		25-35	
		(mo to 1)	
Third Sample: _____ minutes **Start Time: _____**			
Automobiles			
Medium Trucks (6 Tires)			
Heavy Trucks (>6 Tires)			
Average speed (mph)			
Fourth Sample: _____ minutes **Start Time: _____**			
Automobiles			
Medium Trucks (6 Tires)			
Heavy Trucks (>6 Tires)			
Average speed (mph)			

HARRIS MILLER MILLER & HANSON INC.

M06-Photo 1

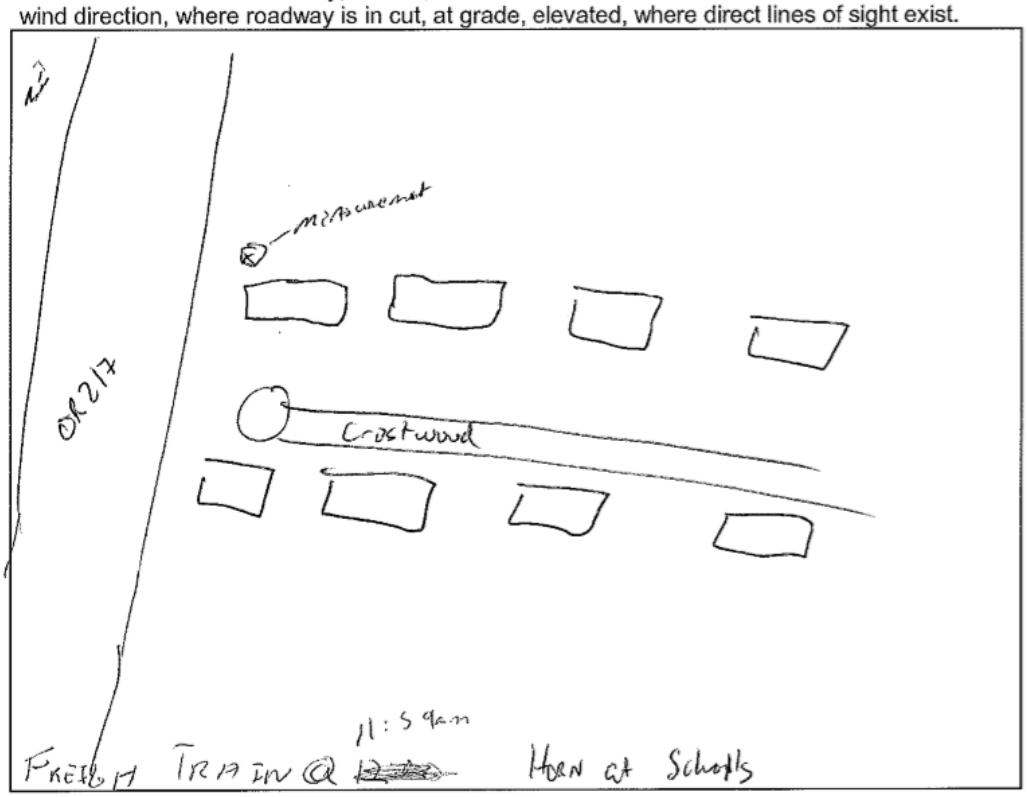
M06-Photo 2

PROJECT: OR217 NB
JOB NO.: 310330.002

SHORT-TERM NOISE MEASUREMENT SITE LOG

ASSESSMENT AREA: 27 MEASUREMENT SITE NO.: 27
ADDRESS: ~~[illegible]~~ 10435 SW Homestead Ln
OWNER:
DESCRIPTION: SF Home
NOISE SOURCES:
NOISE MONITOR: 824 S/N: Apt 1
MICROPHONE: LD S/N:
CALIBRATOR: LD S/N:
TEMP. RANGE (°F): 70 WEATHER CONDITIONS: Sunny

SITE SKETCH: Show roadway, homes, local roads, reference distances, arrows for North & wind direction, where roadway is in cut, at grade, elevated, where direct lines of sight exist.



PHOTOS: GPS COORDINATES:

HARRIS MILLER MILLER & HANSON INC.

SHORT-TERM NOISE MEASUREMENT DATA SHEET

PROJECT: OR217 NB
JOB NO.: 310330.002

MEASUREMENT SITE NO.: 7 PERSONNEL: SN
ADDRESS/DESCRIPTION: 10455 SW Homestead Ln DATE: 6-19

#	30-Minute Period Starting	Meas'd Leq (dBA)	√ or X	Autos	Medium Trucks	Heavy Trucks	Other Noise Sources	COMMENTS (Include Calibration Data)
1	11:33	70.3						
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
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19								
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21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

TOTAL Leq = SUBSET Leq =

√ = Other sources contributed to Leq X = Exclude period - contaminated by non-characteristic sources

>> ADD SKETCH AND WEATHER CONDITIONS TO REVERSE OR OTHER SHEET <<

HARRIS MILLER MILLER & HANSON INC.

PROJECT: OR217 NB
JOB NO.: 310330.002

TRAFFIC VOLUME COUNT DATA SHEET

ASSESSMENT AREA: ~~2~~ 7
MEASUREMENT SITE NO.: ~~2~~ 7
ADDRESS/DESCRIPTION: 10435 SW Hunziker Ln

START TIME: 11:33
END TIME: 12:10
DATE: 6/14/19
PERSONNEL: SN

		DIRECTION 1:	DIRECTION 2:
ROADWAY:	OR 217	SB	NB
First Sample: 15 **minutes** **Start Time:** 11:33			
	Automobiles	765	870
	Medium Trucks (6 Tires)	37	27
	Heavy Trucks (>6 Tires)	24	3
	Average speed (mph)	50-60	50-60
Second Sample: 15 **minutes** **Start Time:** 12:00	RAMPS	SB ON	~~SB~~ OFF
	Automobiles	48	88
	Medium Trucks (6 Tires)	~~0~~	~~9~~
	Heavy Trucks (>6 Tires)	3	3
	Average speed (mph)	15-35	~~0~~-45
Third Sample: _____ **minutes** **Start Time:** _____			
	Automobiles		
	Medium Trucks (6 Tires)		
	Heavy Trucks (>6 Tires)		
	Average speed (mph)		
Fourth Sample: _____ **minutes** **Start Time:** _____			
	Automobiles		
	Medium Trucks (6 Tires)		
	Heavy Trucks (>6 Tires)		
	Average speed (mph)		

HARRIS MILLER MILLER & HANSON INC.

M07-Photo 1

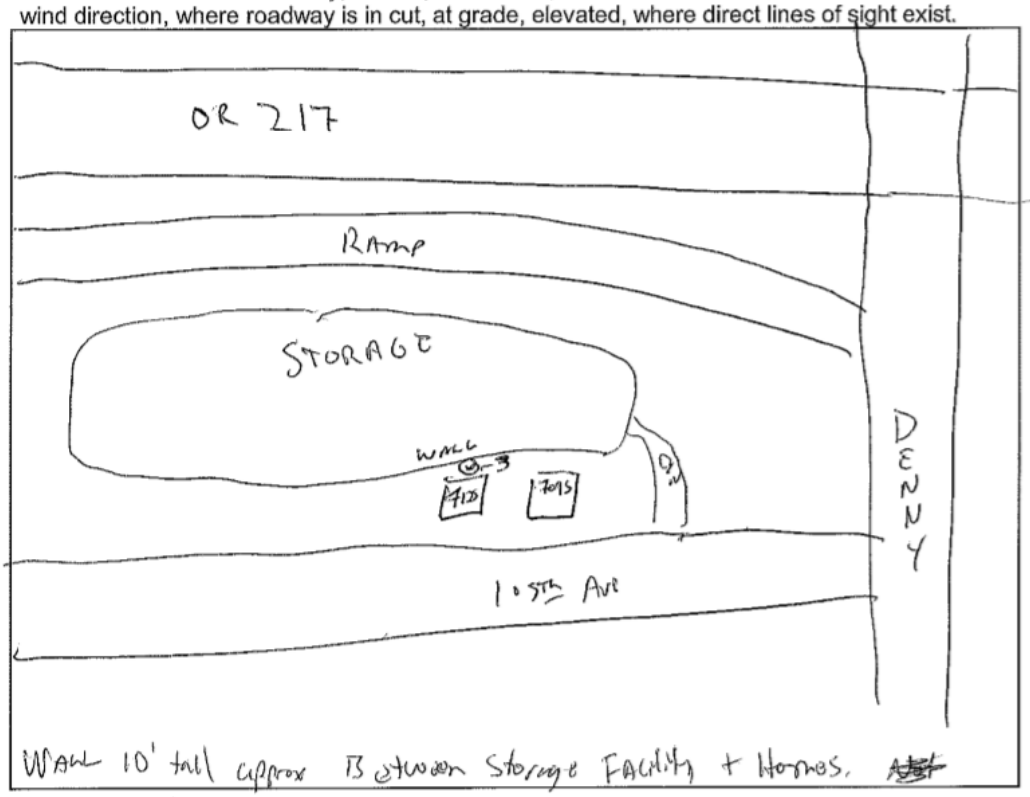
M07- Photo 2

PROJECT: OR217 NB
JOB NO.: 310330.002

SHORT-TERM NOISE MEASUREMENT SITE LOG

ASSESSMENT AREA: 8 MEASUREMENT SITE NO.: 8
ADDRESS: 7125 105th AVE
OWNER:
DESCRIPTION: SF Home
NOISE SOURCES: OR 217
NOISE MONITOR: 824 S/N: Kit 1
MICROPHONE: S/N:
CALIBRATOR: S/N:
TEMP. RANGE (°F): 70° WEATHER CONDITIONS: Sunny

SITE SKETCH: Show roadway, homes, local roads, reference distances, arrows for North & wind direction, where roadway is in cut, at grade, elevated, where direct lines of sight exist.



Wall 10' tall approx Between Storage Facility + Homes.

PHOTOS: YES GPS COORDINATES:

HARRIS MILLER MILLER & HANSON INC.

SHORT-TERM NOISE MEASUREMENT DATA SHEET

PROJECT: OR217 NB
JOB NO.: 310330.002

MEASUREMENT SITE NO.: 8 PERSONNEL: SN
ADDRESS/DESCRIPTION: 8 7123 SW 105th Ave DATE: 6/13/19

#	__ Minute Period Starting	Meas'd Leq (dBA)	√ or X	Autos	Medium Trucks	Heavy Trucks	Other Noise Sources	COMMENTS (Include Calibration Data)
1	1:21	56.3						
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
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25								
26								
27								
28								
29								
30								

TOTAL Leq = SUBSET Leq =

√ = Other sources contributed to Leq X = Exclude period - contaminated by non-characteristic sources

>> ADD SKETCH AND WEATHER CONDITIONS TO REVERSE OR OTHER SHEET <<

HARRIS MILLER MILLER & HANSON INC.

PROJECT: OR217 NB
JOB NO.: 310330.002

TRAFFIC VOLUME COUNT DATA SHEET

ASSESSMENT AREA:	#8	START TIME:	1:21
MEASUREMENT SITE NO.:	#8	END TIME:	[redacted] 1:55
ADDRESS/DESCRIPTION:	7125 105th	DATE:	6/12/19
		PERSONNEL:	SN

		DIRECTION 1:	DIRECTION 2:
ROADWAY:	OR 217	SB	NB
First Sample: 15 minutes **Start Time: 1:21**			
	Automobiles	978	1055
	Medium Trucks (6 Tires)	21	9
	Heavy Trucks (>6 Tires)	6	18
	Average speed (mph)	35-60	40-60
Second Sample: 15 minutes **Start Time: 1:37**		NB offramp	SB onramp
	Automobiles	63	70
	Medium Trucks (6 Tires)	3	4
	Heavy Trucks (>6 Tires)	-	-
	Average speed (mph)	0-45	0-45
Third Sample: _____ minutes **Start Time: _____**			
	Automobiles		
	Medium Trucks (6 Tires)		
	Heavy Trucks (>6 Tires)		
	Average speed (mph)		
Fourth Sample: _____ minutes **Start Time: _____**			
	Automobiles		
	Medium Trucks (6 Tires)		
	Heavy Trucks (>6 Tires)		
	Average speed (mph)		

HARRIS MILLER MILLER & HANSON INC.

M08-Photo 1

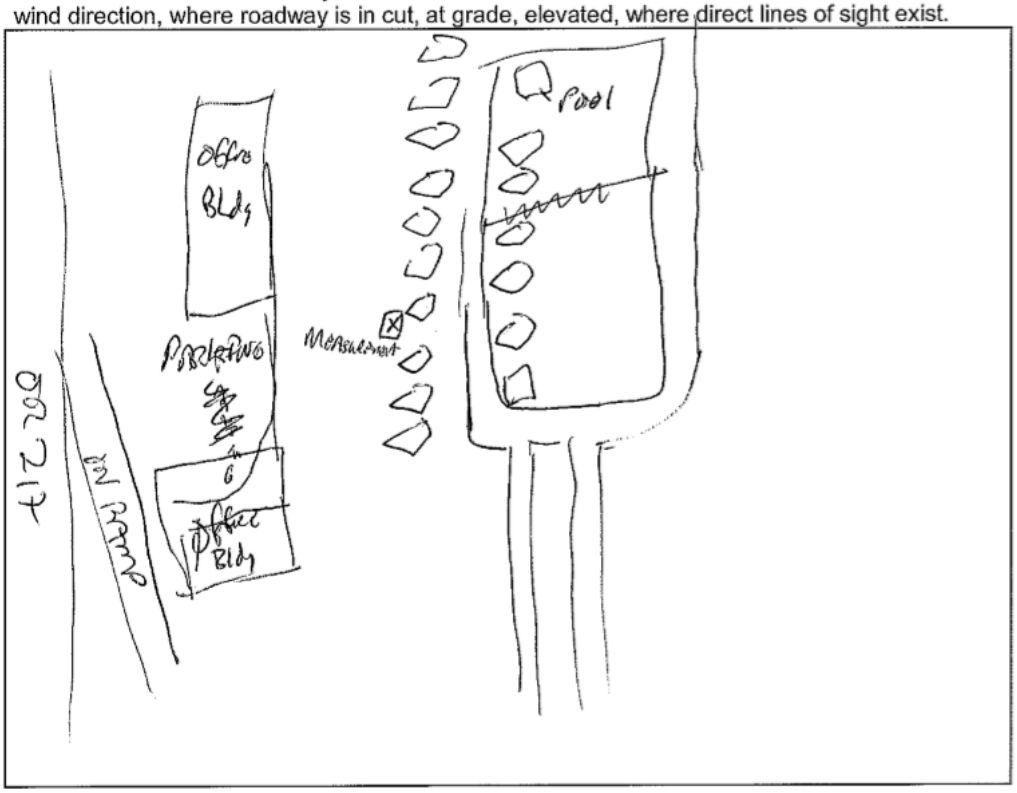
M08-Photo 2

PROJECT: OR217 NB
JOB NO.: 310330.002

SHORT-TERM NOISE MEASUREMENT SITE LOG

ASSESSMENT AREA: #7 MEASUREMENT SITE NO.:
ADDRESS: ~~115~~ Hidden Village Mobile Home Park Unit 6
OWNER: N/A
DESCRIPTION: Mobile Homes
NOISE SOURCES: OR 217, surface streets
NOISE MONITOR: 824 S/N: Kit #1
MICROPHONE: LD S/N:
CALIBRATOR: LD S/N:
TEMP. RANGE (°F): 70 WEATHER CONDITIONS: Sunny

SITE SKETCH: Show roadway, homes, local roads, reference distances, arrows for North & wind direction, where roadway is in cut, at grade, elevated, where direct lines of sight exist.



PHOTOS: Yes GPS COORDINATES: Yes

HARRIS MILLER MILLER & HANSON INC.

SHORT-TERM NOISE MEASUREMENT DATA SHEET

PROJECT: OR217 NB
JOB NO.: 310330.002
MEASUREMENT SITE NO.: #9 PERSONNEL: SW
ADDRESS/DESCRIPTION: #6 Mobile Home DATE: 6/14/09

#	__ Minute Period Starting	Meas'd Leq (dBA)	√ or X	Autos	Medium Trucks	Heavy Trucks	Other Noise Sources	COMMENTS (Include Calibration Data)
1	2:01	56.2						
2	2:32							
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
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24								
25								
26								
27								
28								
29								
30								

TOTAL Leq = SUBSET Leq =

√ = Other sources contributed to Leq X = Exclude period - contaminated by non-characteristic sources

>> ADD SKETCH AND WEATHER CONDITIONS TO REVERSE OR OTHER SHEET <<

HARRIS MILLER MILLER & HANSON INC.

PROJECT: OR217 NB
JOB NO.: 310330.002

TRAFFIC VOLUME COUNT DATA SHEET

ASSESSMENT AREA: ~~39~~
MEASUREMENT SITE NO.: ~~39~~
ADDRESS/DESCRIPTION: Mobile Home Park Unit #6

START TIME: 2:00
END TIME: 2:35
DATE: 6/13/19
PERSONNEL: SN

		DIRECTION 1:	DIRECTION 2:
ROADWAY:	OR217	SB	NB
First Sample: 15 minutes **Start Time: 2:05**			
	Automobiles	910	951
	Medium Trucks (6 Tires)	37	12
	Heavy Trucks (>6 Tires)	4	4
	Average speed (mph)	25-40	40-50
Second Sample: 15 minutes **Start Time: 2:20**		NB on ramp	
	Automobiles	77	
	Medium Trucks (6 Tires)	—	
	Heavy Trucks (>6 Tires)	6	
	Average speed (mph)		
Third Sample: _____ minutes **Start Time: _____**			
	Automobiles		
	Medium Trucks (6 Tires)		
	Heavy Trucks (>6 Tires)		
	Average speed (mph)		
Fourth Sample: _____ minutes **Start Time: _____**			
	Automobiles		
	Medium Trucks (6 Tires)		
	Heavy Trucks (>6 Tires)		
	Average speed (mph)		

HARRIS MILLER MILLER & HANSON INC.

M09-Photo 1

M09-Photo 2

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.41536

Instrument:	**Sound Level Meter**	*Date Calibrated:*	**10/5/2018**	*Cal Due:*	
Model:	**820**	*Status:*	**Received**	**Sent**	
Manufacturer:	**Larson Davis**	*In tolerance:*	**X**	**X**	
Serial number:	**1212**	*Out of tolerance:*			
Tested with:	**Microphone 40AQ s/n 25851**	*See comments:*			
	Preamplifier PRM828s/n 1906	*Contains non-accredited tests:*	**__Yes X No**		
Type (class):	**1**	*Calibration service:*	**__ Basic X Standard**		
Customer:	**Harris Miller Miller & Hanson Inc.**	*Address:*	**77 South Bedford Street, Burlington, MA 01803**		
Tel/Fax:	**781-229-0707 x3119 / 781-229-7939**				

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31052	Oct 30, 2017	Scantek, Inc./ NVLAP	Oct 30, 2018
DS-360-SRS	Function Generator	33584	Oct 24, 2017	ACR Env./ A2LA	Oct 24, 2019
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Oct 25, 2017	ACR Env. / A2LA	Oct 25, 2018
HM30-Thommen	Meteo Station	1040170/39633	Oct 25, 2017	ACR Env./ A2LA	Oct 25, 2018
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2017	Scantek, Inc./ NVLAP	Nov 10, 2018

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.8	100.48	54.8

Calibrated by:	Lydon Dawkins	**Authorized signatory:**	Steven E. Marshall
Signature	Lydon Dawkins	Signature	Steven E. Marshall
Date	10/5/2018	Date	10/6/2018

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Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.41537

Instrument: **Microphone**
Model: **40AQ**
Manufacturer: **GRAS**
Serial number: **25851**
Composed of:

Date Calibrated: **10/5/2018** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **Harris Miller Miller & Hanson Inc.**
Tel/Fax: **781-229-0707 x3119/781-229-7939**
Address: **77 South Bedford Street, Burlington, MA 01803**

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31052	Oct 30, 2017	Scantek, Inc./ NVLAP	Oct 30, 2018
DS-360-SRS	Function Generator	33584	Oct 24, 2017	ACR Env./ A2LA	Oct 24, 2019
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Oct 25, 2017	ACR Env. / A2LA	Oct 25, 2018
HM30-Thommen	Meteo Station	1040170/39633	Oct 25, 2017	ACR Env./ A2LA	Oct 25, 2018
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2017	Scantek, Inc./ NVLAP	Nov 10, 2018
1203-Norsonic	Preamplifier	14059	Feb 12, 2018	Scantek, Inc./ NVLAP	Feb 12, 2019
4180-Brüel&Kjær	Microphone	2246115	Oct 24, 2017	DANAK / DPLA	Oct 24, 2019

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Lydon Dawkins	Authorized signatory:	Steven E. Marshall
Signature	Lydon Dawkins	Signature	Steven E. Marshall
Date	10/5/2018	Date	10/6/2018

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Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.41538

Instrument:	**Acoustical Calibrator**	*Date Calibrated:* **10/2/2018** *Cal Due:*	
Model:	**CAL250**	*Status:*	**Received** / **Sent**
Manufacturer:	**Larson Davis**	*In tolerance:*	X / X
Serial number:	**2842**	*Out of tolerance:*	
Class (IEC 60942):	**1L**	*See comments:*	
Barometer type:		*Contains non-accredited tests:*	**__Yes _X_ No**
Barometer s/n:			
Customer:	**Harris Miller Miller & Hanson Inc.**	*Address:*	**77 South Bedford Street, Burlington, MA 01803**
Tel/Fax:	**781-229-0707 x3119 / 781-229-7939**		

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., Rev. 10/1/2010

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31052	Oct 30, 2017	Scantek, Inc./ NVLAP	Oct 30, 2018
DS-360-SRS	Function Generator	33584	Oct 24, 2017	ACR Env./ A2LA	Oct 24, 2019
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Oct 25, 2017	ACR Env. / A2LA	Oct 25, 2018
HM30-Thommen	Meteo Station	1040170/39633	Oct 25, 2017	ACR Env./ A2LA	Oct 25, 2018
140-Norsonic	Real Time Analyzer	1406423	Oct 31, 2017	Scantek / NVLAP	Oct 31, 2018
PC Program 1018 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
4134-Brüel&Kjær	Microphone	173368	Nov 10, 2017	Scantek, Inc. / NVLAP	Nov 10, 2018
1203-Norsonic	Preamplifier	14059	Feb 12, 2018	Scantek, Inc./ NVLAP	Feb 12, 2019

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by:	Lydon Dawkins	**Authorized signatory:**	Steven E. Marshall
Signature	Lydon Dawkins	Signature	Steven E. Marshall
Date	10/2/2018	Date	10/4/2018

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Appendix C Detailed Barrier Spreadsheet

Project Information	No Barrier Analysis	Analysis1	Analysis2	Analysis3	Analysis4	Analysis5
	No Barrier	Barr_1_10_feet	Barr_1_12_feet	Barr_1_14_feet	Barr_1_16_feet	Barr_1_18_feet
		Average Wtd I.L. (benefited) 6.0 dB I.L. Avg	Average Wtd I.L. 6.7 dB I.L. Avg	Average Wtd I.L. 7.2 dB I.L. Avg	Average Wtd I.L. 7.6 dB I.L. Avg	Average Wtd I.L. 8.0 dB I.L. Avg
		Maximum I.L. 8 dB I.L. Max	Maximum I.L. 10 dB I.L. Max	Maximum I.L. 12 dB I.L. Max	Maximum I.L. 14 dB I.L. Max	Maximum I.L. 15 dB I.L. Max
OR 217 North of Hall Overpass	Total Units Exposed to Impact 12	Benefited/Impacted ≥ AFG 12 # Prot Units	Benefited/Impacted ≥ AFG 12 # Prot Units	Benefited/Impacted ≥ AFG 12 # Prot Units	Benefited/Impacted ≥ AFG 12 # Prot Units	Benefited/Impacted ≥ AFG 12 # Prot Units
310330.002	# Impacts - NAC only 12	Benefited/Non Impact ≥ AFG 14 # Units	Benefited/Non Impact ≥ AFG 16 # Units	Benefited/Non Impact ≥ AFG 18 # Units	Benefited/Non Impact ≥ AFG 19 # Units	Benefited/Non Impact ≥ AFG 19 # Units
Build, Barr 1	# Impacts - SI only 0	Total Benefited 26 # Ben Units	Total Benefited 28 # Ben Units	Total Benefited 30 # Ben Units	Total Benefited 31 # Ben Units	Total Benefited 31 # Ben Units
Barr 1	# Impacts - Both NAC & SI 0	Impacted Units ≥ NRDG 6 # Units	Impacted Units ≥ NRDG 11 # Units	Impacted Units ≥ NRDG 12 # Units	Impacted Units ≥ NRDG 12 # Units	Impacted Units ≥ NRDG 12 # Units
Oregon Department of Transportation, Region 1	Front Row Summary	Benefited Units ≥ NRDG 7 # Units	Benefited Units ≥ NRDG 15 # Units	Benefited Units ≥ NRDG 20 # Units	Benefited Units ≥ NRDG 23 # Units	Benefited Units ≥ NRDG 23 # Units
Dillon Tanner (DST) and Scott Noel (SRN)	Feasibility Uses Front Row? (Enter "Y") Y	Percent of impacts ≥ AFG 100% % Ben Units	Percent of impacts ≥ AFG 100% % Ben Units	Percent of impacts ≥ AFG 100% % Ben Units	Percent of impacts ≥ AFG 100% % Ben Units	Percent of impacts ≥ AFG 100% % Ben Units
6/20/2019	Reasonableness Uses Front Row? (Enter "Y") Y	Percent of benefits ≥ NRDG 27% % NRDG Units	Percent of benefits ≥ NRDG 54% % NRDG Units	Percent of benefits ≥ NRDG 67% % NRDG Units	Percent of benefits ≥ NRDG 74% % NRDG Units	Percent of benefits ≥ NRDG 74% % NRDG Units
	Front Row Impacts 0	"Cost-Reasonable"? Yes	"Cost-Reasonable"? Yes	"Cost-Reasonable"? Yes	"Cost-Reasonable"? Yes	"Cost-Reasonable"? Yes
		Surface Area 20130 Sq Feet	Surface Area 24153 Sq Feet	Surface Area 28181 Sq Feet	Surface Area 32209 Sq Feet	Surface Area 36233 Sq Feet
	$/dB/BR?	Surface Area/Ben Rec 774 Sq Feet	Surface Area/Ben Rec 863 Sq Feet	Surface Area/Ben Rec 939 Sq Feet	Surface Area/Ben Rec 1039 Sq Feet	Surface Area/Ben Rec 1169 Sq Feet
		Barrier Length 2,017 Feet	Barrier Length 2,017 Feet	Barrier Length 2,017 Feet	Barrier Length 2,017 Feet	Barrier Length 2,017 Feet
		Min Height 10.0 Feet	Min Height 12.0 Feet	Min Height 14.0 Feet	Min Height 16.0 Feet	Min Height 18.0 Feet
		Max Height 10.0 Feet	Max Height 12.0 Feet	Max Height 14.0 Feet	Max Height 16.0 Feet	Max Height 18.0 Feet
		Avg Height 10.0 Feet	Avg Height 12.0 Feet	Avg Height 14.0 Feet	Avg Height 16.0 Feet	Avg Height 18.0 Feet
		Total Barrier Cost $402,600	Total Barrier Cost $483,060	Total Barrier Cost $563,620	Total Barrier Cost $644,180	Total Barrier Cost $724,660
	Enter SI Info $/dB/BR? 25000	Cost/Ben Rec $15,485	Cost/Ben Rec $17,252	Cost/Ben Rec $18,787	Cost/Ben Rec $20,780	Cost/Ben Rec $23,376
	Enter SI Info	Front Row Benefits 0	Front Row Benefits 0	Front Row Benefits 0	Front Row Benefits 0	Front Row Benefits 0
		Front Row NRDG 0	Front Row NRDG 0	Front Row NRDG 0	Front Row NRDG 0	Front Row NRDG 0

U.S. Department of Transportation Federal Highway Administration

Receiver ID	Row	FHWA Act Cat	No. of Dwelling Units	Type of Impact: Bld Leq > NAC?	Type of Impact: Sub. Inc.?	Impact?	No. of Impacted Units	With Barrier Sound Levels, Impact and Benefit: Leq(dBA)	IL (db)	Impacted?	No. Benefited
R-172	0	C	1	49				49	0		
R-171	0	C	1	52				51	1		
R-173	0	C	1	60				59	1		
R-174	0	C	1	58				56	2		
R-175	0	C	1	55				53	2		
R-176	0	D	1	30				30	0		
R-177	0	C	1	76		Impact!	1	68	8	Benefited/Impact	1
R-178	0	B	1	70		Impact!	1	63	7	Benefited/Impact	1
R-179	0	B	1	67		Impact!	1	61	6	Benefited/Impact	1
R-180	0	B	1	66		Impact!	1	60	6	Benefited/Impact	1
R-181	0	B	1	66		Impact!	1	59	7	Benefited/Impact	1
R-182	0	B	1	66		Impact!	1	59	7	Benefited/Impact	1
R-183	0	B	1	64				59	5	Benefited/Non-Imp	1
R-184	0	B	1	63				57	6	Benefited/Non-Imp	1
R-185	0	B	1	61				55	6	Benefited/Non-Imp	1
R-186	0	B	1	66		Impact!	1	60	6	Benefited/Impact	1
R-187	0	B	1	67		Impact!	1	60	7	Benefited/Impact	1
R-188	0	B	1	62				55	7	Benefited/Non-Imp	1
R-189	0	B	1	62				56	6	Benefited/Non-Imp	1
R-190	0	B	1	66		Impact!	1	60	6	Benefited/Impact	1
R-191	0	B	1	67		Impact!	1	61	6	Benefited/Impact	1
R-192	0	B	1	60				55	5	Benefited/Non-Imp	1
R-193	0	B	1	64				59	5	Benefited/Non-Imp	1
R-194	0	B	1	60				55	5	Benefited/Non-Imp	1
R-195	0	B	1	66		Impact!	1	60	6	Benefited/Impact	1
R-196	0	B	1	60				56	4		
R-197	0	B	1	56				55	1		
R-198	0	B	1	57				53	4		
R-199	0	B	1	58				53	5	Benefited/Non-Imp	1
R-200	0	B	1	54				53	1		
R-201	0	B	1	69		Impact!	1	61	8	Benefited/Impact	1
R-202	0	B	1	60				57	3		
R-203	0	B	1	58				55	3		
R-204	0	B	1	57				55	2		
R-213	0	E	1	57				55	2		
R-214	0	B	1	57				56	1		
R-215	0	B	1	57				56	1		
R-216	0	B	1	56				55	1		
R-217	0	B	1	55				54	1		
R-218	0	B	1	55				54	1		
R-219	0	B	1	54				53	1		
R-220	0	B	1	54				53	1		
R-221	0	B	1	53				51	2		
R-222	0	B	1	53				52	1		
R-223	0	B	1	51				50	1		
R-224	0	B	1	51				50	1		
R-225	0	B	1	55				52	3		
R-226	0	B	1	53				51	2		
R-227	0	B	1	52				51	1		
R-228	0	B	1	57				52	5	Benefited/Non-Imp	1
R-229	0	B	1	56				53	3		
R-230	0	B	1	53				52	1		
R-231	0	B	1	59				54	5	Benefited/Non-Imp	1
R-232	0	B	1	57				52	5	Benefited/Non-Imp	1
R-233	0	B	1	56				52	4		
R-234	0	B	1	55				52	3		
R-235	0	B	1	54				51	3		
R-236	0	B	1	54				52	2		
R-237	0	B	1	59				53	6	Benefited/Non-Imp	1
R-238	0	B	1	58				53	5	Benefited/Non-Imp	1
R-239	0	B	1	54				51	3		
R-240	0	B	1	53				50	3		
R-241	0	B	1	53				51	2		
R-242	0	B	1	56				52	4		

Receiver ID	Analysis2: Leq(dBA)	IL (db)	Impacted?	No. Benefited	Analysis3: Leq(dBA)	IL (db)	Impacted?	No. Benefited	Analysis4: Leq(dBA)	IL (db)	Impacted?	No. Benefited	Analysis5: Leq(dBA)	IL (db)	Impacted?	No. Benefited
R-172	49	0			49	0			49	0			49	0		
R-171	51	1			51	1			51	1			51	1		
R-173	59	1			59	1			59	1			58	2		
R-174	55	3			55	3			54	4			54	4		
R-175	52	3			52	3			52	3			51	4		
R-176	30	0			30	0			30	0			30	0		
R-177	66	10	Benefited/Impact	1	64	12	Benefited/Impact	1	62	14	Benefited/Impact	1	61	15	Benefited/Impact	1
R-178	61	9	Benefited/Impact	1	60	10	Benefited/Impact	1	59	11	Benefited/Impact	1	59	11	Benefited/Impact	1
R-179	60	7	Benefited/Impact	1	59	8	Benefited/Impact	1	58	9	Benefited/Impact	1	58	9	Benefited/Impact	1
R-180	59	7	Benefited/Impact	1	58	8	Benefited/Impact	1	58	8	Benefited/Impact	1	57	9	Benefited/Impact	1
R-181	58	8	Benefited/Impact	1	58	8	Benefited/Impact	1	57	9	Benefited/Impact	1	57	9	Benefited/Impact	1
R-182	59	7	Benefited/Impact	1	58	8	Benefited/Impact	1	58	8	Benefited/Impact	1	57	9	Benefited/Impact	1
R-183	58	6	Benefited/Non-Imp	1	57	7	Benefited/Non-Imp	1	56	8	Benefited/Non-Imp	1	55	9	Benefited/Non-Imp	1
R-184	56	7	Benefited/Non-Imp	1	55	8	Benefited/Non-Imp	1	54	9	Benefited/Non-Imp	1	53	10	Benefited/Non-Imp	1
R-185	54	7	Benefited/Non-Imp	1	53	8	Benefited/Non-Imp	1	53	8	Benefited/Non-Imp	1	52	9	Benefited/Non-Imp	1
R-186	59	7	Benefited/Impact	1	58	8	Benefited/Impact	1	58	8	Benefited/Impact	1	57	9	Benefited/Impact	1
R-187	59	8	Benefited/Impact	1	59	8	Benefited/Impact	1	58	9	Benefited/Impact	1	57	10	Benefited/Impact	1
R-188	55	7	Benefited/Non-Imp	1	54	8	Benefited/Non-Imp	1	53	9	Benefited/Non-Imp	1	53	9	Benefited/Non-Imp	1
R-189	55	7	Benefited/Non-Imp	1	54	8	Benefited/Non-Imp	1	54	8	Benefited/Non-Imp	1	54	8	Benefited/Non-Imp	1
R-190	59	7	Benefited/Impact	1	59	7	Benefited/Impact	1	58	8	Benefited/Impact	1	57	9	Benefited/Impact	1
R-191	60	7	Benefited/Impact	1	60	7	Benefited/Impact	1	59	8	Benefited/Impact	1	59	8	Benefited/Impact	1
R-192	54	6	Benefited/Non-Imp	1	53	7	Benefited/Non-Imp	1	53	7	Benefited/Non-Imp	1	53	7	Benefited/Non-Imp	1
R-193	58	6	Benefited/Non-Imp	1	58	6	Benefited/Non-Imp	1	57	7	Benefited/Non-Imp	1	57	7	Benefited/Non-Imp	1
R-194	54	6	Benefited/Non-Imp	1	54	6	Benefited/Non-Imp	1	53	7	Benefited/Non-Imp	1	53	7	Benefited/Non-Imp	1
R-195	60	6	Benefited/Impact	1	59	7	Benefited/Impact	1	58	8	Benefited/Impact	1	58	8	Benefited/Impact	1
R-196	56	4			55	5	Benefited/Non-Imp	1	55	5	Benefited/Non-Imp	1	54	6	Benefited/Non-Imp	1
R-197	54	2			54	2			53	3			53	3		
R-198	52	5	Benefited/Non-Imp	1	52	5	Benefited/Non-Imp	1	52	5	Benefited/Non-Imp	1	52	5	Benefited/Non-Imp	1
R-199	52	6	Benefited/Non-Imp	1	52	6	Benefited/Non-Imp	1	52	6	Benefited/Non-Imp	1	52	6	Benefited/Non-Imp	1
R-200	53	1			52	2			52	2			52	2		
R-201	60	9	Benefited/Impact	1	59	10	Benefited/Impact	1	59	10	Benefited/Impact	1	58	11	Benefited/Impact	1
R-202	57	3			56	4			55	5	Benefited/Non-Imp	1	55	5	Benefited/Non-Imp	1
R-203	55	3			54	4			54	4			54	4		
R-204	55	2			55	2			55	2			55	2		
R-213	55	2			54	3			53	4			53	4		
R-214	56	1			55	2			55	2			55	2		
R-215	56	1			56	1			55	2			55	2		
R-216	55	1			55	1			55	1			55	1		
R-217	54	1			54	1			54	1			54	1		
R-218	54	1			54	1			54	1			54	1		
R-219	53	1			53	1			53	1			53	1		
R-220	53	1			52	2			52	2			52	2		
R-221	51	2			51	2			51	2			51	2		
R-222	52	1			52	1			52	1			52	1		
R-223	50	1			50	1			50	1			50	1		
R-224	50	1			50	1			50	1			50	1		
R-225	52	3			52	3			52	3			52	3		
R-226	51	2			51	2			51	2			51	2		
R-227	51	1			51	1			51	1			51	1		
R-228	52	5	Benefited/Non-Imp	1	52	5	Benefited/Non-Imp	1	52	5	Benefited/Non-Imp	1	51	6	Benefited/Non-Imp	1
R-229	52	4			52	4			52	4			52	4		
R-230	51	2			51	2			51	2			51	2		
R-231	53	6	Benefited/Non-Imp	1	52	7	Benefited/Non-Imp	1	52	7	Benefited/Non-Imp	1	52	7	Benefited/Non-Imp	1
R-232	52	5	Benefited/Non-Imp	1	51	6	Benefited/Non-Imp	1	51	6	Benefited/Non-Imp	1	51	6	Benefited/Non-Imp	1
R-233	51	5	Benefited/Non-Imp	1	51	5	Benefited/Non-Imp	1	51	5	Benefited/Non-Imp	1	51	5	Benefited/Non-Imp	1
R-234	51	4			51	4			51	4			51	4		
R-235	51	3			51	3			51	3			51	3		
R-236	51	3			51	3			51	3			51	3		
R-237	53	6	Benefited/Non-Imp	1	52	7	Benefited/Non-Imp	1	52	7	Benefited/Non-Imp	1	52	7	Benefited/Non-Imp	1
R-238	52	6	Benefited/Non-Imp	1	52	6	Benefited/Non-Imp	1	51	7	Benefited/Non-Imp	1	51	7	Benefited/Non-Imp	1
R-239	50	4			50	4			50	4			50	4		
R-240	50	3			50	3			50	3			50	3		
R-241	51	2			50	3			50	3			50	3		
R-242	52	4			51	5	Benefited/Non-Imp	1	51	5	Benefited/Non-Imp	1	51	5	Benefited/Non-Imp	1

Project Information		No Barrier Analysis		Analysis7		
		No Barrier		Barr_1_Optimized		
				Average Wtd I.L. (benefited)	7.2	dB I.L. Avg
				Maximum I.L.	12	dB I.L. Max
OR 217 North of Hall Overpass		Total Units Exposed to Impact	12	Benefited/Impacted ≥ AFG	12	# Prot Units
310330.002		# Impacts - NAC only	12	Benefited/Non Impact ≥ AFG	17	# Units
Build, Barr 1		# Impacts - SI only	0	Total Benefited	29	# Ben Units
Barr 1		# Impacts - Both NAC & SI	0	Impacted Units ≥ NRDG	12	# Units
Oregon Department of Transportation, Region 1		Front Row Summary		Benefited Units ≥ NRDG	19	# Units
Dillon Tannler (DST) and Scott Noel (SRN)		Feasibility Uses Front Row? (Enter "Y")	Y	Percent of impacts ≥ AFG	100%	% Ben Units
6/20/2019		Reasonableness Uses Front Row? (Enter "Y")	Y	Percent of benefits ≥ NRDG	66%	% NRDG Units
		Front Row Impacts	0	"Cost-Reasonable" ?	Yes	
				Surface Area	23983	Sq Feet
			SF/dB/BR?	Surface Area/Ben Rec	827	Sq Feet
				Barrier Length	1,749	Feet
				Min Height	10.0	Feet
				Max Height	14.0	Feet
				Avg Height	13.7	Feet
				Total Barrier Cost	$479,660	
		Enter SI Info	$/dB/BR? 25000	Cost/Ben Rec	$16,540	
		Enter SI Info		Front Row Benefits		0
				Front Row NRDG		0

Receiver ID	Row	FHWA Act Cat	No. of Dwelling Units	Type of Impact: Bld Leq > NAC?	Type of Impact: Sub. Inc.?	Impact?	No. of Impacted Units	With Barrier Sound Levels, Impact and Benefit: Leq(dBA)	IL (db)	Impacted?	No. Benefited
R-172	0	C	1	49				49	0		
R-171	0	C	1	52				51	1		
R-173	0	C	1	60				59	1		
R-174	0	C	1	58				56	2		
R-175	0	C	1	55				52	3		
R-176	0	D	1	30				29	1		
R-177	0	C	1	76		Impact!	1	64	12	Benefited/Impact	1
R-178	0	B	1	70		Impact!	1	60	10	Benefited/Impact	1
R-179	0	B	1	67		Impact!	1	59	8	Benefited/Impact	1
R-180	0	B	1	66		Impact!	1	58	8	Benefited/Impact	1
R-181	0	B	1	66		Impact!	1	58	8	Benefited/Impact	1
R-182	0	B	1	66		Impact!	1	58	8	Benefited/Impact	1
R-183	0	B	1	64				57	7	Benefited/Non-Imp	1
R-184	0	B	1	63				55	8	Benefited/Non-Imp	1
R-185	0	B	1	61				53	8	Benefited/Non-Imp	1
R-186	0	B	1	66		Impact!	1	58	8	Benefited/Impact	1
R-187	0	B	1	67		Impact!	1	59	8	Benefited/Impact	1
R-188	0	B	1	62				54	8	Benefited/Non-Imp	1
R-189	0	B	1	62				54	8	Benefited/Non-Imp	1
R-190	0	B	1	66		Impact!	1	59	7	Benefited/Impact	1
R-191	0	B	1	67		Impact!	1	60	7	Benefited/Impact	1
R-192	0	B	1	60				53	7	Benefited/Non-Imp	1
R-193	0	B	1	64				58	6	Benefited/Non-Imp	1
R-194	0	B	1	60				54	6	Benefited/Non-Imp	1
R-195	0	B	1	66		Impact!	1	59	7	Benefited/Impact	1
R-196	0	B	1	60				55	5	Benefited/Non-Imp	1
R-197	0	B	1	56				54	2		
R-198	0	B	1	57				52	5	Benefited/Non-Imp	1
R-199	0	B	1	58				52	6	Benefited/Non-Imp	1
R-200	0	B	1	54				53	1		
R-201	0	B	1	69		Impact!	1	60	9	Benefited/Impact	1
R-202	0	B	1	60				56	4		
R-203	0	B	1	58				55	3		
R-204	0	B	1	57				55	2		
R-213	1	B	1	57				55	2		
R-214	2	B	1	57				56	1		
R-215	3	B	1	57				56	1		
R-216	4	B	1	56				55	1		
R-217	5	B	1	55				54	1		
R-218	6	B	1	55				54	1		
R-219	7	B	1	54				53	1		
R-220	8	B	1	54				53	1		
R-221	9	B	1	53				51	2		
R-222	10	B	1	53				52	1		
R-223	11	B	1	51				50	1		
R-224	12	B	1	51				50	1		
R-225	13	B	1	55				52	3		
R-226	14	B	1	53				51	2		
R-227	15	B	1	52				51	1		
R-228	16	B	1	57				52	5	Benefited/Non-Imp	1
R-229	17	B	1	56				52	4		
R-230	18	B	1	53				51	2		
R-231	19	B	1	59				53	6	Benefited/Non-Imp	1
R-232	20	B	1	57				52	5	Benefited/Non-Imp	1
R-233	21	B	1	56				51	5	Benefited/Non-Imp	1
R-234	22	B	1	55				51	4		
R-235	23	B	1	54				51	3		
R-236	24	B	1	54				51	3		
R-237	25	B	1	59				52	7	Benefited/Non-Imp	1
R-238	26	B	1	58				52	6	Benefited/Non-Imp	1
R-239	27	B	1	54				50	4		
R-240	28	B	1	53				50	3		
R-241	29	B	1	53				51	2		
R-242	30	B	1	56				52	4		