WEST DAVIS
CORRIDOR

Noise Technical Report

in support of the
Antelope Drive SPUI Re-evaluation of the Environmental Impact Statement

West Davis Corridor Project

Utah Department of Transportation

UDOT
udot.utah.gov

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1 Introduction

The purpose of this technical report is to evaluate the expected changes in noise impacts and mitigation, as documented in the West Davis Corridor (WDC) Final Environmental Impact Statement (EIS) and Record of Decision (ROD), compared to the Request for Proposal (RFP) design for the WDC for the Antelope Drive (State Route 127) interchange in the area between 3000 West and about 2300 South in Syracuse, Utah.

The WDC ROD was signed on September 29, 2017. In November 2019, the Utah Department of Transportation (UDOT) prepared a re-evaluation of the EIS that evaluated the change from a diamond interchange at Antelope Drive in Syracuse, Utah, to a single-point urban interchange (SPUI). This report evaluates the traffic-generated noise impacts from this change. More details about this change are provided in Section 2, Project Description, of this report.

This noise analysis was prepared in accordance with UDOT's Noise Abatement Policy, last revised June 15, 2017, which is consistent with federal regulation 23 Code of Federal Regulations (CFR) Part 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, and Utah Administrative Code Rule R930-3, *Highway Noise Abatement*.

2 Project Description

The project area for this report is the area along the WDC from 3000 West to about 2300 South in Syracuse, Utah.

In the Final EIS, the Preferred Alternative design at the Antelope Drive interchange was a grade-separated diamond interchange with a loop ramp for the southbound on ramp movement. With the Final EIS Preferred Alternative, 3000 West was shifted west between about 1600 South and 1800 South to provide spacing for the southbound off ramp and southbound on ramp loop ramp.

The WDC RFP design Refined Selected Alternative evaluated in this report includes the WDC RFP design at the Antelope Drive interchange. The WDC RFP design includes constructing a grade-separated SPUI at Antelope Drive. The WDC RFP design does not require any realignment of 3000 West.

The changes with the Refined Selected Alternative are (1) small shifts to the horizontal alignment of the WDC at the Antelope Drive interchange and (2) changes to horizontal and vertical alignments of the on and off ramps with the WDC RFP SPUI interchange at Antelope Drive.

Applicability

The Refined Selected Alternative is new highway construction. Therefore, this project is a Type 1 project that requires considering noise-abatement measures.

What is a Type 1 project?

According to UDOT's Noise Abatement Policy, a Type 1 project is a project that alters the horizontal or vertical alignment of a road or increases the number of through travel lanes.

UDOT evaluated noise impacts using noise models and methodologies approved by the Federal Highway Administration (FHWA) and UDOT (*Noise Abatement*, UDOT 08A2-01, revised June 15, 2017). Noise impacts were identified and evaluated at residential and other locations (for example, schools and recreation sites) within about 800 feet from the nearest travel lane using level of service (LOS) C traffic volumes to represent the worst-case noise conditions while traffic is operating at uncongested, free-flow speeds of 65 miles per hour (mph) on the WDC, 45 mph on the WDC on and off ramps, and 40 mph on Antelope Drive.

3 Characteristics of Noise

Sound travels through the air as waves of minute air-pressure fluctuations caused by vibration. In general, sound waves travel away from the noise source as an expanding spherical surface. As a result, the energy contained in a sound wave is spread over an increasing area as it travels away from the source. This results in a decrease in loudness at greater distances from the noise source.

Sound-level meters measure the actual pressure fluctuations caused by sound waves and record separate measurements for different sound frequency ranges. The decibel (dB) scale used to describe sound is a logarithmic scale that accounts for the large range of sound-pressure levels in the environment. Most sounds consist of a broad range of sound frequencies. Several frequency-weighting schemes have been used to develop composite decibel scales that approximate the way the human ear responds to sound levels. The A-weighted decibel (dBA) scale most closely approximates the way the human ear hears sounds and is the most widely used scale in assessing traffic-related noise impacts. Typical A-weighted noise levels for various types of sound sources are summarized in Table 1.

Varying noise levels are often described in terms of the equivalent noise level (L_{eq}). Equivalent noise levels are used to develop single-value descriptions of average noise exposure over stated periods of time (for example, 1 hour) and are generally based on A-weighted sound-level measurements.

The logarithmic nature of decibel scales is such that individual decibel ratings for different noise sources cannot be added directly to give the noise level for the combined noise source. For example, two noise sources that produce equal decibel ratings at a given location will produce a combined noise level that is 3 dBA greater than either sound alone. When two noise sources differ by 10 dBA, the combined noise level will be 0.4 dBA greater than the louder source alone.

People generally perceive a 10-dBA increase in a noise source as a doubling of loudness. For example, a 70-dBA sound will be perceived by an average person as twice as loud as a

60-dBA sound. People generally cannot detect a 1-to-2-dBA increase in noise levels. Under ideal listening conditions, differences of 2 or 3 dBA can be detected by some people. A 5-dBA change would probably be perceived by most people under normal listening conditions.

When distance is the only factor considered, sound levels from isolated point sources of noise typically decrease by about 6 dBA for every doubling of distance from the noise source. When the noise source is a continuous line (for example, vehicle traffic on a highway), noise levels decrease by about 3 dBA for every doubling of distance away from the source.

Table 1. Weighted Noise Levels and Human Response

Sound Source	dBA[a]	Response Descriptor
Carrier deck jet operation	140	Limit of amplified speech
	130	Painfully loud
Jet takeoff (200 feet) Auto horn (3 feet)	120	Threshold of feeling and pain
Riveting machine Jet takeoff (2,000 feet)	110	
Shout (0.5 foot) New York subway station	100	Very annoying
Heavy truck (50 feet) Pneumatic drill (50 feet)	90	Hearing damage (8-hour exposure)
Passenger train (100 feet) Helicopter (in-flight, 500 feet) Freight train (50 feet)	80	Annoying
Freeway traffic (50 feet)	70	Intrusive
Air conditioning unit (20 feet) Light auto traffic (50 feet)	60	
Normal speech (15 feet)	50	Quiet
Living room, bedroom, library	40	
Soft whisper (15 feet)	30	Very quiet
Broadcasting studio	20	
	10	Just audible
	0	Threshold of hearing

Source: CEQ 1970

[a] Typical A-weighted noise levels taken with a sound-level meter and expressed as decibels on the “A” scale. The “A” scale approximates the frequency response of the human ear.

Noise levels at different distances can also be affected by factors other than the distance from the noise source. Topographic features and structural barriers that absorb, reflect, or scatter sound waves can increase or decrease noise levels. Atmospheric conditions (wind speed and direction, humidity levels, and temperatures) can also affect the degree to which sound is attenuated over distance.

4 Regulatory Setting

The federal regulation that FHWA uses to assess noise impacts is 23 CFR Part 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*. This regulation was most recently updated on July 13, 2010. Utah Administrative Code Rule R930-3, *Highway Noise Abatement*, and UDOT's Noise Abatement Policy 08A2-01, revised June 15, 2017, establish UDOT's noise impact and abatement policies and procedures, which are compliant with 23 CFR Part 772.

Noise-abatement criteria (NAC) are used to define the noise levels that are considered an impact (in hourly A-weighted sound-level decibels) for each land use activity category. UDOT's Noise Abatement Policy states that a traffic noise impact occurs when either (1) the future worst-case noise level is equal to or greater than the UDOT NAC for specified land use activity categories or (2) the future worst-case noise level is greater than or equal to an increase of 10 dBA over the existing noise level (substantial increase).

The UDOT NAC are summarized in Table 2.

Table 2. UDOT's Noise-abatement Criteria

Activity Category	L_{eq} Noise Levels (dBA)	Description of Activity Category
A	56 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	66 (exterior)	Residential.
C	66 (exterior)	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails and trail crossings.
D	51 (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting room, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	71 (exterior)	Hotels, motels, offices, restaurants/bars, and other undeveloped lands, properties, or activities not included in categories A–D or F.
F	—	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	—	Undeveloped lands that are not permitted.

Source: UDOT 2017

5 Affected Environment

The noise study area (see Figure 1 and Figure 2, Existing Noise Receptor Map) includes parts of Syracuse, Utah, within an 800-foot buffer from the nearest travel lane of the WDC or WDC interchange ramps from 3000 West to about 2300 South.

The project corridor is a mix of undeveloped land, residential developments, recreational properties (a golf course and a park), and schools.

5.1 Noise Monitoring

Existing noise levels in the noise study area were determined by taking short-term (15-minute) sound-level measurements at four locations throughout the noise study area with a Larson-Davis model 824 sound-level meter. Noise-measurement locations were selected to represent existing residential developments or other areas where people could be exposed to traffic noise for extended periods. Noise-monitoring locations (ML) are shown in Figure 1 and Figure 2, and the associated measured noise levels are listed in Table 3.

Table 3. Measured Noise Levels in the Noise Study Area

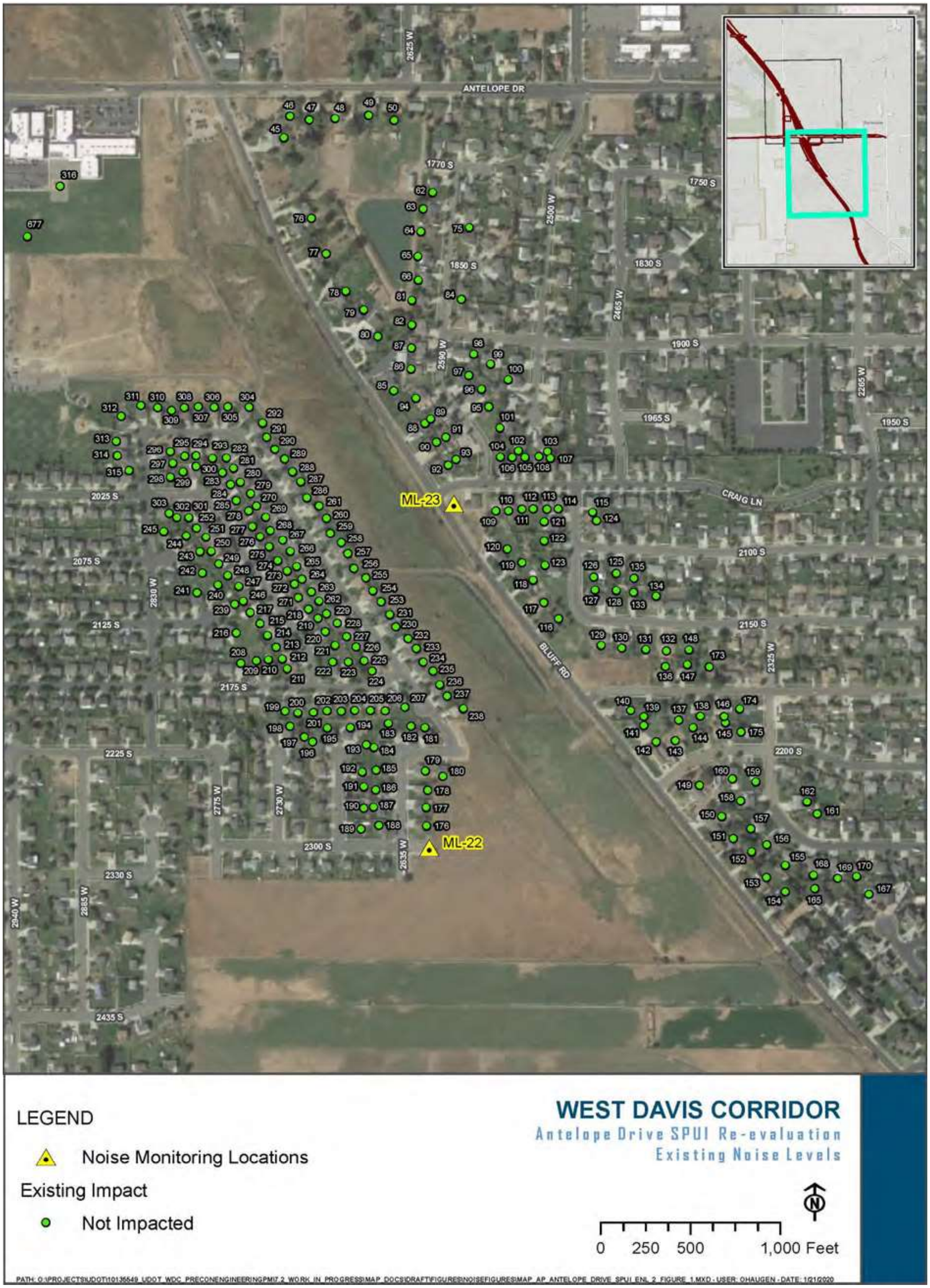
Monitoring Location	Address	Activity Category and Noise Level (dBA L_{eq})[a]	Measured Noise Level (dBA L_{eq}, rounded)
ML-22	Intersection of 2635 West and 2300 South, Syracuse	B	44
ML-23	Intersection of Craig Lane and 2015 South on Bluff Road	B	61
ML-25	South of 3000 West and 1525 South, Syracuse	B	65
ML-26	3000 West north of 1200 South, Syracuse	B	62

[a] For descriptions of the activity categories, see Table 2, UDOT's Noise-abatement Criteria, above.

Measured noise levels were used to characterize the existing noise environment. Measured noise levels in the noise study area ranged from 44 to 65 dBA depending on the proximity of the monitoring location to noise sources such as the existing 3000 West, Antelope Drive, and the nearby residential roads. As a comparison, typical noise levels range from 35 to 50 dBA in rural and agricultural areas, 50 to 65 dBA in suburban to urban areas, and 65 to 75 dBA in downtown urban areas.

Figure 1. Existing Noise Receptor Map [1 of 2]

Figure 2. Existing Noise Receptor Map [2 of 2]



5.2 Existing Noise Levels

The predominant source of existing noise in the noise study area is automobile and truck traffic on the existing 3000 West, Antelope Drive, and the nearby residential roads. Existing traffic noise levels for receptors in the noise study area were estimated based on measurements of existing noise levels taken at various locations in the study area. Under existing conditions, no receptors exceeded the NAC of 66 dBA. The locations of those receptors are shown above in Figure 1 and Figure 2, Existing Noise Receptor Map.

The noise model developed for the existing conditions scenario included 290 receptors (representing 286 individual dwelling units and 4 recreational sites) throughout the noise study area. With the Refined Selected Alternative, UDOT would acquire three residential properties located near the intersection Bluff Road and Antelope Drive. Properties to be acquired will be demolished and were not included as receptors in the existing conditions or in the noise analysis for the Refined Selected Alternative's build scenario.

Traffic-related noise impacts with the Refined Selected Alternative were estimated with FHWA's Traffic Noise Model version 2.5 based on the proposed roadway design. The modeled roadway included the proposed WDC RFP SPUI improvements between 3000 West and 2300 South. Roadway links were modeled in 100-foot increments to provide a high degree of accuracy in the model output. Traffic volumes used in the model were based on LOS C volumes for the WDC as provided by UDOT, with traffic on the WDC operating at 65 mph, traffic on the WDC ramps operating at 45 mph, and traffic on Antelope Drive operating at 40 mph.

Overall, noise levels with the Refined Selected Alternative would range from 53 to 74 dBA, compared to the existing conditions of 48 to 65 dBA.

6 Expected Impacts with the Refined Selected Alternative

With the Refined Selected Alternative, 124 receptors (representing 122 dwelling units and 2 recreational sites) out of the 290 receptors would have traffic noise impacts; that is, the noise levels at those receptors would approach, exceed, or substantially exceed (≥ 10-dBA increase over existing noise levels) the NAC as defined in Table 2. The locations of those receptors that would exceed the NAC are shown in Figure 3 and Figure 4, Build Scenario Noise Receptor Map. Additionally, 3 receptors would be acquired as part of the Refined Selected Alternative's right-of-way requirements.

7 Summary

Table 4 summarizes the modeled existing and Refined Selected Alternative noise levels at the 290 receptors throughout the noise study area. Shaded cells indicate impacts with the Refined Selected Alternative. For receptor locations, refer to the maps in Figure 3 and Figure 4, Build Scenario Noise Receptor Map, and Appendix A, Noise Wall Analysis.

Table 4. Modeled Existing and Refined Selected Alternative Noise Levels in the Noise Study Area

Receptor	Activity Category	UDOT NAC $L_{eq}(h)$	Existing		With Refined Selected Alternative		
			Existing Noise Levels (dBA)	Existing Impact?	Refined Selected Alternative Noise Levels (dBA)	≥ UDOT NAC?	≥ 10 dBA Increase over Existing Noise Level?
1	B	66	60	N	**68**	**Y**	N
2	B	66	60	N	**68**	**Y**	N
3	B	66	55	N	**66**	**Y**	**Y**
4	B	66	52	N	**63**	N	**Y**
5	B	66	52	N	**63**	N	**Y**
6	B	66	51	N	**61**	N	**Y**
7	B	66	51	N	**62**	N	**Y**
8	B	66	52	N	**62**	N	**Y**
9	B	66	55	N	**65**	N	**Y**
10	B	66	55	N	**66**	**Y**	**Y**
11	B	66	55	N	**66**	**Y**	**Y**
12	B	66	55	N	**65**	N	**Y**
13	B	66	60	N	**68**	**Y**	N
14	B	66	60	N	**69**	**Y**	N
15	B	66	60	N	**69**	**Y**	N
16	B	66	60	N	**70**	**Y**	**Y**
45	B	66	57	N	**69**	**Y**	**Y**
46	B	66	59	N	**69**	**Y**	**Y**
47	B	66	59	N	**68**	**Y**	N
48	B	66	59	N	**68**	**Y**	N
49	B	66	59	N	**68**	**Y**	N
50	B	66	59	N	**68**	**Y**	N
62	B	66	52	N	61	N	N
63	B	66	52	N	61	N	N
64	B	66	52	N	61	N	N
65	B	66	52	N	61	N	N
66	B	66	52	N	61	N	N
75	B	66	52	N	59	N	N
76	B	66	57	N	**68**	**Y**	**Y**
77	B	66	57	N	**67**	**Y**	**Y**
78	B	66	57	N	**67**	**Y**	N
79	B	66	57	N	65	N	N
80	B	66	57	N	**66**	**Y**	N
81	B	66	55	N	62	N	N
82	B	66	55	N	62	N	N
84	B	66	55	N	59	N	N
85	B	66	60	N	**66**	**Y**	N
86	B	66	55	N	64	N	N
87	B	66	55	N	63	N	N
88	B	66	57	N	63	N	N
89	B	66	55	N	63	N	N

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Table 4. Modeled Existing and Refined Selected Alternative Noise Levels in the Noise Study Area

Receptor	Activity Category	UDOT NAC $L_{eq}(h)$	Existing		With Refined Selected Alternative		
			Existing Noise Levels (dBA)	Existing Impact?	Refined Selected Alternative Noise Levels (dBA)	≥ UDOT NAC?	≥ 10 dBA Increase over Existing Noise Level?
90	B	66	57	N	62	N	N
91	B	66	57	N	64	N	N
92	B	66	57	N	63	N	N
93	B	66	57	N	63	N	N
94	B	66	57	N	64	N	N
95	B	66	52	N	59	N	N
96	B	66	52	N	59	N	N
97	B	66	52	N	60	N	N
98	B	66	52	N	59	N	N
99	B	66	51	N	58	N	N
100	B	66	51	N	58	N	N
101	B	66	52	N	59	N	N
102	B	66	52	N	59	N	N
103	B	66	52	N	58	N	N
104	B	66	52	N	60	N	N
105	B	66	52	N	59	N	N
106	B	66	52	N	59	N	N
107	B	66	52	N	58	N	N
108	B	66	52	N	58	N	N
109	B	66	57	N	63	N	N
110	B	66	56	N	61	N	N
111	B	66	54	N	61	N	N
112	B	66	53	N	60	N	N
113	B	66	52	N	59	N	N
114	B	66	51	N	59	N	N
115	B	66	51	N	57	N	N
116	B	66	57	N	62	N	N
117	B	66	57	N	61	N	N
118	B	66	57	N	61	N	N
119	B	66	57	N	61	N	N
120	B	66	57	N	61	N	N
121	B	66	53	N	60	N	N
122	B	66	56	N	60	N	N
123	B	66	57	N	60	N	N
124	B	66	51	N	57	N	N
125	B	66	52	N	58	N	N
126	B	66	53	N	59	N	N
127	B	66	53	N	59	N	N
128	B	66	52	N	58	N	N
129	B	66	57	N	62	N	N
130	B	66	56	N	60	N	N
131	B	66	56	N	59	N	N
132	B	66	51	N	58	N	N
133	B	66	51	N	58	N	N
134	B	66	51	N	57	N	N
135	B	66	51	N	57	N	N
136	B	66	52	N	59	N	N
137	B	66	52	N	61	N	N
138	B	66	52	N	59	N	N
139	B	66	57	N	61	N	N
140	B	66	57	N	61	N	N
141	B	66	57	N	61	N	N

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Table 4. Modeled Existing and Refined Selected Alternative Noise Levels in the Noise Study Area

Receptor	Activity Category	UDOT NAC $L_{eq}(h)$	Existing		With Refined Selected Alternative		
			Existing Noise Levels (dBA)	Existing Impact?	Refined Selected Alternative Noise Levels (dBA)	≥ UDOT NAC?	≥ 10 dBA Increase over Existing Noise Level?
142	B	66	57	N	61	N	N
143	B	66	57	N	61	N	N
144	B	66	56	N	60	N	N
145	B	66	51	N	58	N	N
146	B	66	51	N	58	N	N
147	B	66	51	N	58	N	N
148	B	66	51	N	57	N	N
149	B	66	57	N	61	N	N
150	B	66	57	N	61	N	N
151	B	66	57	N	60	N	N
152	B	66	57	N	60	N	N
153	B	66	57	N	59	N	N
154	B	66	57	N	60	N	N
155	B	66	55	N	60	N	N
156	B	66	55	N	60	N	N
157	B	66	55	N	61	N	N
158	B	66	55	N	60	N	N
159	B	66	51	N	59	N	N
160	B	66	55	N	60	N	N
161	B	66	51	N	56	N	N
162	B	66	51	N	56	N	N
165	B	66	55	N	59	N	N
167	B	66	53	N	58	N	N
168	B	66	53	N	57	N	N
169	B	66	53	N	56	N	N
170	B	66	53	N	58	N	N
173	B	66	51	N	57	N	N
174	B	66	51	N	57	N	N
175	B	66	51	N	58	N	N
176	B	66	48	N	**61**	N	**Y**
177	B	66	48	N	**61**	N	**Y**
178	B	66	49	N	**62**	N	**Y**
179	B	66	49	N	**63**	N	**Y**
180	B	66	50	N	**64**	N	**Y**
181	B	66	50	N	**65**	N	**Y**
182	B	66	50	N	**63**	N	**Y**
183	B	66	50	N	**61**	N	**Y**
184	B	66	50	N	**60**	N	**Y**
185	B	66	50	N	58	N	N
186	B	66	50	N	56	N	N
187	B	66	50	N	55	N	N
188	B	66	48	N	54	N	N
189	B	66	48	N	56	N	N
190	B	66	48	N	56	N	N
191	B	66	48	N	57	N	N
192	B	66	48	N	**58**	N	**Y**
193	B	66	48	N	**60**	N	**Y**
194	B	66	48	N	**58**	N	**Y**
195	B	66	48	N	57	N	N
196	B	66	48	N	56	N	N
197	B	66	48	N	56	N	N

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Table 4. Modeled Existing and Refined Selected Alternative Noise Levels in the Noise Study Area

Receptor	Activity Category	UDOT NAC $L_{eq}(h)$	Existing		With Refined Selected Alternative		
			Existing Noise Levels (dBA)	Existing Impact?	Refined Selected Alternative Noise Levels (dBA)	≥ UDOT NAC?	≥ 10 dBA Increase over Existing Noise Level?
198	B	66	48	N	55	N	N
199	B	66	48	N	54	N	N
200	B	66	48	N	55	N	N
201	B	66	48	N	56	N	N
202	B	66	48	N	57	N	N
203	B	66	48	N	57	N	N
204	B	66	50	N	58	N	N
205	B	66	50	N	59	N	N
206	B	66	50	N	**61**	N	**Y**
207	B	66	50	N	**63**	N	**Y**
208	B	66	48	N	55	N	N
209	B	66	48	N	55	N	N
210	B	66	48	N	54	N	N
211	B	66	48	N	55	N	N
212	B	66	48	N	53	N	N
213	B	66	48	N	53	N	N
214	B	66	48	N	53	N	N
215	B	66	48	N	53	N	N
216	B	66	48	N	54	N	N
217	B	66	48	N	53	N	N
218	B	66	50	N	**60**	N	**Y**
219	B	66	50	N	**60**	N	**Y**
220	B	66	50	N	**60**	N	**Y**
221	B	66	50	N	**60**	N	**Y**
222	B	66	50	N	**60**	N	**Y**
223	B	66	50	N	**60**	N	**Y**
224	B	66	50	N	**62**	N	**Y**
225	B	66	50	N	59	N	N
226	B	66	50	N	59	N	N
227	B	66	50	N	**60**	N	**Y**
228	B	66	50	N	59	N	N
229	B	66	50	N	**60**	N	**Y**
230	B	66	52	N	**72**	**Y**	**Y**
231	B	66	52	N	**72**	**Y**	**Y**
232	B	66	52	N	**73**	**Y**	**Y**
233	B	66	52	N	**73**	**Y**	**Y**
234	B	66	52	N	**72**	**Y**	**Y**
235	B	66	52	N	**74**	**Y**	**Y**
236	B	66	52	N	**72**	**Y**	**Y**
237	B	66	52	N	**72**	**Y**	**Y**
238	B	66	52	N	**74**	**Y**	**Y**
239	B	66	48	N	53	N	N
240	B	66	48	N	54	N	N
241	B	66	48	N	54	N	N
242	B	66	48	N	55	N	N
243	B	66	48	N	53	N	N
244	B	66	48	N	55	N	N
245	B	66	48	N	54	N	N
246	B	66	48	N	53	N	N
247	B	66	48	N	53	N	N
248	B	66	48	N	53	N	N

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Table 4. Modeled Existing and Refined Selected Alternative Noise Levels in the Noise Study Area

Receptor	Activity Category	UDOT NAC $L_{eq}(h)$	Existing		With Refined Selected Alternative		
			Existing Noise Levels (dBA)	Existing Impact?	Refined Selected Alternative Noise Levels (dBA)	≥ UDOT NAC?	≥ 10 dBA Increase over Existing Noise Level?
249	B	66	48	N	53	N	N
250	B	66	48	N	53	N	N
251	B	66	48	N	53	N	N
252	B	66	52	N	53	N	N
253	B	66	52	N	72	Y	Y
254	B	66	52	N	73	Y	Y
255	B	66	52	N	72	Y	Y
256	B	66	52	N	70	Y	Y
257	B	66	52	N	71	Y	Y
258	B	66	52	N	71	Y	Y
259	B	66	52	N	70	Y	Y
260	B	66	52	N	71	Y	Y
261	B	66	52	N	70	Y	Y
262	B	66	50	N	60	N	Y
263	B	66	50	N	60	N	Y
264	B	66	50	N	60	N	Y
265	B	66	50	N	60	N	Y
266	B	66	50	N	59	N	N
267	B	66	50	N	60	N	Y
268	B	66	50	N	60	N	Y
269	B	66	50	N	60	N	Y
270	B	66	50	N	60	N	Y
271	B	66	50	N	61	N	Y
272	B	66	50	N	60	N	Y
273	B	66	50	N	60	N	Y
274	B	66	50	N	60	N	Y
275	B	66	50	N	61	N	Y
276	B	66	50	N	60	N	Y
277	B	66	50	N	61	N	Y
278	B	66	50	N	60	N	Y
279	B	66	50	N	59	N	N
280	B	66	50	N	60	N	Y
281	B	66	50	N	60	N	Y
282	B	66	50	N	59	N	N
283	B	66	50	N	60	N	Y
284	B	66	50	N	60	N	Y
285	B	66	50	N	61	N	Y
286	B	66	52	N	71	Y	Y
287	B	66	52	N	72	Y	Y
288	B	66	52	N	71	Y	Y
289	B	66	52	N	72	Y	Y
290	B	66	52	N	70	Y	Y
291	B	66	52	N	70	Y	Y
292	B	66	52	N	71	Y	Y
293	B	66	50	N	59	N	N
294	B	66	50	N	59	N	N
295	B	66	50	N	58	N	N
296	B	66	48	N	57	N	N
297	B	66	48	N	58	N	Y
298	B	66	48	N	58	N	Y

(*continued on next page*)

Table 4. Modeled Existing and Refined Selected Alternative Noise Levels in the Noise Study Area

Receptor	Activity Category	UDOT NAC $L_{eq}(h)$	Existing		With Refined Selected Alternative		
			Existing Noise Levels (dBA)	Existing Impact?	Refined Selected Alternative Noise Levels (dBA)	≥ UDOT NAC?	≥ 10 dBA Increase over Existing Noise Level?
299	B	66	48	N	**58**	N	**Y**
300	B	66	50	N	59	N	N
301	B	66	48	N	53	N	N
302	B	66	48	N	53	N	N
303	B	66	48	N	53	N	N
304	B	66	52	N	**70**	**Y**	**Y**
305	B	66	51	N	**66**	**Y**	**Y**
306	B	66	50	N	**64**	N	**Y**
307	B	66	50	N	**63**	N	**Y**
308	B	66	50	N	**62**	N	**Y**
309	B	66	50	N	**61**	N	**Y**
310	B	66	48	N	**60**	N	**Y**
311	B	66	48	N	**59**	N	**Y**
312	B	66	48	N	**58**	N	**Y**
313	B	66	48	N	**58**	N	**Y**
314	B	66	48	N	57	N	N
315	B	66	48	N	57	N	N
316	C	66	44	N	**64**	N	**Y**
326	B	66	52	N	**62**	N	**Y**
327	B	66	52	N	61	N	N
328	B	66	54	N	**68**	**Y**	**Y**
329	B	66	54	N	**68**	**Y**	**Y**
330	B	66	54	N	**65**	N	**Y**
331	B	66	54	N	**68**	**Y**	**Y**
332	B	66	55	N	**68**	**Y**	**Y**
333	B	66	54	N	60	N	N
334	B	66	54	N	61	N	N
335	B	66	61	N	**67**	**Y**	N
336	B	66	61	N	**67**	**Y**	N
337	B	66	61	N	**66**	**Y**	N
338	B	66	59	N	**68**	**Y**	N
339	B	66	59	N	**68**	**Y**	N
340	B	66	57	N	65	N	N
341	B	66	57	N	**68**	**Y**	**Y**
342	B	66	57	N	**69**	**Y**	**Y**
343	B	66	60	N	59	N	N
344	B	66	61	N	61	N	N
345	B	66	61	N	61	N	N
346	B	66	61	N	63	N	N
484	B	66	60	N	58	N	N
485	B	66	65	N	58	N	N
486	B	66	65	N	58	N	N
677	C	66	50	N	**62**	N	**Y**
678 – Golf Course	C	66	55	N	58	N	N
679 –Golf Course	C	66	55	N	59	N	N

Shaded cells indicate impacts with the Refined Selected Alternative.

Figure 3. Build Scenario Noise Receptor Map [1 of 2]

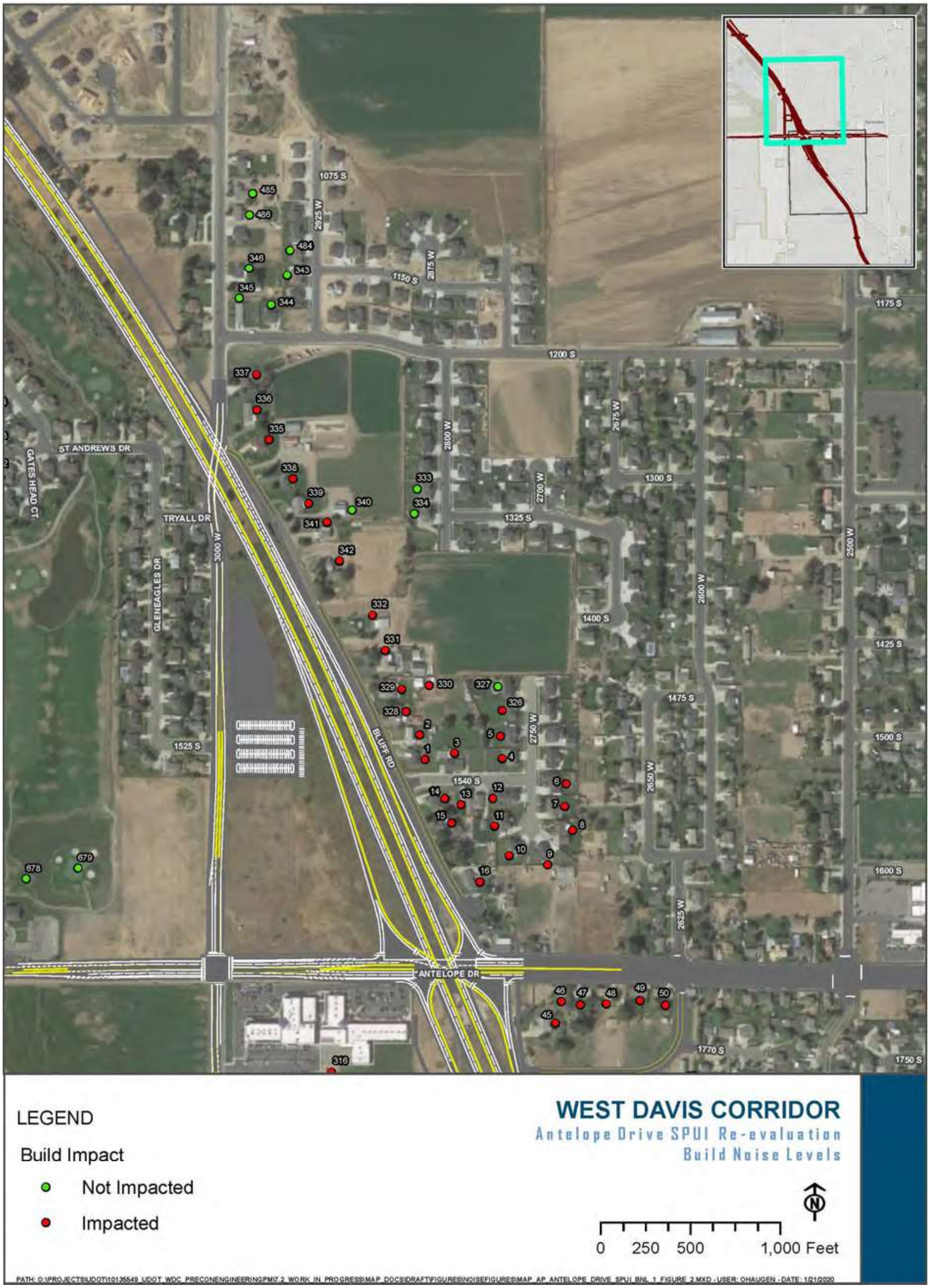
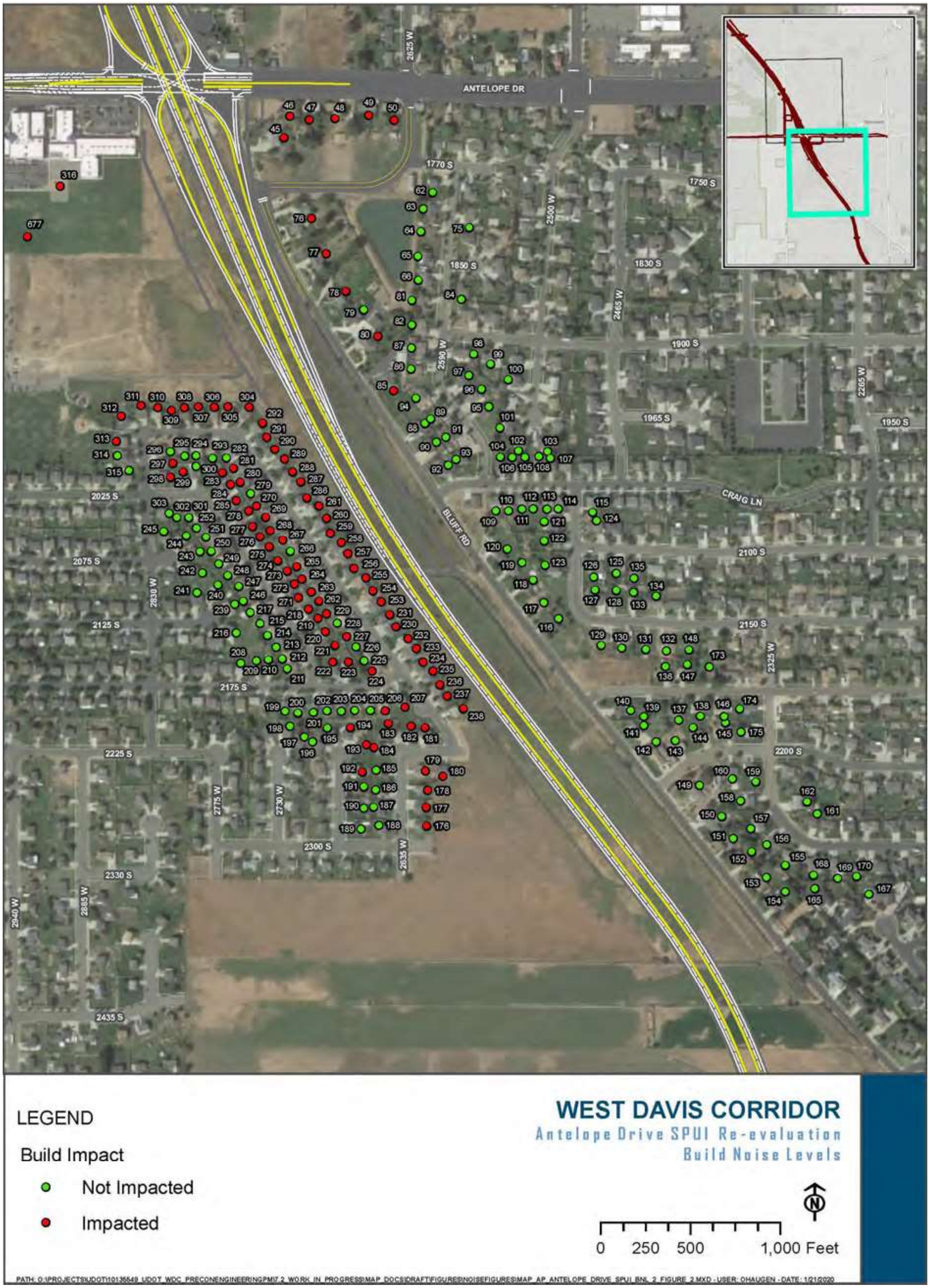


Figure 4. Build Scenario Noise Receptor Map [2 of 2]



8 Noise Abatement Methodology

This section discusses UDOT's methodology for evaluating noise-abatement mitigation measures for the traffic noise impacts identified in Section 6, Expected Impacts with the Refined Selected Alternative.

For a noise wall to be effective, it must be high enough and long enough to block the view of the noise source (that is, traffic on the roadway) from the receptor's line of sight. FHWA's *Highway Traffic Noise: Analysis and Abatement Guidance* (FHWA 2011) states that, as a general rule of thumb, the noise barrier should extend 4 times as far in each direction as the distance from the receptor to the barrier. For example, if the receptor is 50 feet from the proposed noise barrier, the barrier needs to extend at least 200 feet on either side of the receptor in order to shield the receptor from noise traveling past the ends of the barrier.

Noise walls for individual homes do not meet the cost-effectiveness criterion of UDOT's Noise Abatement Policy. Gaps in a noise wall cause "noise leaks," which reduce the effectiveness of the wall at homes near the gap. In addition, the effectiveness of noise walls decreases with increasing distance from the wall. For example, a residence that is 300 feet from a noise wall might experience noise levels that exceed the residential NAC. However, the noise wall might be ineffective in reducing noise levels by 7 dBA or more at that distance, and, therefore, a noise barrier might not be warranted according to UDOT's Noise Abatement Policy. The goal of noise abatement is to substantially reduce noise, which might or might not result in noise levels below the residential NAC.

The two primary criteria to consider when evaluating noise-abatement measures are feasibility and reasonableness. Noise abatement would be provided by UDOT only if UDOT determines that noise-abatement measures are *both* feasible and reasonable.

8.1 Feasibility and Reasonableness Factors

8.1.1 Feasibility Factors

The feasibility of noise-abatement measures deals primarily with construction and engineering considerations such as safety, location of cross streets, sight distance, and access to adjacent properties, among other considerations. Under UDOT's Noise Abatement Policy, a noise barrier must be considered "acoustically feasible" (that is, the barrier must reduce noise by at least 5 dBA for at least 50% of front-row receptors).

What are feasibility factors?

The feasibility of noise-abatement measures deals primarily construction and engineering considerations.

If a noise-abatement measure is determined by UDOT to be acoustically feasible, then the abatement measure will be evaluated to determine whether its construction is reasonable. If a noise-abatement measure is determined by UDOT to be not feasible, it will not be considered any further.

8.1.2 Reasonableness Factors

Under UDOT's Noise Abatement Policy, reasonableness factors must be collectively achieved in order for a noise-abatement measure to be considered "reasonable." All three reasonableness factors described below must be met in order for a noise barrier to be considered reasonable.

What are reasonableness factors?

Reasonableness factors are the noise-abatement design goal, cost-effectiveness, and the viewpoints of property owners and residents.

- ***Noise-abatement Design Goal.*** Every reasonable effort should be made to achieve substantial reductions in noise. UDOT defines the minimum noise reduction (design goal) from proposed abatement measures to be 7 dBA or greater for at least 35% of front-row receptors. No abatement measure will be considered reasonable if the noise-abatement design goal cannot be achieved.
- ***Cost-effectiveness.*** The cost of a noise-abatement measure must be considered reasonable in order for it to be included in a project. Noise-abatement costs are determined by multiplying a fixed unit cost per square foot by the height and length of the barrier.

  For residential receptors, cost-effectiveness is based on the cost of the abatement measure (for example, a noise wall) divided by the number of benefited receptors (the total number of dwelling units at which noise is reduced by a minimum of 5 dBA as a result of the abatement measure).

  Currently, the maximum cost used to determine the reasonableness of a noise-abatement measure is $30,000 per benefiting residence (Activity Category B) based on a unit cost of $20 per square foot of barrier, and $360 per lineal foot for Activity Categories A, C, D, or E.
- ***Viewpoints of Property Owners and Residents.*** If a noise-abatement measure is both feasible and cost-effective, UDOT will also consider the viewpoints of property owners and residents to determine whether the noise-abatement measures are desired. Balloting will be conducted for those noise-abatement measures that both meet the noise-abatement design goal and are cost-effective consistent with the procedures described in UDOT's Noise Abatement Policy.

The noise walls considered for the Refined Selected Alternative are discussed below. UDOT evaluated noise walls for three locations along WDC where noise impacts would occur with the Refined Selected Alternative. One noise wall, Fremont Crest Avenue Wall, was found to be both feasible and reasonable.

8.1.3 Noise Wall Evaluations

In this section, noise wall evaluations are summarized for locations where there would be impacts to noise receptors as defined in Sections 6 and 7. The noise walls that were evaluated are described from north to south on the east side of the WDC, then from north to south on the west side of the WDC. Figure 5 and Figure 6, Build Scenario Noise Walls, show the noise walls that were evaluated.

Figure 5. Build Scenario Noise Walls [1 of 2]

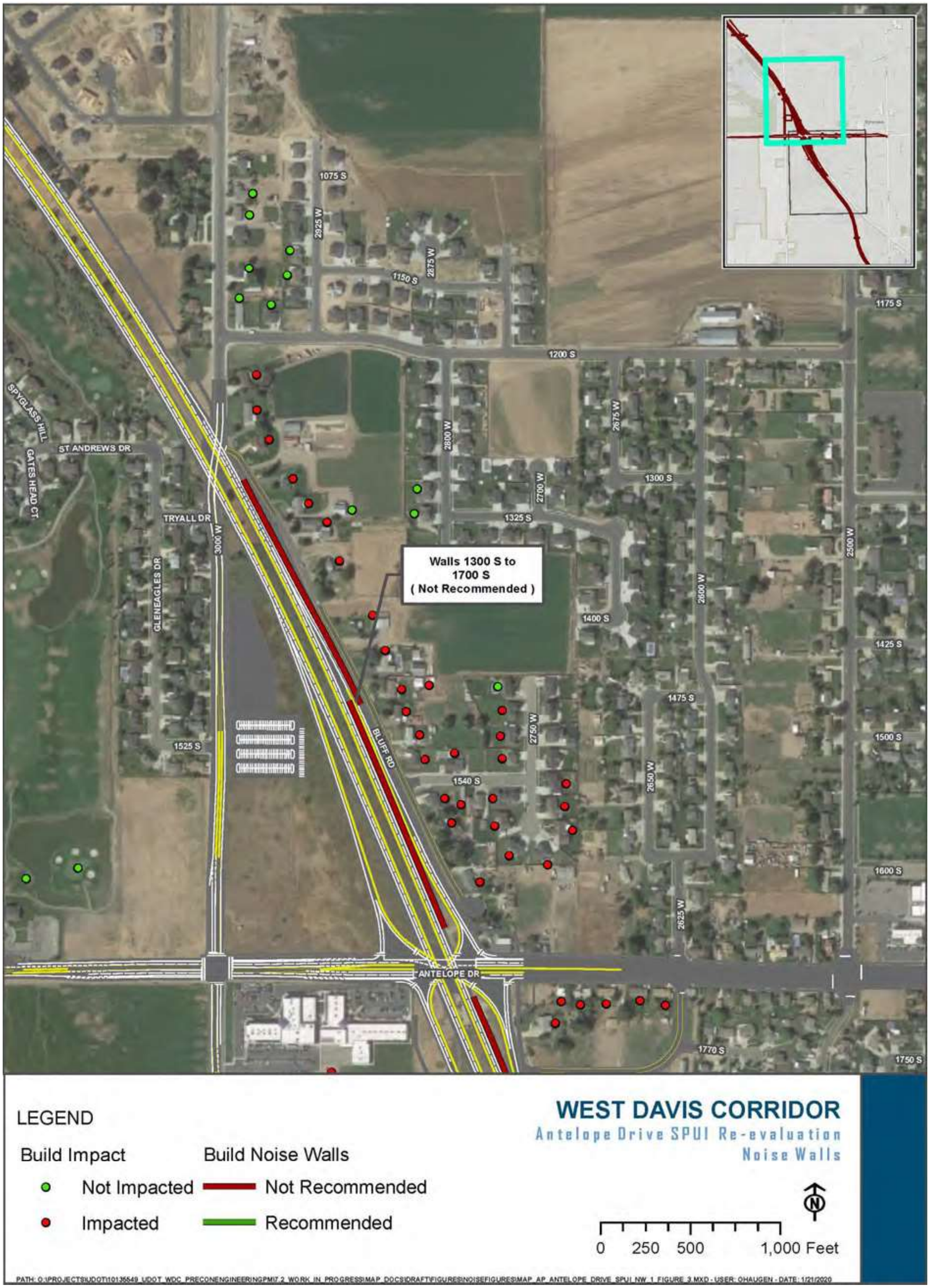
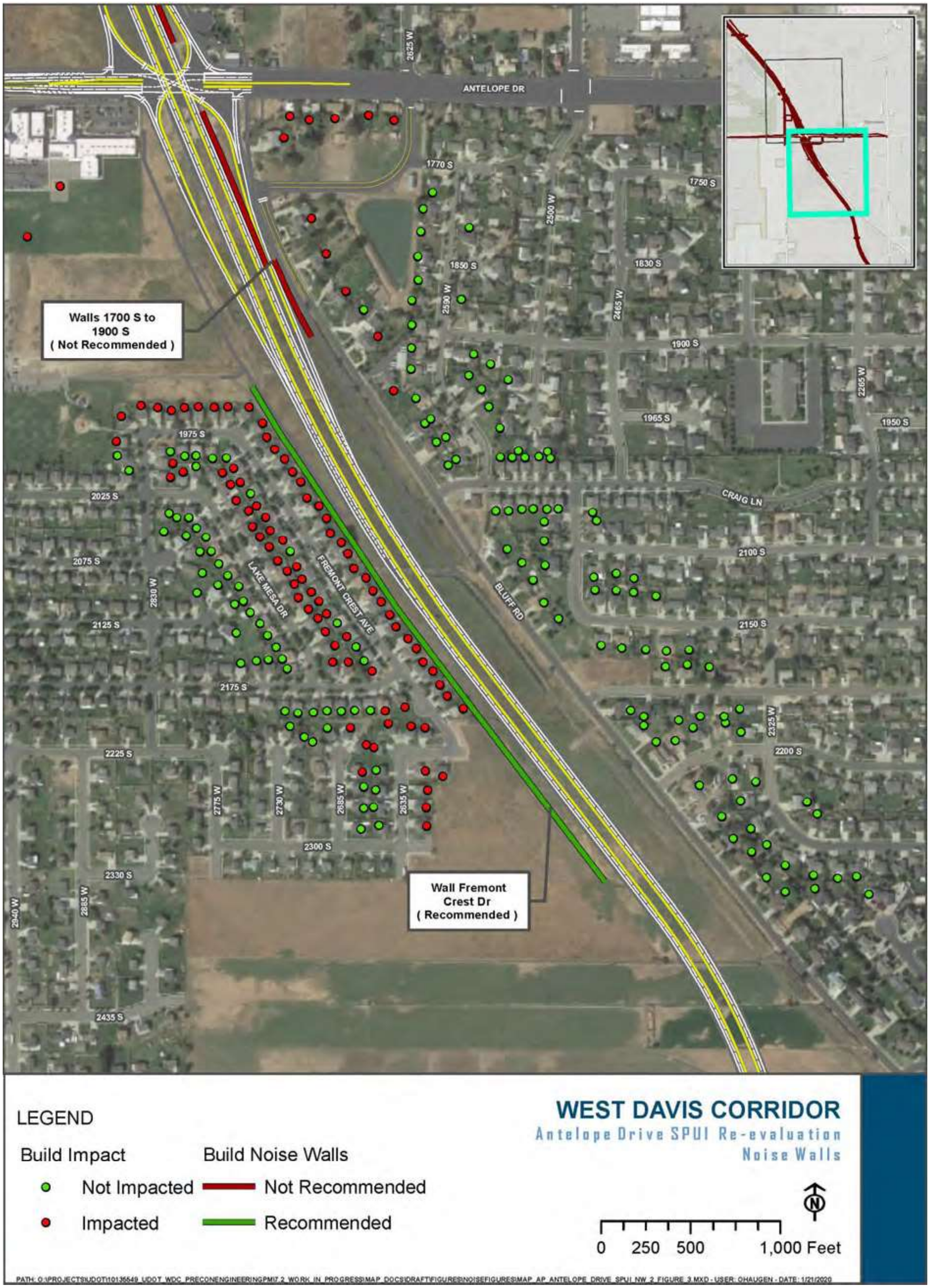


Figure 6. Build Scenario Noise Walls [2 of 2]



1300 South to 1700 South Walls – East of WDC

The walls from 1300 South to 1700 South consist of two noise walls that were evaluated where noise impacts are expected to a total of 29 receptors, including 13 front-row receptors. One wall would be located between northbound WDC and the northbound on ramp from Antelope Drive, and the other wall would be located between the WDC and Bluff Road after the northbound WDC on ramp has merged onto the WDC. The two walls evaluated have a combined length of about 2,113 feet (see Figure 5, Build Scenario Noise Walls [1 of 2]).

As summarized in Table 5, UDOT evaluated 18 foot high walls (for detailed information, see Appendix A, Noise Wall Analysis). A 17-foot-high wall is the tallest wall allowed by UDOT's structure standards. An 18-foot-high wall was modeled to be conservative and to account for the possibility of a 17-foot-high wall being place on a 1-foot-high foot embankment.

Table 5. Noise-abatement Analysis for 1300 South to 1700 South Walls

Barrier Height	Feasibility		Reasonable					Is Barrier Feasible and Reasonable?
	% Front-row with 5-dBA Reduction	Acoustically Feasible?[a]	% Front-row with 7-dBA Reduction	Noise Abatement Design Goal?[b]	Anticipated Cost	Allowable Cost	Cost-effective?[c]	
18	0	N	0	N	NA	NA	NA	**N**

[a] 5-dBA reduction for at least 50% of front-row receptors.

[b] 7-dBA reduction for at least 35% of front-row receptors.

[c] Anticipated cost is less than allowable cost.

Noise walls from 1300 South to 1700 South east of the WDC do not meet the feasibility and reasonable criteria in UDOT's Noise Abatement Policy and are therefore not recommended.

1700 South to 1900 South Walls – East of WDC

The walls from 1700 South to 1900 South consist of two noise walls that were evaluated where noise impacts are expected to nine receptors, including five front-row receptors. One wall would be located between northbound WDC and the northbound off ramp to Antelope Drive, and the other wall would be located between the northbound off ramp to Antelope Drive and Bluff Road. The two walls evaluated have a combined length of about 1,056 feet (see Figure 6, Build Scenario Noise Walls [2 of 2]).

As summarized in Table 6, UDOT evaluated walls ranging from 14 to 18 feet high (for detailed information, see Appendix A, Noise Wall Analysis).

Table 6. Noise-abatement Analysis for 1700 South to 1900 South Walls

	Feasibility		Reasonable					
Barrier Height	**% Front-row with 5-dBA Reduction**	**Acoustically Feasible?[a]**	**% Front-row with 7-dBA Reduction**	**Noise Abatement Design Goal?[b]**	**Anticipated Cost**	**Allowable Cost**	**Cost-effective?[c]**	**Is Barrier Feasible and Reasonable?**
14	0	N	0	N	NA	NA	NA	**N**
16	0	N	0	N	NA	NA	NA	**N**
18	0	N	0	N	NA	NA	NA	**N**

[a] 5-dBA reduction for at least 50% of front-row receptors.

[b] 7-dBA reduction for at least 35% of front-row receptors.

[c] Anticipated cost is less than allowable cost.

Noise walls from 1700 South to 1900 South east of the WDC do not meet the feasibility and reasonable criteria in UDOT's Noise Abatement Policy and are therefore not recommended.

Fremont Crest Wall – West of WDC

The Fremont Crest wall would be located near the WDC right-of-way line adjacent to the Fremont Crest neighborhood where noise impacts are expected to 81 receptors, including 26 front-row receptors. This wall would be about 2,254 feet long (see Figure 6, Build Scenario Noise Walls [2 of 2]).

As summarized in Table 7, UDOT evaluated walls ranging from 10 to 18 feet high (for detailed information, see Appendix A, Noise Wall Analysis).

Table 7. Noise-abatement Analysis for Fremont Crest Wall

Barrier Height	Feasibility		Reasonable					Is Barrier Feasible and Reasonable?
	% Front-row with 5-dBA Reduction	Acoustically Feasible?[a]	% Front-row with 7-dBA Reduction	Noise Abatement Design Goal?[b]	Anticipated Cost	Allowable Cost	Cost-effective?[c]	
10	62	Y	8	N	NA	NA	NA	**N**
12	100	Y	62	Y	$540,960	$780,000	Y	**Y**
16	100	Y	100	Y	$721,280	$780,000	Y	**Y**
17	100	Y	100	Y	$766,360	$780,000	Y	**Y**
18	100	Y	100	Y	$811,440	$780,000	N	**N**

[a] 5-dBA reduction for at least 50% of front-row receptors.

[b] 7-dBA reduction for at least 35% of front-row receptors.

[c] Anticipated cost is less than allowable cost.

A noise wall 2,254 feet long with a height of 12 feet is the shortest wall height that meets the feasibility and reasonable criteria in UDOT's Noise Abatement Policy; therefore, a 12-foot-high wall at this location is recommended for balloting.

9 Construction Noise

9.1 Construction Noise Activities

Table 8 shows the noise levels produced by various types of construction equipment. Properly maintained equipment will produce noise levels near the middle of the indicated ranges. The types of construction equipment used for this project will typically generate noise levels of 80 dBA to 90 dBA at a distance of 50 feet while the equipment is operating (EPA 1971; Gharabegian and others 1985; Toth 1979).

Construction equipment operations can vary from intermittent to fairly continuous with multiple pieces of equipment operating concurrently. Assuming that a bulldozer (85 dBA), backhoe (90 dBA), grader (90 dBA), and front-end loader (82 dBA) are operating concurrently in the same area, peak construction-period noise would generally be about 94 dBA at 50 feet from the construction site. Table 8 summarizes noise levels expected near an active construction site with the above equipment operating.

Table 8. Typical Noise Levels for Construction Equipment

Type of Equipment	Noise Level (dBA) at 50 feet
Bulldozer	85
Front loader	72 – 84
Jack hammer or rock drill	81 – 98
Crane with headache ball	75 – 87
Backhoe	72 – 93
Scraper and grader	80 – 93
Electrical generator	71 – 82
Concrete pump	81 – 83
Concrete vibrator	76
Concrete and dump trucks	83 – 90
Air compressor	74 – 87
Pile drivers (peaks)	95 – 106
Pneumatic tools	81 – 98
Roller (compactor)	73 – 75
Saws	73 – 82

Source: EPA 1971

Locations within about 1,900 feet of a construction site will experience occasional episodes of noise levels greater than 60 dBA. Areas within about 750 feet of a construction site will experience episodes of noise levels greater than 70 dBA. Such episodes of high noise levels associated with the proposed construction would not be continuous throughout the day and would generally be restricted to daytime hours.

Most construction activities associated with the Refined Selected Alternative would occur during daylight hours, which would minimize the number of noise impacts. Noise impacts could occur when construction directly adjacent to residential, park, or recreational areas is necessary.

9.2 Construction Noise Mitigation

To reduce temporary noise impacts associated with construction, contractors will comply with all state and local regulations relating to construction noise.

The contractor will be required to follow UDOT *Special Provision* Section 00555M, *Prosecution and Progress*. The contractor will be required to conform to this specification to reduce the impact of construction noise on the surrounding community.

10 Information for Local Officials

Activity Categories F and G include lands that are not sensitive to traffic noise. There are no impact criteria for these land use types, so noise abatement is not required. However, for Activity Category G, an estimate of the distance to the approach criteria must be provided to local governments. This estimate will help local government officials promote compatibility between land development and the Refined Selected Alternative. Syracuse City is the local government that has land use jurisdiction in the project study area.

Table 9 lists the distances from the edge of the roadway pavement to the locations where the worst-hour $L_{eq}(h)$ levels of 66 dBA and 71 dBA would occur.

Table 9. Contour Distance to Future Noise Levels

Roadway	Approximate Distance from Edge of West Davis Corridor Pavement to Noise-level Contour	
	66-dBA Noise-level Contour	71-dBA Noise-level Contour
West Davis Corridor	205 feet	105 feet

11 Conclusions

The Refined Selected Alternative would generally result in a 9-dBA increase in noise levels throughout the noise study area. Of the 290 receptors that were modeled, 122 dwelling units and 2 recreational sites would have traffic noise impacts from the Refined Selected Alternative. Section 11.1 discusses the recommended noise wall in the noise study area that met the requirements of UDOT's Noise Abatement Policy.

As part of the final design phase for the Refined Selected Alternative, UDOT will conduct balloting consistent with the procedures in UDOT's 2017 Noise Abatement Policy.

11.1 Summary of Recommended Noise Walls

11.1.1 Fremont Crest Wall

The recommended Fremont Crest wall would be 12 feet high and 2,254 feet long. It would extend from about 1950 South to about 2350 South on the west side of the WDC near the right-of way line (see Figure 6, Build Scenario Noise Walls [2 of 2]).

12 References

[CEQ] Council on Environmental Quality

1970 Environmental Quality: The First Annual Report of the Council on Environmental Quality. U.S. Government Printing Office, Washington, DC.

[EPA] U.S. Environmental Protection Agency

1971 Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances. NTID300.1. Prepared by Bolt, Beranek, & Newman, Boston, Mass. U.S. Government Printing Office, Washington, DC.

[FHWA] Federal Highway Administration

2011 Highway Traffic Noise: Analysis and Abatement Guidance. FHWA-HEP-10-025. https://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/analysis_and_abatement_guidance/revguidance.pdf. December.

Gharabegian, A., K.M. Cosgrove, J.R. Pehrson, and T.D. Trinh

1985 Forest Fire Fighters' Noise Exposure. *Noise Control Engineering Journal* 25(3): 96–111.

Toth, W.J.

1979 Noise-Abatement Techniques for Construction Equipment. HS-803 293; DOT-TSC-NHTSA-79-45: PB-300 948. U.S. Department of Transportation, National Highway Traffic Safety Administration, Washington, DC.

[UDOT] Utah Department of Transportation

2017 Noise Abatement. UDOT 08A2-1. Effective November 6, 1987. Revised June 15, 2017. https://www.udot.utah.gov/main/uconowner.gf?n=10496602977480171.

Appendix A. Noise Wall Analysis

Walls 1300 South to 1700 South - East Side of WDC

Wall Length (ft): 2113
Wall Cost per sq ft: $20
# of Front Row Receptors (R): 17

Reeval #1 **TNM File:** **Sept 15 1700 S to 700 S**
Barrier Analysis: Sept 18 18' 1300 S to 1700 S East Side
Height = 18

Receptor Name	# of Receptors	1st Row Y=Yes	Existing Noise Level	Build Noise Level - No Wall	Increase Over Existing	Receptors Impacted	Noise Level With 18-ft Wall	Noise Reduction	Front Row Receptors With 5 dBA Reduction	Front Row Receptors With 7 dba Reduction	Receptors With 5 dba Benefit
338	1	Y	59	68	9	1	68	0	0	0	0
339	1	Y	59	68	9	1	68	0	0	0	0
341	1	Y	57	68	11	1	68	0	0	0	0
342	1	Y	57	69	12	1	68	1	0	0	0
332	1	Y	55	68	13	1	66	2	0	0	0
331	1	Y	54	68	14	1	65	3	0	0	0
328	1	Y	54	68	14	1	65	3	0	0	0
329	1	Y	54	68	14	1	64	4	0	0	0
2	1	Y	60	68	8	1	65	3	0	0	0
1	1	Y	60	68	8	1	65	3	0	0	0
14	1	Y	60	69	9	1	66	3	0	0	0
15	1	Y	60	69	9	1	68	1	0	0	0
16	1	Y	60	70	10	1	70	0	0	0	0
					Total	13			0	0	0

Feasibility:	
# of First-Row 5 dBA Reduction:	0
% of First-Row 5 dBA Reduction:	0%
Acoustic Feasibility (5 dBA reduction for 50% of front-row):	No
Reasonableness:	
# of First-Row 7 dBA Design Goal:	0
% of First-Row 7 dBA Design Goal:	0.0%
Noise Abatement Design Goal (7 dBA reduction for 35% of front-row):	No
Cost:	
# of Benefited:	0
Cost of Noise Wall (Length x Height x $20/sq ft):	N/A
Cost of any other items critical to safety:	N/A
Anticipated Cost of Noise Abatement:	N/A
Allowable Cost ($30,000 per benefited receptor):	N/A
Cost Effective (Anticipated Cost < Allowable Cost):	N/A
5 dba Reduction Goal Met?	Yes
7 dba Recduction Goal Met?	No
Cost Criteria Met?	N/A
Feasible and Reasonable?:	No
Conclusion:	**Wall 1300 South to 1700 South, East Side is not recommended**

WEST DAVIS CORRIDOR

R#2 - Walls 1700 S - 1900 S

Walls 1700 South to 1900 South - East Side of WDC

Wall Length (ft): 1056
Wall Cost per sq ft: $20
# of Front Row Receptors (R): 5

Reeval #2 **TNM File: Oct 19 2700 S to 1700 S - E Side**
Barrier Analysis: Oct 28 14' Wall 1700 S to 1900 S — Height = 14
Barrier Analysis: Oct 28 16' Wall 1700 S t — Height = 16

Receptor Name	# of Receptors	1st Row of WDC Y=Yes	Existing Noise Level	Build Noise Level - No Wall	Increase Over Existing	Receptors Impacted	Noise Level With 14-ft Wall	Noise Reduction	Front Row Receptors With 5 dBA Reduction	Front Row Receptors With 7 dba Reduction	Receptors With 5 dba Benefit	Noise Level With 16-ft Wall	Noise Reduction	Front Row Receptors With 5 dBA Reduction
45	1	Y	57	69	12	1	67	2	0	0	0	67	2	0
46	1	Y	59	69	10	1	68	1	0	0	0	68	1	0
47	1	N	59	68	9	1	67	1	0	0	0	67	1	0
48	1	N	59	68	9	1	67	1	0	0	0	67	1	0
49	1	N	59	68	9	1	68	0	0	0	0	68	0	0
50	1	N	59	68	9	1	67	1	0	0	0	67	1	0
62	1	N	52	61	9	0	61	0	0	0	0	61	0	0
63	1	N	52	61	9	0	61	0	0	0	0	61	0	0
64	1	N	52	61	9	0	61	0	0	0	0	60	1	0
65	1	N	52	61	9	0	61	0	0	0	0	60	1	0
66	1	N	52	61	9	0	61	0	0	0	0	60	1	0
75	1	N	52	59	7	0	58	1	0	0	0	58	1	0
76	1	Y	57	68	11	1	66	2	0	0	0	65	3	0
77	1	Y	57	68	11	1	65	3	0	0	0	65	3	0
78	1	Y	57	67	10	1	66	1	0	0	0	65	2	0
					Total	9			0	0	0			0

	14-ft Wall	16-ft Wall
Feasibility:		
# of First-Row 5 dBA Reduction:	0	0
% of First-Row 5 dBA Reduction:	0%	0%
Acoustic Feasibility (5 dBA reduction for 50% of front-row):	No	No
Reasonableness:		
# of First-Row 7 dBA Design Goal:	0	0
% of First-Row 7 dBA Design Goal:	0.0%	0.0%
Noise Abatement Design Goal (7 dBA reduction for 35% of front-row):	No	No
Cost:		
# of Benefited:	0	0
Cost of Noise Wall (Length x Height x $20/sq ft):	N/A	N/A
Cost of any other items critical to safety:	N/A	N/A
Anticipated Cost of Noise Abatement:	N/A	N/A
Allowable Cost ($30,000 per benefited receptor):	N/A	N/A
Cost Effective (Anticipated Cost < Allowable Cost):	N/A	N/A
5 dba Reduction Goal Met?	Yes	Yes
7 dba Recduction Goal Met?	No	Yes
Cost Criteria Met?	N/A	No
Feasible and Reasonable?:	No	No
Conclusion:	**Walls 1700 South to 1900 South, East Side is not recommended**	

Page 1 of 2

R#2 - Walls 1700 S - 1900 S

Walls 1700 South to 1900 South - East Side (

Wall Length (ft): 1056
Wall Cost per sq ft: $20
# of Front Row Receptors (R): 5

:o 1900 S

Barrier Analysis: Oct 28 18' Wall 1700 S to 1900 S
Height = 18

Receptor Name	# of Receptors	1st Row of WDC Y=Yes	Existing Noise Level	Build Noise Level - No Wall	Increase Over Existing	Receptors Impacted	Front Row Receptors With 7 dba Reduction	Receptors With 5 dba Benefit	Noise Level With 18-ft Wall	Noise Reduction	Front Row Receptors With 5 dBA Reduction	Front Row Receptors With 7 dba Reduction	Receptors With 5 dba Benefit
45	1	Y	57	69	12	1	0	0	67	2	0	0	0
46	1	Y	59	69	10	1	0	0	68	1	0	0	0
47	1	N	59	68	9	1	0	0	67	1	0	0	0
48	1	N	59	68	9	1	0	0	67	1	0	0	0
49	1	N	59	68	9	1	0	0	68	0	0	0	0
50	1	N	59	68	9	1	0	0	67	1	0	0	0
62	1	N	52	61	9	0	0	0	60	1	0	0	0
63	1	N	52	61	9	0	0	0	60	1	0	0	0
64	1	N	52	61	9	0	0	0	60	1	0	0	0
65	1	N	52	61	9	0	0	0	60	1	0	0	0
66	1	N	52	61	9	0	0	0	60	1	0	0	0
75	1	N	52	59	7	0	0	0	58	1	0	0	0
76	1	Y	57	68	11	1	0	0	64	4	0	0	0
77	1	Y	57	68	11	1	0	0	64	4	0	0	0
78	1	Y	57	67	10	1	0	0	64	3	0	0	0
					Total	9	0	0			0	0	0

Feasibility:	
# of First-Row 5 dBA Reduction:	0
% of First-Row 5 dBA Reduction:	0%
Acoustic Feasibility (5 dBA reduction for 50% of front-row):	No
Reasonableness:	
# of First-Row 7 dBA Design Goal:	0
% of First-Row 7 dBA Design Goal:	0.0%
Noise Abatement Design Goal (7 dBA reduction for 35% of front-row):	No
Cost:	
# of Benefited:	0
Cost of Noise Wall (Length x Height x $20/sq ft):	N/A
Cost of any other items critical to safety:	N/A
Anticipated Cost of Noise Abatement:	N/A
Allowable Cost ($30,000 per benefited receptor):	N/A
Cost Effective (Anticipated Cost < Allowable Cost):	N/A
5 dba Reduction Goal Met?	Yes
7 dba Recduction Goal Met?	No
Cost Criteria Met?	N/A
Feasible and Reasonable?:	No
Conclusion:	

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R#2 - Wall Fremont Cr Ave

Wall Near Fremont Crest Ave, West Side

TNM File: Oct 23 Freemont Cr Area - Wall & All Rows

Wall Cost per sq ft: $20

# of Front Row Receptors (R): 26

Barrier Analysis: Sept 30 10' Wall Fremont Crest — Height = 10, Length = 2254

Barrier Analysis: Sept 30 12' Wall Fremont Crest — Height = 12, Length =

Receptor Name	# of Receptors	1st Row Y=Yes	Existing Noise Level	Build Noise Level - No Wall	Increase Over Existing	Receptors Impacted	Noise Level With 10-ft Wall	Noise Reduction	Front Row Receptors With 5 dBA Reduction	Front Row Receptors With 7 dba Reduction	Receptors With 5 dba Benefit	Noise Level With 12-ft Wall	Noise Reduction	Front Row Receptors With 5 dBA Reduction
176	1	N	48	61	13	1	61	0	0	0	0	60	1	0
177	1	N	48	61	13	1	61	0	0	0	0	61	0	0
178	1	N	49	62	13	1	62	0	0	0	0	61	1	0
180	1	N	50	64	14	1	64	0	0	0	0	63	1	0
230	1	Y	52	72	20	1	67	5	1	0	1	65	7	1
231	1	Y	52	72	20	1	67	5	1	0	1	65	7	1
232	1	Y	52	73	21	1	67	6	1	0	1	65	8	1
233	1	Y	52	73	21	1	67	6	1	0	1	65	8	1
234	1	Y	52	72	20	1	67	5	1	0	1	65	7	1
235	1	Y	52	74	22	1	69	5	1	0	1	66	8	1
236	1	Y	52	72	20	1	68	4	0	0	0	65	7	1
237	1	Y	52	72	20	1	68	4	0	0	0	66	6	1
238	1	Y	52	74	22	1	67	7	1	1	1	65	9	1
253	1	Y	52	72	20	1	67	5	1	0	1	65	7	1
254	1	Y	52	73	21	1	68	5	1	0	1	65	8	1
255	1	Y	52	72	20	1	67	5	1	0	1	65	7	1
256	1	Y	52	70	18	1	67	3	0	0	0	65	5	1
257	1	Y	52	71	19	1	67	4	0	0	0	65	6	1
258	1	Y	52	71	19	1	67	4	0	0	0	65	6	1
259	1	Y	52	70	18	1	67	3	0	0	0	65	5	1
260	1	Y	52	71	19	1	66	5	1	0	1	64	7	1
261	1	Y	52	70	18	1	65	5	1	0	1	63	7	1
286	1	Y	52	71	19	1	67	4	0	0	0	65	6	1
287	1	Y	52	72	20	1	68	4	0	0	0	65	7	1
288	1	Y	52	71	19	1	67	4	0	0	0	65	6	1
289	1	Y	52	72	20	1	67	5	1	0	1	65	7	1
290	1	Y	52	70	18	1	66	4	0	0	0	64	6	1
291	1	Y	52	70	18	1	65	5	1	0	1	64	6	1
292	1	Y	52	71	19	1	64	7	1	1	1	63	8	1
304	1	Y	52	70	18	1	65	5	1	0	1	64	6	1
305	1	N	51	66	15	1	65	1	0	0	0	64	2	0
					Total	31			16	2	16			26

	10-ft Wall	12-ft Wall
Feasibility:		
# of First-Row 5 dBA Reduction:	16	26
% of First-Row 5 dBA Reduction:	62%	100%
Acoustic Feasibility (5 dBA reduction for 50% of front-row):	Yes	Yes
Reasonableness:		
# of First-Row 7 dBA Design Goal:	2	16
% of First-Row 7 dBA Design Goal:	7.7%	61.5%
Noise Abatement Design Goal (7 dBA reduction for 35% of front-row):	No	Yes
Cost:		
# of Benefited:	16	26
Cost of Noise Wall (Length x Height x $20/sq ft):	N/A	$540,960
Cost of any other items critical to safety:	N/A	0
Anticipated Cost of Noise Abatement:	N/A	$540,960
Allowable Cost ($30,000 per benefited receptor):	N/A	$780,000.00
Cost Effective (Anticipated Cost < Allowable Cost):	N/A	Yes
5 dba Reduction Goal Met?	No	Yes
7 dba Recduction Goal Met?	No	Yes
Cost Criteria Met?	N/A	Yes
Feasible and Reasonable?:	No	Yes
Conclusion:	**Walls ranging from 12' to 17' high, 2254 ' long meet UDOT Noise Abatement Policy**	

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R#2 - Wall Fremont Cr Ave

Wall Near Fremont Crest Ave, West Side

TNM File: Oct 23 Freemont Cr Area - Wall & All Rows

Wall Cost per sq ft: $20

\# of Front Row Receptors (R): 26

2254

Barrier Analysis: Sept 30 16' Wall Fremont Crest — Height = 16 — Length = 2254

Barrier Analysis: S... — Height =

Receptor Name	# of Receptors	1st Row Y=Yes	Existing Noise Level	Build Noise Level - No Wall	Increase Over Existing	Receptors Impacted	Front Row Receptors With 7 dba Reduction	Receptors With 5 dba Benefit	Noise Level With 16-ft Wall	Noise Reduction	Front Row Receptors With 5 dBA Reduction	Front Row Receptors With 7 dba Reduction	Receptors With 5 dba Benefit	Noise Level With 17-ft Wall
176	1	N	48	61	13	1	0	0	59	2	0	0	0	58
177	1	N	48	61	13	1	0	0	59	2	0	0	0	58
178	1	N	49	62	13	1	0	0	60	2	0	0	0	59
180	1	N	50	64	14	1	0	0	61	3	0	0	0	60
230	1	Y	52	72	20	1	1	1	62	10	1	1	1	62
231	1	Y	52	72	20	1	1	1	62	10	1	1	1	62
232	1	Y	52	73	21	1	1	1	62	11	1	1	1	62
233	1	Y	52	73	21	1	1	1	62	11	1	1	1	62
234	1	Y	52	72	20	1	1	1	62	10	1	1	1	62
235	1	Y	52	74	22	1	1	1	63	11	1	1	1	63
236	1	Y	52	72	20	1	1	1	63	9	1	1	1	62
237	1	Y	52	72	20	1	0	1	63	9	1	1	1	62
238	1	Y	52	74	22	1	1	1	62	12	1	1	1	62
253	1	Y	52	72	20	1	1	1	62	10	1	1	1	62
254	1	Y	52	73	21	1	1	1	63	10	1	1	1	62
255	1	Y	52	72	20	1	1	1	63	9	1	1	1	62
256	1	Y	52	70	18	1	0	1	62	8	1	1	1	62
257	1	Y	52	71	19	1	0	1	62	9	1	1	1	62
258	1	Y	52	71	19	1	0	1	62	9	1	1	1	62
259	1	Y	52	70	18	1	0	1	63	7	1	1	1	62
260	1	Y	52	71	19	1	1	1	62	9	1	1	1	61
261	1	Y	52	70	18	1	1	1	61	9	1	1	1	61
286	1	Y	52	71	19	1	0	1	62	9	1	1	1	62
287	1	Y	52	72	20	1	1	1	62	10	1	1	1	62
288	1	Y	52	71	19	1	0	1	62	9	1	1	1	62
289	1	Y	52	72	20	1	1	1	62	10	1	1	1	62
290	1	Y	52	70	18	1	0	1	62	8	1	1	1	61
291	1	Y	52	70	18	1	0	1	61	9	1	1	1	61
292	1	Y	52	71	19	1	1	1	61	10	1	1	1	60
304	1	Y	52	70	18	1	0	1	62	8	1	1	1	62
305	1	N	51	66	15	1	0	0	64	2	0	0	0	64
					Total	31	16	26			26	26	26	

	16-ft Wall	17-ft Wall
Feasibility:		
# of First-Row 5 dBA Reduction:	26	26
% of First-Row 5 dBA Reduction:	100%	100%
Acoustic Feasibility (5 dBA reduction for 50% of front-row):	Yes	Yes
Reasonableness:		
# of First-Row 7 dBA Design Goal:	26	26
% of First-Row 7 dBA Design Goal:	100.0%	100.0%
Noise Abatement Design Goal (7 dBA reduction for 35% of front-row):	Yes	Yes
Cost:		
# of Benefited:	26	26
Cost of Noise Wall (Length x Height x $20/sq ft):	$721,280	$766,360
Cost of any other items critical to safety:	0	0
Anticipated Cost of Noise Abatement:	$721,280	$766,360
Allowable Cost ($30,000 per benefited receptor):	$780,000.00	$780,000.00
Cost Effective (Anticipated Cost < Allowable Cost):	Yes	Yes
5 dba Reduction Goal Met?	Yes	Yes
7 dba Recduction Goal Met?	Yes	Yes
Cost Criteria Met?	Yes	Yes
Feasible and Reasonable?:	Yes	Yes
Conclusion:		

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R#2 - Wall Fremont Cr Ave

Wall Near Fremont Crest Ave, West Side

TNM File: Oct 23 Freemont Cr Area - Wall & All Rows

Wall Cost per sq ft: $20

# of Front Row Receptors (R): 26

Sept 30 17' Wall Fremont Crest — 17 Length = 2254

Barrier Analysis: Oct 3 18' Wall Fremont Crest — Height = 18 Length = 2254

Receptor Name	# of Receptors	1st Row Y=Yes	Existing Noise Level	Build Noise Level - No Wall	Increase Over Existing	Receptors Impacted	Noise Reduction	Front Row Receptors With 5 dBA Reduction	Front Row Receptors With 7 dba Reduction	Receptors With 5 dba Benefit	Noise Level With 18 ft Wall	Noise Reduction	Front Row Receptors With 5 dBA Reduction	Front Row Receptors With 7 dba Reduction
176	1	N	48	61	13	1	3	0	0	0	58	3	0	0
177	1	N	48	61	13	1	3	0	0	0	58	3	0	0
178	1	N	49	62	13	1	3	0	0	0	58	4	0	0
180	1	N	50	64	14	1	4	0	0	0	59	5	0	0
230	1	Y	52	72	20	1	10	1	1	1	61	11	1	1
231	1	Y	52	72	20	1	10	1	1	1	61	11	1	1
232	1	Y	52	73	21	1	11	1	1	1	61	12	1	1
233	1	Y	52	73	21	1	11	1	1	1	62	11	1	1
234	1	Y	52	72	20	1	10	1	1	1	61	11	1	1
235	1	Y	52	74	22	1	11	1	1	1	62	12	1	1
236	1	Y	52	72	20	1	10	1	1	1	62	10	1	1
237	1	Y	52	72	20	1	10	1	1	1	62	10	1	1
238	1	Y	52	74	22	1	12	1	1	1	61	13	1	1
253	1	Y	52	72	20	1	10	1	1	1	61	11	1	1
254	1	Y	52	73	21	1	11	1	1	1	62	11	1	1
255	1	Y	52	72	20	1	10	1	1	1	61	11	1	1
256	1	Y	52	70	18	1	8	1	1	1	61	9	1	1
257	1	Y	52	71	19	1	9	1	1	1	61	10	1	1
258	1	Y	52	71	19	1	9	1	1	1	62	9	1	1
259	1	Y	52	70	18	1	8	1	1	1	62	8	1	1
260	1	Y	52	71	19	1	10	1	1	1	61	10	1	1
261	1	Y	52	70	18	1	9	1	1	1	60	10	1	1
286	1	Y	52	71	19	1	9	1	1	1	61	10	1	1
287	1	Y	52	72	20	1	10	1	1	1	61	11	1	1
288	1	Y	52	71	19	1	9	1	1	1	61	10	1	1
289	1	Y	52	72	20	1	10	1	1	1	61	11	1	1
290	1	Y	52	70	18	1	9	1	1	1	61	9	1	1
291	1	Y	52	70	18	1	9	1	1	1	61	9	1	1
292	1	Y	52	71	19	1	11	1	1	1	60	11	1	1
304	1	Y	52	70	18	1	8	1	1	1	62	8	1	1
305	1	N	51	66	15	1	2	0	0	0	63	3	0	0
					Total	31		26	26	26			26	26

Feasibility:	
# of First-Row 5 dBA Reduction:	26
% of First-Row 5 dBA Reduction:	100%
Acoustic Feasibility (5 dBA reduction for 50% of front-row):	Yes
Reasonableness:	
# of First-Row 7 dBA Design Goal:	26
% of First-Row 7 dBA Design Goal:	100.0%
Noise Abatement Design Goal (7 dBA reduction for 35% of front-row):	Yes
Cost:	
# of Benefited:	27
Cost of Noise Wall (Length x Height x $20/sq ft):	$811,440
Cost of any other items critical to safety:	0
Anticipated Cost of Noise Abatement:	$811,440
Allowable Cost ($30,000 per benefited receptor):	$810,000.00
Cost Effective (Anticipated Cost < Allowable Cost):	No
5 dba Reduction Goal Met?	Yes
7 dba Recduction Goal Met?	Yes
Cost Criteria Met?	No
Feasible and Reasonable?:	No
Conclusion:	

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R#2 - Wall Fremont Cr Ave

Wall Near Fremont Crest Ave, West Side

TNM File: Oct 23 Freemont Cr Area - Wall & All Rows

Wall Cost per sq ft: $20

# of Front Row Receptors (R): 26

Receptor Name	# of Receptors	1st Row Y=Yes	Existing Noise Level	Build Noise Level - No Wall	Increase Over Existing	Receptors Impacted	Receptors With 5 dba Benefit
176	1	N	48	61	13	1	0
177	1	N	48	61	13	1	0
178	1	N	49	62	13	1	0
180	1	N	50	64	14	1	1
230	1	Y	52	72	20	1	1
231	1	Y	52	72	20	1	1
232	1	Y	52	73	21	1	1
233	1	Y	52	73	21	1	1
234	1	Y	52	72	20	1	1
235	1	Y	52	74	22	1	1
236	1	Y	52	72	20	1	1
237	1	Y	52	72	20	1	1
238	1	Y	52	74	22	1	1
253	1	Y	52	72	20	1	1
254	1	Y	52	73	21	1	1
255	1	Y	52	72	20	1	1
256	1	Y	52	70	18	1	1
257	1	Y	52	71	19	1	1
258	1	Y	52	71	19	1	1
259	1	Y	52	70	18	1	1
260	1	Y	52	71	19	1	1
261	1	Y	52	70	18	1	1
286	1	Y	52	71	19	1	1
287	1	Y	52	72	20	1	1
288	1	Y	52	71	19	1	1
289	1	Y	52	72	20	1	1
290	1	Y	52	70	18	1	1
291	1	Y	52	70	18	1	1
292	1	Y	52	71	19	1	1
304	1	Y	52	70	18	1	1
305	1	N	51	66	15	1	0
					Total	31	27

Feasibility:

# of First-Row 5 dBA Reduction:

% of First-Row 5 dBA Reduction:

Acoustic Feasibility (5 dBA reduction for 50% of front-row):

Reasonableness:

# of First-Row 7 dBA Design Goal:

% of First-Row 7 dBA Design Goal:

Noise Abatement Design Goal (7 dBA reduction for 35% of front-row):

Cost:

# of Benefited:

Cost of Noise Wall (Length x Height x $20/sq ft):

Cost of any other items critical to safety:

Anticipated Cost of Noise Abatement:

Allowable Cost ($30,000 per benefited receptor):

Cost Effective (Anticipated Cost < Allowable Cost):

5 dba Reduction Goal Met?

7 dba Recduction Goal Met?

Cost Criteria Met?

Feasible and Reasonable?:

Conclusion:

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