Appendix B
Noise Study

Appendix B:
Noise Technical Memorandum
Antelope Valley Draft Environmental Impact Statement

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1.0 Introduction

This technical memorandum provides a detailed discussion of the potential traffic and construction-related noise impacts associated with the preferred alternative, the Draft Single Package, of the Antelope Valley Major Investment Study (AV MIS). A comparison of the preferred alternative's impacts is made to the No-Action Alternative. Where potential traffic noise impacts are identified, measures to avoid, minimize, and mitigate them are evaluated. Additional relevant information about the alternatives under study is provided in Chapter 4.9.

The AV MIS is sponsored by the City of Lincoln (the City), the University of Nebraska-Lincoln (UNL), and the Lower Platte South Natural Resources District (LPSNRD). Its three components include stormwater management, transportation improvements, and community revitalization within Lincoln's Antelope Valley. Although there are two important non-traffic-related aspects of the AV MIS, this noise analysis considers the potential impacts related to traffic only. It is unlikely that other aspects (i.e., stormwater management and community revitalization) would affect long-term ambient noise.

This noise analysis has been conducted in accordance with 23 CFR Part 772, "Procedures for Abatement of Highway Traffic Noise and Construction Noise" and with "Noise Abatement Policy" of the Nebraska Department of Roads (5/98). Consistent with these procedures, noise levels within the study area are predicted using a version of the Federal Highway Administration's (FHWA) Noise Barrier Cost Reduction Procedure – STAMINA 2.0/OPTIMA known as STAM2VU1/OPTIMVU, Version 1.35 (Bowlby & Associates, 1993). Using the model results, predicted noise levels are compared to existing noise levels and the Federal Noise Abatement Criteria (NAC) to determine if there are any study-related noise impacts. Where impacts are predicted under the Draft Single Package, appropriate noise mitigation measures are evaluated, including noise barriers. Mitigation is not considered for the No-Action Alternative.

2.0 Noise

Noise or sound consists of sound waves that are intercepted and interpreted by our ears. Sound pressure levels are measured in decibels (dB). For this study, the A-weighted sound network was used to characterize sound pressure levels. The A-weighted network was used because it closely reflects the range of human hearing. The network is also logarithmic. So, for instance, a sound level of 70 dBA is twice as loud as a sound level of 60 dBA. Given this information, common noise levels expressed in dBA are provided below:

Activity	Distance to Activity	Noise Level
Rock band	5 m (16 ft.)	110 dBA
Jet fly-over	300 m (985 ft.)	105 dBA
Gas lawn mower	1 m (3 ft.)	95 dBA
Diesel truck	15 m (50 ft.)	85 dBA
Diesel truck	33 m (110 ft.)	80 dBA
Gas lawn mower	30 m (100 ft.)	70 dBA
Normal speech	1 m (3 ft.)	65 dBA

Activity	Noise Level
Birds chirping	50 dBA
Leaves rustling	40 dBA
Very quiet whisper	30 dBA
Threshold of hearing	0 dBA

3.0 Noise Abatement Criteria and Land Use

23 CFR Part 772 outlines procedures for noise studies and noise abatement measures, establishes public information requirements, and supplies noise abatement criteria for FHWA projects. The procedures outlined for noise studies are being followed throughout this study, and the public information requirements are covered in Chapter 7 of this memo. In this regulation, Noise Abatement Criteria (NAC) have been adopted for various land uses and include minimum thresholds that, when approached or exceeded, indicate when noise abatement must be considered. These thresholds are expressed in equivalent levels (L_{eq}) of sound. L_{eq} is the steady-state sound level that contains the same acoustic energy as the time-varying traffic sound level. The L_{eq} from 23 CFR Part 772 for various land uses are provided in Table B.1.

Noise impacts occur when noise levels approach or exceed the NAC. For sensitive land uses such as residences, vehicle-generated noise levels approaching or exceeding 67 dBA L_{eq} cause an impact. For land uses less likely to be bothered by traffic noise, such as businesses and industries, outdoor noise levels approaching or exceeding 72 dBA L_{eq} cause an impact. However, NDOR interprets federal policy to mean that noise levels of at least 66 dBA L_{eq} for residences and at least 71 dBA L_{eq} for commercial/industrial establishments are noise impacts. Future noise levels that are predicted to be 15 decibels higher than existing levels are also considered an impact.

Table B.1
NOISE ABATEMENT CRITERIA

Activity Category	L_{eq}(h)	L10(h)	Description of Activity
A	57 Ext.	60 Ext.	Land on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 Ext.	70 Ext.	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 Ext.	75 Ext.	Developed lands, properties, or activities not included in Categories A or B above.
D	-	-	Undeveloped lands.
E	52 Int.	55 Int.	Residences, m/hotels, public meeting rooms, schools, churches, libraries, hospitals & auditoriums.

Note: Ext. = Exterior Int. = Interior
Source: 23 CFR Part 772.

4.0 Existing Noise Levels

Ambient noise levels within the study area are primarily the result of vehicles moving on the existing road network and, in some areas, railroad operations unrelated to this study. Vehicle noise on roadways is caused by pavement and tire friction, tailpipe emissions, and engine noise, and varies by vehicle speeds and traffic volumes. Vehicle operating speeds on study area roadways in Lincoln are well below highway speeds, where associated noise levels are typically greatest. Traffic-generated noise levels were estimated for existing conditions and predicted within the study area for full build-out using computer modeling techniques. Noise levels of railcars operating through the study area were not estimated or projected since this study would not affect rail operations other than the removal of at-grade roadway crossings, which would not adversely impact noise. In fact, the need for trains to sound their whistles would be removed at these crossings.

Study-area noise levels were recorded from 7 A.M. to 9 A.M. and 4 P.M. to 6 P.M. on May 5-7, 1998 at five representative sites. Vehicle noise during these peak periods is a function of traffic volume, vehicle composition or mix, and vehicle operating speed. The vehicle mix is assumed fairly constant throughout the day, and congestion isn't predicted to noticeably slow or stop free-flow traffic during peak periods (which would serve to decrease noise levels). Therefore, the peak-hour periods were assumed to coincide with the peak noise hours.

Noise levels during peak traffic periods were measured at each noise measurement location listed in Table B.2. Readings were taken during fair weather conditions. No unusual events were noted during noise monitoring, with the exception of noise from occasional passing trains. When this occurred, noise monitoring equipment was paused to eliminate this contribution.

Noise measurements were taken with a Bruel & Kjaer Instruments, Inc. Type 2230 (ANSI Type I) sound level meter, using a Type 4155 microphone cartridge. Both the sound level meter and the microphone cartridge were calibrated three months prior on February 16, 1998. The meter was validated before each measurement period to ensure measurement accuracy. Noise readings were recorded in decibels using the A-weighted network, which approximates the response of the human ear. Traffic counts along major roadways near each receptor were taken during the monitoring periods. Separate counts for cars, medium trucks (trucks with two axles), and heavy trucks (trucks with three or more axles) were recorded.

L_{eq}, which represents the equivalent steady-state or average noise level over a specific time period, was recorded at each noise measurement location. Based on the measurements, the existing noise levels at the receptors measured range from a low of 60dBA L_{eq} at receptor 3 to a high of 71 dBA L_{eq} at receptor 5 (see Table B.2 and FigureB.1).

Figure B.1

Table B.2
MEASURED NOISE LEVELS

Monitor Receptor	Land Use	Measured Noise Level (dBA L_{eq})		Comparable Modeled Noise Level (dBA L_{eq})		Difference	
		a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
1	Residential	67	66	67	66	0	0
2	Institutional	57	60	58	59	1	1
3	Park	58	56	56	56	2	0
4	Residential	60	63	61	63	1	0
5	Undev'd	68	71	68	68	0	3*

Source: AV Study Team
*Heavy truck idled and slowly passed approximately 7 meters (23 feet) from noise meter, but was not modeled.

5.0 Predicted Noise Levels

5.1 Prediction Methodology

Prior to predicting noise levels for full build-out conditions, the model setup was validated by running the traffic volumes that were counted during monitoring and comparing the modeled noise levels to the measured noise levels. The measured noise levels and the modeled noise levels for existing traffic were found to be within two decibels at all receptors, with the exception of Receptor 5 (where a heavy truck passed within 7 meters (23 feet) of the receptor from a side driveway). The variation shown between the measured and modeled results is less than 3 dBA L_{eq}^{*}, which is acceptable, and the model is therefore considered valid for this study.

Following model validation, existing peak hour traffic volumes were modeled to establish a baseline L_{eq} noise level at each receptor. The vehicle mix applied within the study area varied by roadway and was based on actual counts. Traffic volumes for future (full build-out) conditions for the Draft Single Package and the No-Action Alternative are represented as Design Hourly Volumes (DHV) in the model.

Noise levels within the study area are modeled for full build-out conditions. The predicted sound levels are compared to both the NAC and the existing noise levels to determine if impacts may occur. Where impacts may occur, the full range of abatement options, including traffic management techniques and physical improvements, are considered. When abatement options are considered, the feasibility and

reasonableness of providing them will determine whether the options are recommended. Feasibility and reasonableness are discussed in section 6.3.1.

Noise levels at receptors within the study area that are adjacent to improvements of the Draft Single Package are shown in Table B-3. For comparison purposes, the noise levels under existing conditions, future Draft Single Package conditions, and future No-Action Alternative conditions are provided.

In addition to calculating noise levels at specific receptors, noise contours for build-out conditions are forecast throughout the study area. Noise contours show approximate lines of equal loudness and can provide rough estimates of noise levels at locations within the study area. Noise contours are provided on the maps contained in Appendix I.

5.2 Noise Abatement

The FHWA's NAC and the NDOR's Noise Abatement Policy provide consistent guidelines on when noise abatement should be considered to mitigate noise impacts. Specifically, noise abatement should be considered when predicted traffic noise levels approach or exceed the noise abatement criteria, or when the predicted traffic noise levels substantially exceed the existing noise levels (i.e., 15 dBA L_{eq}).

Noise abatement is only considered for *sensitive* land uses within the study area that may be adversely affected by noise. When abatement is considered, there are several criteria that help determine when abatement is feasible and reasonable. Both conditions must be met before abatement in the form of noise barriers is recommended.

5.2.1 Noise Barrier Analysis

Noise barriers are considered to protect properties where traffic noise is predicted to create an impact—based either on the noise abatement criteria or on a substantial increase from existing to future traffic noise levels. Where these tests are met, noise barriers must be *feasible* from an engineering standpoint and *reasonable* from a cost, effectiveness, and access standpoint to be recommended.

Barriers are considered *feasible* if the insertion loss (reduction in traffic noise at a point 10 feet from a residence) is at least five decibels. To meet this criterion, the following questions must be favorably addressed:

1. Is noise abatement compatible with the topography?
2. The exposed height of a noise wall cannot exceed 5 meters (16 feet), except for short lengths.
3. Are other noise sources present?
4. A noise barrier will be located beyond the clear recovery zone or be incorporated into existing highway barriers.

Table B.3
PREDICTED NOISE LEVELS

Receptor Number	Address	Land Use	NAC	Existing		No-Action Alternative		Draft Single Package	
				A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
20	1215 N. 17th St.	Commercial	C-72	61	62	63	63	60	61
27	1456 N. 15th St.	Residential	B-67	54	54	55	56	62	62
28	1452 N. 15th St.	Residential	B-67	52	53	54	55	62	61
29	1438 N. 15th St.	Residential	B-67	52	53	53	54	61	60
30	1436 N. 15th St.	Residential	B-67	52	53	53	54	61	60
31	1412 N. 15th St.	Residential	B-67	51	52	53	54	60	60
32	1406 N. 15th St.	Residential	B-67	51	52	53	53	60	60
44	800 N. 17th St.	Commercial	C-72	56	59	57	59	56	55
47	1451 N. 15th St.	Residential	B-67	53	54	55	56	59	59
51	1405 N. 15th St.	Residential	B-67	53	54	54	55	58	58
120	1973 S St.	Residential	B-67	48	49	50	49	65	63
121	1971 S St.	Residential	B-67	49	49	50	50	68	65
133	1911 R St.	Commercial	C-72	53	53	54	54	64	62
136	567 Q St.	Residential	B-67	58	56	60	58	62	61
137	240 N. 17th St.	Commercial	C-72	62	60	64	62	61	62
144	1914 P St.	Commercial	C-72	58	61	59	61	66	66
145	1935 Q St.	Commercial	C-72	62	61	63	62	67	67
151	1732 O St.	Commercial	C-72	58	60	58	60	56	56
152	1742 O St.	Commercial	C-72	63	63	63	64	62	61
155	1840 O St.	Commercial	C-72	63	63	63	64	66	66
158	136 N. 19th St.	Commercial	C-72	61	64	62	64	70	70
161	1940 O St.	Commercial	C-72	60	61	61	62	61	60
162	1908 O St.	Commercial	C-72	65	66	65	66	65	65
163	737 N. 22nd St.	Residential	B-67	56	57	57	57	62	63
165	2223 Vine St.	Residential	B-67	50	50	50	51	62	64
166	2203 Vine St.	Residential	B-67	53	53	53	54	62	64
171	2030 Q St.	Residential	B-67	58	56	60	58	61	59
176	2108 Q St.	Residential	B-67	62	59	63	61	57	55
177	2110 Q St.	Residential	B-67	62	60	64	61	54	52
178	2021 Q St.	Residential	B-67	63	61	65	62	64	63
179	2011 Q St.	Residential	B-67	62	60	64	62	63	62
183	2035 Q St.	Residential	B-67	64	61	65	63	64	64
184	2145 Q St.	Residential	B-67	60	58	62	60	51	50
185	2135 Q St.	Residential	B-67	61	59	62	60	52	51
186	2127 Q St.	Residential	B-67	60	58	62	60	53	52
187	2119 Q St.	Residential	B-67	60	58	62	60	53	52
188	2109 Q St.	Residential	B-67	61	59	63	61	55	54
189	228 N. 21st St.	Residential	B-67	60	58	61	60	58	56
190	104 N. 20th St.	Commercial	C-72	64	64	64	65	59	59
191	2010 O St.	Commercial	C-72	64	64	64	65	59	58

Table B.3
PREDICTED NOISE LEVELS (continued)

Receptor Number	Address	Land Use	NAC	Existing		No-Action Alternative		Draft Single Package	
				A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
204	1900 N St.	Commercial	C-72	60	61	60	61	68	68
205	1901 O St.	Commercial	C-72	64	65	64	65	66	66
207	1955 O St.	Commercial	C-72	65	66	66	66	62	63
208	1903 O St.	Commercial	C-72	64	65	65	66	62	63
209	1745 O St.	Commercial	C-72	65	65	65	66	63	63
218	1827 O St.	Commercial	C-72	68	69	69	69	68	68
219	1819 O St.	Commercial	C-72	68	69	69	69	67	67
220	1801 O St.	Commercial	C-72	60	61	61	62	60	60
225	212 S. 19th St.	Commercial	C-72	57	58	57	59	66	65
226	238 S. 19th St.	Commercial	C-72	58	60	59	60	68	67
227	254 S. 19th St.	Commercial	C-72	58	60	59	60	67	67
228	230 S. 19th St.	Commercial	C-72	58	60	59	60	68	67
229	1919 N St.	Commercial	C-72	60	62	60	62	70	70
236	320 S. 19th St.	Commercial	C-72	60	62	61	62	69	69
237	324 S. 19th St.	Commercial	C-72	62	63	62	63	70	70
238	336 S. 19th St.	Residential	B-67	61	61	61	61	66	66
239	338 S. 19th St.	Residential	B-67	62	61	62	62	67	66
243	1944 L St.	Residential	B-67	72	69	72	69	69	68
244	302 S 19th St.	Commercial	C-72	74	71	74	71	71	71
249	1925 L St.	Residential	B-67	67	64	67	64	64	66
250	1921 L St.	Residential	B-67	66	63	66	64	64	66
251	1915 L St.	Residential	B-67	66	63	66	64	64	66
252	1907 L St.	Residential	B-67	66	63	66	64	65	66
253	426 S. 19th St.	Residential	B-67	61	62	62	63	65	66
254	1900 K St.	Residential	B-67	61	64	61	64	65	65
262	2340 Kimarra Pl.	Commercial	C-72	61	62	62	63	62	61
266	2300 Kimarra Pl.	Commercial	C-72	53	64	54	55	67	66
273	1546 N. 14th St.	Residential	B-67	62	64	64	65	60	60
274	1528 N. 14th St.	Residential	B-67	59	60	60	62	59	59
275	1520 N. 14th St.	Residential	B-67	59	61	60	62	59	58
276	1501 N. 15th St.	Residential	B-67	54	55	55	56	60	59
277	1515 N. 15th St.	Residential	B-67	54	55	56	57	60	60
278	1525 N. 15th St.	Residential	B-67	55	56	57	58	61	60
279	1535 N. 15th St.	Residential	B-67	57	58	59	59	62	62
280	1545 N. 15th St.	Residential	B-67	60	61	62	63	63	62
326	1715 N. 14th St.	Residential	B-67	66	66	68	68	63	62
327	1711 N. 14th St.	Residential	B-67	66	66	68	68	61	61
328	1643 N. 14th St.	Residential	B-67	67	67	69	68	59	59
329	1635 N. 14th St.	Residential	B-67	66	66	67	67	59	59

Table B.3
PREDICTED NOISE LEVELS (continued)

Receptor Number	Address	Land Use	NAC	Existing		No-Action Alternative		Draft Single Package	
				A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
330	1627 N. 14th St.	Residential	B-67	68	67	69	69	59	59
331	1625 N. 14th St.	Residential	B-67	67	67	69	69	58	58
332	1611 N. 14th St.	Residential	B-67	66	66	68	68	58	58
333	1601 N. 14th St.	Residential	B-67	65	65	67	67	57	57
334	1515 N. 12th St.	Public	B-67	47	47	48	48	55	55
355	4051 N. 40th St.	Residential	B-67	46	46	49	49	45	45
356	2940 Cornhusker Hwy.	Commercial	C-72	67	67	68	68	68	69
358	3010 Cornhusker Hwy.	Commercial	C-72	65	65	65	65	65	66
370	2902 Cornhusker Hwy.	Commercial	C-72	68	68	69	68	71	71
372	3210 Cornhusker Hwy.	Commercial	C-72	67	66	67	67	55	57
373	3244 Cornhusker Hwy.	Commercial	C-72	63	63	64	64	53	54
374	3240 N. 33rd St.	Commercial	C-72	49	49	50	50	52	53
375	3400 Cornhusker Hwy.	Commercial	C-72	68	68	68	68	49	50
376	3700 Cornhusker Hwy.	Commercial	C-72	45	45	45	46	40	40
379	3630 Adams St.	Commercial	C-72	46	46	46	47	41	41
384	3700 Adams St.	Commercial	C-72	44	44	44	44	40	40
385	3300 Gladstone St.	Industrial	C-72	45	45	46	46	52	52
386	3421 Gladstone St.	Industrial	C-72	44	45	45	45	54	54
387	3441 N. 35th Cir.	Industrial	C-72	43	43	43	44	56	56
405	3030 N. 33rd St.	Commercial	C-72	60	60	60	60	51	51
407	3320 Cornhusker Hwy.	Commercial	C-72	70	70	71	70	51	52
412	3101 Cornhusker Hwy.	Commercial	C-72	62	62	62	63	64	65
413	3201 Cornhusker Hwy.	Commercial	C-72	67	67	67	68	66	69
414	3245 Adams St.	Commercial	C-72	72	74	72	74	54	55
424	2740 N. 27th St.	Commercial	C-72	60	62	62	63	59	59
428	2829 N. 33rd St.	Commercial	C-72	70	71	70	71	64	67
433	3001 Cornhusker Hwy.	Industrial	C-72	52	53	53	54	60	60
438	2705 N. 33rd St.	Commercial	C-72	62	65	62	64	60	60
477	2525 N. 33rd St.	Commercial	C-72	65	67	65	67	66	66
478	2503 N. 33rd St.	Commercial	C-72	63	65	63	65	70	69
481	2547 N. 33rd St.	Commercial	C-72	65	68	65	67	69	69
484	2415 N. 33rd St.	Commercial	C-72	64	67	64	66	66	68
491	3441 Adams St.	Commercial	C-72	61	62	62	62	47	48
492	3311 Cornhusker Hwy.	Commercial	C-72	62	63	62	63	51	52
497	2933 N. 36th St.	Commercial	C-72	42	44	42	44	42	42
501	2936 N. 36th St.	Commercial	C-72	41	43	41	43	42	42
502	2900 N. 36th St.	Commercial	C-72	42	44	42	44	42	42
503	3645 Adams St.	Commercial	C-72	47	48	48	48	48	48
504	3733 Adams St.	Industrial	C-72	42	42	42	42	39	39
505	2851 N. 35th St.	Commercial	C-72	49	51	49	51	45	45

Table B.3
PREDICTED NOISE LEVELS (continued)

Receptor Number	Address	Land Use	NAC	Existing		No-Action Alternative		Draft Single Package	
				A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
506	3421 Cleveland Ave.	Commercial	C-72	51	52	51	52	45	45
507	3411 Cleveland Ave.	Commercial	C-72	52	54	52	53	46	46
513	2835 N. 36th St.	Residential	B-67	44	46	45	46	43	43
514	2829 N. 36th St.	Residential	B-67	45	46	45	46	43	43
528	3300 Huntington Ave.	Residential	B-67	52	55	52	54	69	69
530	3310 Madison Ave.	Residential	B-67	60	62	60	62	53	53
531	3304 Madison Ave.	Commercial	C-72	65	67	65	67	53	53
533	3440 Madison Ave.	Commercial	C-72	50	52	50	51	50	50
534	3400 Madison Ave.	Commercial	C-72	51	53	52	53	50	51
535	3316 Madison Ave.	Commercial	C-72	55	57	55	57	52	52
539	3701 Adams St.	Commercial	C-72	44	44	44	44	41	41
540	3711 Adams St.	Commercial	C-72	45	45	45	45	47	47
546	Harper/Schramm/Smith Dorm.	Residential	B-67	50	50	51	51	58	58
549	UNL Recreation Area	Recreation	B-67	50	50	52	51	56	56
550	UNL Police Dept.	Public	C-72	58	58	59	59	59	60
551	UNL Maintenance Bldg.	Public	C-72	62	63	64	65	59	59
552	UNL Landscape Srvcs.	Public	C-72	62	62	62	62	57	57
553	UNL Business Services	Public	C-72	58	57	60	59	59	59
555	UNL Nebraska Hall	Public	B-67	57	57	59	59	58	57
556	UNL Engineering Center	Public	B-67	45	46	45	47	51	51
557	Abel/Sandoz Dorm.	Residential	B-67	58	61	59	61	58	58
558	Abel/Sandoz Dorm.	Residential	B-67	45	47	46	48	55	55
561	UNL-Mail & Distribution	Public	C-72	53	53	54	54	61	60
562	UNL Beadle Center	Public	B-67	54	55	54	55	65	65
563	Lincoln-Trago Park	Recreation	B-67	48	49	49	49	60	59
564	UNL Recreation Area	Recreation	B-67	59	60	60	60	68	67
566	Indian Center	Public	B-67	51	51	51	51	59	59
568	Lincoln-Fire Dept.	Public	C-72	66	63	68	65	64	65
569	Armory (historic)	Public	C-72	63	64	64	65	64	64
570	Devaney Center	Recreation	B-67	50	52	51	53	58	58
574	Superior St.	Residential	B-67	62	62	65	65	64	63
575	Baldwin Ave.	Public	B-67	60	62	60	62	60	60
578	C & S Annex	Public	B-67	59	58	60	60	62	61
579	Boat House	Public	B-67	58	57	59	59	60	60
580	N. 14th St.	Commercial	C-72	53	54	55	55	60	60
582	N. 16th St.	Residential	B-67	51	51	52	52	43	43
583	N. 16th St.	Residential	B-67	54	53	56	54	62	61
584	N. 16th St.	Residential	B-67	56	55	57	56	61	61
585	N. 16th St.	Residential	B-67	61	59	62	60	61	61
586	N. 16th St.	Residential	B-67	57	56	59	57	59	59

Table B.3
PREDICTED NOISE LEVELS (continued)

Receptor Number	Address	Land Use	NAC	Existing		No-Action Alternative		Draft Single Package	
				A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
587	Abel/Sandoz Dorm.	Residential	B-67	50	52	51	53	57	57
588	3100 Cornhusker Hwy.	Commercial	C-72	55	55	55	56	58	59
589	2255 Vine St.	Residential	B-67	46	47	47	47	62	64
590	UNL Recreation Area	Recreation	B-67	60	62	60	63	57	57
591	Malone Community Ctr.	Public	B-67	54	54	54	55	63	63
592	Devaney Center	Recreation	B-67	57	58	59	60	59	59
A8	1315 New Hampshire St.	Residential	B-67	51	51	52	52	57	57
A9	1311 New Hampshire St.	Residential	B-67	50	51	51	52	57	57
A10	1301 New Hampshire St.	Residential	B-67	49	50	51	51	57	56
A11	1245 New Hampshire St.	Residential	B-67	49	49	50	50	56	56
A12	1235 New Hampshire St.	Residential	B-67	48	49	49	50	56	56
A14	1219 New Hampshire St.	Residential	B-67	48	48	49	49	55	55
A15	1209 New Hampshire St.	Residential	B-67	47	48	48	49	55	55
A16	1201 New Hampshire St.	Residential	B-67	47	47	48	48	55	54
A17	1204 Charleston St.	Residential	B-67	48	48	49	49	47	57
A18	1210 Charleston St.	Residential	B-67	49	48	49	49	57	57
A20	1219 N. 14th St.	Commercial	C-72	64	64	65	65	62	62
A21	1145 Charleston St.	Residential	B-67	49	48	49	49	58	58
A22	1143 Charleston St.	Residential	B-67	48	48	49	48	57	57
A23	1141 Charleston St.	Residential	B-67	48	47	48	48	57	57
A24	1139 Charleston St.	Residential	B-67	47	47	48	48	57	56
A25	1137 Charleston St.	Residential	B-67	47	47	48	48	56	56
A26	1135 Charleston St.	Residential	B-67	47	47	48	47	56	56
A27	1131 Charleston St.	Residential	B-67	47	46	47	47	56	56
A28	1125 Charleston St.	Residential	B-67	46	46	47	47	55	55
A29	1119 Charleston St.	Residential	B-67	46	46	47	47	55	55
A30	1109 Charleston St.	Residential	B-67	46	45	46	46	55	55
A31	1101 Charleston St.	Residential	B-67	45	45	46	46	54	54
A32	1047 Charleston St.	Residential	B-67	45	45	46	46	54	54
A33	1045 Charleston St.	Residential	B-67	45	44	46	45	54	54
A34	1041 Charleston St.	Residential	B-67	45	44	45	45	53	53
A35	1031 Charleston St.	Residential	B-67	44	44	45	45	53	53
A36	1027 Charleston St.	Residential	B-67	44	44	45	45	53	53
A37	1025 Charleston St.	Residential	B-67	44	44	45	44	53	53
A38	1017 Charleston St.	Residential	B-67	43	43	44	44	52	52
A40	1018 Y St.	Residential	B-67	45	44	45	45	54	54
A41	1020 Y St.	Residential	B-67	45	45	46	45	54	54
A42	1020 Y St.	Residential	B-67	45	45	46	45	54	54
A43	1022 Y St.	Residential	B-67	45	45	46	46	55	55
A44	1024 Y St.	Residential	B-67	46	45	47	46	55	55

Table B.3
PREDICTED NOISE LEVELS (continued)

Receptor Number	Address	Land Use	NAC	Existing		No-Action Alternative		Draft Single Package	
				A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
A45	1036 Y St.	Residential	B-67	46	46	47	47	56	56
A46	1048 Y St.	Residential	B-67	47	46	47	47	56	56
A48	1062 Y St.	Residential	B-67	48	47	48	48	57	57
A53	1009 Charleston St.	Public	B-67	43	43	44	44	52	51
A54	1142 Y St.	Residential	B-67	52	52	53	52	62	62
A57	1207 Charleston St.	Residential	B-67	51	50	51	51	60	60
A58	1201 Charleston St.	Residential	B-67	50	50	51	51	60	59
A63	1001 Y St.	Industrial	C-72	50	50	51	50	60	60

Source: AV Study Team

Barriers not meeting these criteria are not *feasible*. Barriers are considered *reasonable* if they meet the criteria outlined below. Depending on the characteristics of the abatement, ratings of 0 to 4 are assigned, and the total must add to at least 10 to be considered reasonable.

1. The noise abatement must be cost effective. Cost effectiveness is defined as cost per protected residence.
   <$18,000/residence = 4
   $18-$23,000/residence = 3
   $23-$28,000/residence = 2
   >$28,000/residence = 1

2. The change in computed noise levels between the design year and existing will equal or exceed 3 decibels (a barely perceptible change).
   >3 decibels = 4
   3 decibels = 3
   2 decibels = 2
   <2 decibels = 1

3. The housing development or plat preceded FHWA approval of the environmental document for initial highway construction.
   >80 percent = 4
   50-80 percent = 3
   30-50 percent = 2
   <30 percent = 1

4. It is considered unreasonable if it provides noise abatement on a highway with partial or no control of access.
   Full control of access = 4
   ½ mile access control = 2
   ¼ mile access control = 1
   <1/4 mile access control = 0

5.2.2 Other Abatement Measures

Several methods other than the construction of noise barriers are potentially available to mitigate traffic noise impacts, including traffic management techniques and physical changes to the roadway. These measures are summarized below:

Prohibiting noisier vehicle types, such as heavy trucks, from using certain roadways. Trucks would use the North-South and East-West Roadways—much as the existing major routes through the city are used by trucks now. Restricting trucks from using these new routes would be counter to the study's objective of taking through traffic off neighborhood streets. In addition, the use of the new roadways by emergency vehicles cannot be restricted.

Restricting noisier vehicle types from using certain roadways during noise-sensitive hours. Noisier vehicles cannot be restricted from certain roadways given the reasons listed above.

Reducing speed limits. Because of the relatively low speeds to be posted on the North-South and East-West Roadways and the study's objective to decrease traveler delays, lowering the speed limit further is not consistent with the purpose and need.

Relocating the improvements. Relocating the transportation improvements is not reasonable since roadway locations elsewhere would divide long-established neighborhoods, working counter to the study's community revitalization goals.

Lowering the highway. Changes in the vertical alignment cannot be made because constraints imposed by established residences and businesses that would remain on either side of the alignment and the additional construction costs.

Shifting the alignment to provide buffer zones. Shifting the horizontal alignment on the North-South Roadway to reduce noise and provide buffer zones is not possible since the roadway is located to minimize the number of properties to be removed.

Using a quieter pavement type. The use of asphalt instead of concrete is a proven method of reducing tire noise. An asphalt surface—the quieter choice of the two—would be considered for all study-area roadways. Noise readings for this study were taken on asphalt-paved roads.

Abating interior noise impacts by insulating residences and public-use facilities. Interior noise levels caused by vehicles operating on Draft Single Package roadways are not anticipated to be high.

5.3 Noise Impact Analysis

Fifteen properties have been identified with a noise impact. The UNL Beadle Center is also discussed due to the sensitive nature of research conducted there; however, there is no noise impact at this site. Noise levels associated with these sites are summarized in Table B.4 and are shown in Figure B.2.

Table B.4
RECEPTORS IMPACTED BY NOISE

Receptor	Existing		Future N-A		D SP		Land Use	Exceed NAC?	Increase >= 15 dBA?
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.			
120	48	49	50	49	65	63	Residential	No	Yes
121	49	49	50	50	68	65	Residential	Yes	Yes
238	61	61	61	61	66	66	Residential	Yes	No
239	62	61	62	62	67	66	Residential	Yes	No
243	72	69	72	69	69	68	Residential	Yes	No
244	74	71	74	71	71	71	Commercial	Yes	No
249	66	64	67	64	64	66	Residential	Yes	No
250	66	63	66	64	64	66	Residential	Yes	No
251	66	63	66	64	64	66	Residential	Yes	No
252	66	63	66	64	65	66	Residential	Yes	No
253	61	62	62	63	65	66	Residential	Yes	No
254	61	64	61	64	65	66	Residential	Yes	No
370	68	68	69	68	71	71	Commercial	Yes	No
528	52	55	52	54	69	69	Residential	Yes	Yes
564	59	60	60	60	67	66	Recreation	Yes	No
Beadle Center	*	*	*	*	*	*	Research	Yes	*

Source: AV Study Team
* Impact identified by contour analysis rather than by point-by-point site analysis.

A detailed analysis of the noise impact and appropriate mitigation follows:

- **336 S. 19th Street (receptor 238).** This two-family residential property is located on the east side of 19th Street, between L and M Streets. Noise levels associated with the Draft Single Package at the receptor are predicted to be 5 dBA L_{eq} louder in the a.m. and p.m. peak traffic periods. The resultant level creates an impact (i.e., 66 dBA L_{eq} peak) in the property's front yard, where there appears to be no active use. Vehicular access to the house is provided via a north-south alley behind the building.

  A noise barrier was considered to mitigate impacts at this location. To be effective, the barrier would have to extend along the east side of the North-South Roadway to the north of the property. This would adversely and unacceptably affect physical access to commercial properties to the north. Therefore, a barrier is not considered feasible.

- **338 S. 19th Street (receptor 239).** This two-family residential property is immediately south of 336 S. 19th Street (see above). Noise levels associated with the Draft Single Package at the receptor are predicted to be 5 dBA L_{eq} louder in both the a.m. and p.m. peak traffic periods. Similar to the property at 336 S. 19th Street, the resultant level creates an impact (i.e., 67 dBA L_{eq} peak) in the property's

Figure B.2

front yard, where there appears to be no active use. Access to the house is provided via a north-south alley behind the building. Mitigation considerations are similar to those discussed above.

- **1944 L Street (receptor 243).** This single-family residential property is located on the north side of L Street, between 19th and 20th Streets. Noise levels associated with the Draft Single Package at the receptor are predicted to be 3 dBA L_{eq} quieter in the a.m. and 1 dBA L_{eq} quieter in the p.m. peak periods. Despite these decreases, the 69dBA L_{eq} peak a.m. level and 68 dBA L_{eq} peak p.m. level are considered a noise impact.

  A noise barrier in this location is not feasible given the need to maintain driveway access to L Street.

- **302 S. 19th Street (receptor 244).** This commercial property on the east side of 19th Street, between L and M Streets, houses Nebraska Tropical Fish. Noise levels associated with the Draft Single Package at the receptor are predicted to be 3 dBA L_{eq} quieter in the a.m. and the same in the p.m. peak periods. The resultant peaks of 71 dBA L_{eq} in the a.m. and in the p.m. in the front yard are considered an impact for commercial land use.

  A noise barrier is not feasible given the need to maintain driveway access to 19th Street and the building's location on a corner. Therefore, a noise barrier is not recommended.

- **1907 L Street (receptor 252).** This single-family residential property is located on the south side of L Street, between 19th and 20th Streets. Noise levels associated with the Draft Single Package at the receptor are predicted to be 1dBA L_{eq} quieter in the a.m. and 3 dBA L_{eq} louder in the p.m. peak periods. The resultant 66 dBA L_{eq} noise level is considered an impact for residential land use. There is no active use in the front and western side yards, where the impact is predicted to occur. A noise barrier is not feasible given the need to maintain access to L Street.

- **1915 L Street (receptor 251).** This two-family residential property is located just east of 19th Street and east of receptor 252. Noise levels associated with the Draft Single Package at the receptor are predicted to be 2 dBA L_{eq} quieter in the a.m. and 3 dBA L_{eq} louder in the p.m. peak traffic periods. The resultant level creates an impact (i.e., 66 dBA L_{eq} peak) in the property's front yard.

  A noise barrier in this location is not feasible given the need to maintain access to the property.

- **1921 L Street (receptor 250).** This single-family residential property is located east of 19th Street and east of receptors 252 and 251. Noise levels associated with the Draft Single Package at the receptor are predicted to be 2 dBA L_{eq} quieter in the a.m. and 3 dBA L_{eq} louder in the p.m. peak traffic periods. The resultant level creates an impact (i.e. 66 dBA L_{eq}) in the property's front yard. A noise barrier in this location is not feasible given the need to maintain access to the property.

- **1925 L Street (receptor 249).** This single-family residential property is located east of 19th Street and east of receptors 252, 251, and 250. Noise levels associated with the Draft Single Package at the receptor are predicted to be 2 dBA L_{eq} quieter in the a.m. and 2 dBA L_{eq} louder in the p.m. peak traffic periods. The resultant level creates an impact (i.e. 66 dBA L_{eq}) in the property's front yard.

  A noise barrier in this location is not feasible given the need to maintain access to the property.

- **1900 K Street (receptor 254).** This residential apartment building is located on the northeast corner of K and 19th Streets. Noise levels associated with the Draft Single Package at the receptor are predicted to be 4 dBA L_{eq} louder in the a.m. and 2 dBA L_{eq} louder in the p.m. peak traffic periods. The resultant level creates an impact (i.e. 66 dBA L_{eq}) on the west side of the property.

  A noise barrier at this location is not feasible given the need to provide adequate clear zones at the intersection.

- **2902 Cornhusker Highway (receptor 370).** Noise levels associated with the Draft Single Package at this commercial receptor are predicted to be 3 dBA L_{eq} louder in the a.m. and in the p.m. peak traffic periods. The 71dBA L_{eq} peak level is considered an impact.

  A noise barrier in this location is not feasible given the need to maintain physical and visual access to the business. The use at this location is interior rather than exterior, and thus highway noise levels should not be a nuisance. No further analysis is recommended.

- **426 S. 19th Street (receptor 253).** This single-family residential property is located on the east side of 19th Street, between K and L Streets. Noise levels associated with the Draft Single Package at the receptor are predicted to be 4dBA L_{eq} louder in the a.m. and p.m. peak periods. This creates an impact (i.e., 66dBA L_{eq} peak) in the property's front yard, where there appears to be no active use. Access is provided via an east-west alley immediately north of the house. A noise barrier in this location would eliminate access to the east-west alley serving the block and, therefore, is not feasible.

- **1973 S Street (receptor 120).** This single-family residential property is located on the south side of S Street, east of 19th Street and Carter Lumber. Noise levels associated with the Draft Single Package at the receptor are predicted to be 16dBA L_{eq} louder in the a.m. and 13dBA L_{eq} louder in the p.m. peak periods. The a.m. increase of greater than 15 dBA L_{eq} is considered an impact. The peak period noise level is predicted to be only 65 dBA L_{eq} (a.m.).

  A noise barrier on the east side of the North-South Roadway is one of the potential means of mitigating the increase in noise levels at this location., The barrier would be 2.4 meters (8.0 feet) tall and would extend approximately 95.0 meters (312 feet) long. The cost of this barrier totaling 231.7 square meters (2,493.6 square feet) is

approximately $44,880 based on NDOR standard unit costs. Noise levels associated with the barrier are presented in Table B.5 and are referenced to Figure B.3.

The barrier is considered *feasible* in relation to the criteria from section 6.3.1. The proposed noise barrier is compatible with existing topography, is far less than 4.9 meters (16.0 feet) tall, it's effectiveness is not undermined by other noise sources, and it can be located beyond the clear recovery zone. Therefore, the four *reasonableness* criteria from section 6.3.1 are applied below to this site:

	Criteria	Characteristic	Rating
1.	Cost effectiveness	$22,442.40 per residence (1971 and 1973 S Street)	3
2.	Change from existing to future	16dBA L_{eq}	4
3.	Housing entirely precedes study approval	yes	4
4.	Access Control	¼ mile	1
			12

Rating totals greater than 10 are considered "reasonable" by NDOR, and are eligible for barrier construction. If a barrier is desired at this location, the proposed size, reasonableness, and feasibility issues should be revisited as the community revitalization concepts evolve. If new housing is planned, designed, and programmed near this area, before the FEIS is issued, then a longer barrier may be required to adequately protect the entire area from noise impacts.

Per NDOR policy, when it is determined that it would be feasible to provide noise abatement for a site, and a preliminary determination has been made that abatement would be reasonable, a public informational meeting will be held as part of the process for a final determination of whether abatement would be reasonable. The benefited residents will be given an opportunity to vote. "Benefited Residents" are those whose *backyard or sideyard* activity areas are *directly behind and adjacent to* the noise abatement device and, thus, will receive a perceivable noise reduction from the device.

Noise abatement will be provided only if the benefited residents support the proposal. "Support" means at least 75 percent of the benefited property owners voting in favor of the proposed noise abatement. If the benefited property owners vote to reject construction of a noise abatement device, their area *will not be reconsidered* for future noise abatement.

- **1971 S Street (receptor 121).** This single-family residential property is located on the south side of S Street, just west of 1973 S Street (see above). Noise levels associated with the Draft Single Package at the receptor are predicted to be 20 dBA L_{eq} louder in the a.m. and 16 dBA L_{eq} louder in the p.m. peak periods. This

Figure B.3

peak a.m. and p.m. increase of greater than 15 dBA L_{eq} creates an impact. The resultant peak a.m. noise level of 68 dBA L_{eq} is also considered an impact.

Table B.5
Noise Barriers Analyzed

		Noise Level Before Barrier		Noise Level After Barrier		Insertion Loss	
Rec. Pt.	Area Protected	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
120	Res. on S St.	65	63	61	59	4	4
121	"	68	65	62	60	6	5
A	**"**	68	66	62	60	6	6
564	UNL Fields	68	67	62	61	6	6
564a	"	67	66	60	60	7	6
564b	"	66	65	60	60	6	5
564c	"	67	66	61	60	6	6

Source: AV Study Team
Notes: Receptor in **bold** is 3 meters (10 feet) from residence, as per NDOR policy
All noise levels are expressed in dBA L_{eq}.

A noise barrier on the east side of the North-South Roadway is one of the feasible means of mitigating noise impacts at this location, provided access between the North-South Roadway and S Street can be restricted.

- **UNL Recreation fields north of Beadle Center (receptor 564).** This active-use recreation area contains university softball fields. This area is a proposed parking garage according to UNL's Master Plan. For this analysis, it was conservatively assumed that a softball field would remain as the dominant use following construction of the North-South Roadway. Noise levels associated with the Draft Single Package at the receptor are predicted to be 9 dBA L_{eq} louder in the a.m. and 57 dBA L_{eq} louder in the p.m. peak periods. The resultant maximum noise level of 68 dBA L_{eq} during the a.m. peak is considered an impact for active sports areas.

  If the ball fields remain, a noise barrier on the southwestern side of the North-South Roadway and a connected barrier along the north side of Vine Street in this location is one feasible means of mitigating noise impacts. The barrier would be 2.4 meters (8.0 feet) tall and would extend approximately 290.0 meters (951.4 feet) long. The cost of this barrier totaling 707 square meters (7,611 square feet) is approximately $137,000 based on NDOR standard unit costs. This cost is relatively high given the recreation area's use as a softball field, where serenity is not required. Therefore, a noise barrier is not recommended in this location (see Table B.5 and Figure B.3).

  The current UNL Master Plan shows a new parking garage at this site which would not be adversely impacted by noise. The existing recreation fields will be relocated elsewhere as part of Antelope Valley.

- **3300 Huntington Avenue (receptor 528).** This three-story apartment building is located on the north side of Huntington Avenue, just east of 33rd Street.

Huntington Avenue would be widened in this location, with traffic relocated closer to the apartment building. Noise levels associated with the Draft Single Package at the receptor are predicted to be 17 dBA L_{eq} louder in the a.m. and 14 dBA L_{eq} louder in the p.m. peak periods. The a.m. increase of greater than 15 dBA L_{eq} is considered an impact. The resultant levels of 69 dBA L_{eq} for a.m. and p.m. peak periods also exceed the threshold of impact for residential land use. There is a small shed in the courtyard facing Huntington Avenue, but no apparent active use other than apartment balconies, which face the interior courtyard. Driveway access is provided from both Huntington Avenue and 33rd Street.

A noise barrier is not considered feasible in this corner location because of the need to maintain driveway access to Huntington Avenue or 33rd Street. Maintaining access would render barriers ineffective. The results of the analysis at these 15 sites are summarized below in Table B.6.

- **UNL Beadle Center on Vine Street.** This UNL research facility on the south side of Vine Street, just west of the proposed North-South Roadway, houses research laboratories and faculty offices. A receptor placed at the Beadle Center does not indicate there may be an impact with the Amended Draft Single Package (see Table B.6), and the 66 dBA L_{eq} noise contour does not intersect the eastern-most wing of the facility (see Sheet 7 of 11 in Appendix I). Therefore, there is no impact in this area and the study of mitigation is not required. There is no impact opposite the Beadle Center, on the east side of the North-South Roadway, where the 66 dBA L_{eq} contour is contained entirely within the stormwater channel and does not encroach on Trago Park.

6.0 Coordination with Local Officials

Federal regulations at 23 CFR Part 772 mandate that "In an effort to prevent future traffic noise impacts on currently undeveloped lands, highway agencies shall inform local officials within whose jurisdiction the highway project is located of the following:

1. The best estimation of future noise levels (for various distances from the highway improvement) for both developed and undeveloped lands or properties in the immediate vicinity of the project,
2. Information that may be useful to local communities to protect future land development from becoming incompatible with anticipated highway noise levels, and
3. Eligibility for Federal-aid Type II projects…" (Type II projects are for noise abatement on existing highways).

In order to fulfill these requirements, local public officials will receive copies of this technical memo and a copy of the federal policy outlined in 23 CFR Part 772. Meetings between state and local officials will be held if requested.

Although one noise barrier was determined to be feasible and reasonable within the study area, its actual construction would take place only if the affected residents

Table B.6
NOISE ABATEMENT*

Receptor	Study Barrier?	Barrier Feasibility			
		Compatible w/ Topo?	Height? [1]	Other Noise Sources?[2]	Location?
120	Yes	Yes		No	Beyond Clear Zone
121	Yes	Yes		No	Beyond Clear Zone
238	No, visual and physical access adversely affected to north.	n.a.	n.a.	n.a.	n.a.
239	No, visual and physical access adversely affected to north.	n.a.	n.a.	n.a.	n.a.
243	No, physical access adversely affected at the site.	n.a.	n.a.	n.a.	n.a.
244	No, visual and physical access adversely affected to site.	n.a.	n.a.	n.a.	n.a.
249	No, physical access adversely affected.	n.a.	n.a.	n.a.	n.a.
250	No, physical access adversely affected.	n.a.	n.a.	n.a.	n.a.
251	No, physical access adversely affected.	n.a.	n.a.	n.a.	n.a.
252	No, physical access adversely affected at the site.	n.a.	n.a.	n.a.	n.a.
253	No, physical access to east-west alley adversely affected.	n.a.	n.a.	n.a.	n.a.
254	No, physical access adversely affected.	n.a.	n.a.	n.a.	n.a.
370	No, visual and physical access adversely affected.	n.a.	n.a.	n.a.	n.a.
528	No, physical access to this corner site adversely affected.	n.a.	n.a.	n.a.	n.a.
564	Yes	Yes		Yes	Beyond Clear Zone

Source: AV Study Team
Notes: *Interior noise abatement only.
n.a. = Not applicable. Barrier feasibility analysis not conducted because a barrier at this location is not considered reasonable as indicated in the second column.
[1] Can the exposed height of a noise wall (except for short lengths) be built 4.5 meters (16 feet) or less?
[2] Other noise sources include other roadways that contribute noise.
Consult text for a complete discussion of barrier feasibility at each receptor listed.

concur with this recommendation. The final decision on whether to construct a noise barrier would be made after holding a meeting where barrier details (length, height, type, material, cost, and effectiveness) would be presented for public review and appraisal.

7.0 Construction Noise

Construction noise can result in short-term impacts to sensitive land uses. Highway construction noise levels are typically a function of the scale of the project, the phase

of construction, the condition of the equipment and its operating cycles, and the number of construction equipment operating concurrently. Typical noise levels associated with various types of construction equipment are identified in Table B.7 (Reagan and Grant, 1977). The specific number and types of construction equipment to be used if this study becomes a project are unknown, so it is difficult to accurately predict the total noise levels resulting from the simultaneous operation of equipment. However, noise levels at any distance from the construction site may be estimated by applying a ground attenuation rate of 6 dBA per doubling of distance using the sound levels identified in Table B.7. For example, if a dump truck produces a noise level of 88 dBA 15 meters (50 feet) from the source, the noise level at 30 meters (100 feet) would be 82 dBA, all else being equal.

Bowlby and Cohn (1982) identify the clearing and earthwork phases as the noisiest portions of highway construction projects. These phases typically occur in the early and middle portions of project construction and may require mitigation.

Table B.7
TYPICAL NOISE LEVELS OF CONSTRUCTION EQUIPMENT

Type of Equipment	Typical Sound Level at 15 m (50 ft) (dBA L_{eq})
Dump Truck	88
Portable Air Compressor	81
Concrete Mixer (Truck)	85
Jackhammer	88
Scraper	88
Bulldozer	87
Paver	89
Generator	76
Piledriver	101
Rock Drill	98
Pump	76
Pneumatic Tools	85
Backhoe	85

There are several sensitive land uses within the study area that could be affected by construction noise, including the Beadle Center and residences along the north-south and east-west roadways. There are a variety of measures that can be adopted to reduce construction noise impacts at these sensitive areas. The effectiveness of any adopted measures would depend on the scale of construction, the phase of construction, and various aspects of the individual pieces of machinery used. Appropriate measures for the AV MIS include the following:

- **Constructing the noise barrier early in construction:** If the recommended noise barrier is publicly acceptable, its construction at an early phase could mitigate potential construction-related noise impacts.
- **Fostering good community relations:** Although this does not mitigate noise, letting people know that construction noise is imminent, helps the public anticipate it. This includes informing the public when potential noise impacts may occur and specifying what mitigation measures would be used to reduce construction noise. It also includes establishing and advertising a complaint mechanism so that construction operations can be continually responsive to community sentiment. These provisions can easily be applied through contract requirements.
- **Enacting special design considerations:** This includes designing haul routes that would avoid sensitive areas and constructing permanent noise barriers early (as discussed previously). These are effective design considerations for reducing construction noise impacts associated with this study and should be considered further during final design.
- **Controlling noise at the source:** This includes using properly muffled and maintained equipment and using wheeled equipment instead of tracked equipment whenever possible. Source control provisions should be included in contract documents whenever possible, with contractor penalties for non-compliance.
- **Specifying the allowable time, place, and method of operation:** This includes employing special work hour limitations in construction contracts and locating particularly noisy operations away from sensitive receptors. These measures should be included in contract documents for this project.

8.0 Noise Control Ordinance

The City of Lincoln regulates allowable noise levels through a “Noise Control Ordinance” (Chapter 8.24) to “prevent excessive sound and vibration which would jeopardize the health and welfare or safety of its citizens or degrade the quality of life.” The ordinance is administered by the Lincoln-Lancaster County Health Department, which specifies maximum sound levels by receiving land use. However, a variance from these requirements is typically issued for construction projects. Further coordination with the Lincoln-Lancaster County Health Department to obtain a variance would be carried out prior to construction.

References

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Reagan, J.A. and C.A. Grant. 1977. “Highway Construction Noise: Measurement, Prediction and Mitigation.” Special Report, Office of Environmental Policy, Federal Highway Administration.

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US Department of Transportation, Federal Highway Administration. 1974. “Fundamentals and Abatement of Highway Traffic Noise.” Report FHWA-HHI-HEV 73-3973-1.

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US Department of Transportation, Federal Highway Administration. 1981. “Sound Procedures for Measuring Highway Noise: Final Report.” Report FHWA-DP-45-1R.

Glossary

Absolute Impact: A predicted noise level that approaches or exceeds the Federal Noise Abatement Criterion for a particular land use or activity. In Nebraska, absolute impacts occur in residential areas and parks when noise levels are at least 66 dBA L_{eq} and in commercial/industrial areas when noise levels are at least 71 dBA L_{eq}.

Attenuation: A reduction of wave amplitude or, in the case of noise, a reduction in sound level.

A-Weighting: An adjustment made to the overall sound levels of noise that approximates the frequency response of the human ear. All noise levels in this technical memo are A-weighted.

Barrier Height: The height of the noise barrier measured from the ground or top of a retailing wall to the top of the barrier.

Barrier Insertion Loss (IL): The amount of noise level reduction attributable to a noise barrier.

dBA: An abbreviation for A-weighted sound levels in decibels.

L_{eq}: The equivalent steady-state or average sound level within a representative period of time. In this memo, L_{eq} for existing noise levels was measured over 20-minute intervals.

Noise Abatement Criteria (NAC): Design noise levels established in 23 CFR Part 772 that, when approached or exceeded, define the absolute noise impacts associated with a highway project.

Relative Impact: A predicted noise level that is substantially greater than an existing noise level for a particular site.

Traffic Noise Impacts: Impacts which occur when the predicted traffic noise levels approach or exceed the NAC or when the predicted traffic noise levels substantially exceed existing noise levels (i.e., by 15 dBA).