APPENDIX F: NOISE AND AIR DATA

AIR DATA

SH 161 Environmental Assessment
Air Quality Analysis – IH 20 to Rock Island Rd.

	EXISTING VALUES (1995)				PROJECTED VALUES (2015)					
Data Point	1995 ADT	1995 DHV	% of 1 hour standard (60/45)	%of 8 hour standard (60/45)	2015 ADT	2015 DHV	% of 1 hour standard (60/45)	%of 8 hour standard (60/45)	~Station # (west)/ filename	Location Description
1	8500	706	15.71	37.56	14800	1262	14.86	35.56	131+00E	North of Crossland
	22300	1851			37300	3182			131+00P	
	23800	1975			39900	3403				
	8600	714			15300	1305				
2	13600	1129	15.71	37.56	24000	2047	14.86	35.56	166+00E	North of Mayfield
	17800	1477			28400	2423			166+00P	
	18300	1519			30300	2585				
	15000	1245			21500	1834				
3	4200	349	15.14	36.22	7400	631	14.86	35.56	190+00E	North of Warrior Trail
	28300	2349			48000	4094			190+00P	
	29600	2457			49900	4256				
	4600	382			8000	682				
4	15500	1287	16.29	38.89	23200	1979	20.29	48.22	209+00E	South of Arkansas
	17000	1411			32200	2747			209+00P	
	18300	1519			33800	2883				
	16000	1328			24300	2073				
5	6700	556	14.57	34.89	10400	887	14.00	33.56	231+00E	North of Spur 303
	17000	1411			32200	2747			231+00P	
	18900	1569			33800	2883				
	7200	598			11100	947				
6	8800	730	14.86	35.56	13400	1143	14.29	34.22	273+00E	North of Marshall
	16800	1394			31500	2687			273+00P	
	18400	1527			33500	2858				
	9500	789			14100	1203				
7	3600	299	14.29	34.22	5400	461	14.00	33.56	304+00E	North of Robinson/Dickey
	20200	1677			37300	3182			304+00P	
	22100	1834			39600	3378				
	3800	315			5400	461				
8	7800	647	14.57	34.89	11800	1007	14.00	33.56	350+00E	North of Jefferson/US 80/SH 180
	14800	1228			29500	2516			350+00P	
	14700	1220			28900	2465				
	9200	764			13600	1160				
9	10000	830	14.57	34.89	15000	1280	14.29	34.22	361+00E	North of Dalworth
	14800	1228			29500	2516			361+00P	
	14700	1220			28900	2465				
	10600	880			15800	1348				
10	4000	332	14.86	35.56	6400	546	14.29	34.22	393+00E	North of January
	22800	1892			41100	3506			393+00P	
	22800	1892			40100	3421				
	6300	523			10800	921				
11	5600	465	16.00	38.22	9600	819	14.57	34.89	446+00E	North of Egyptian
	26000	2158			47200	4026			446+00P	
	38100	3162			38100	3250				
	7700	639			13300	1134				
12	5100	423	13.43	32.22	9100	776	12.29	29.56	486+00E	Between Carrier Pkwy and Llama
	26000	2158			47200	4026			486+00P	
	38100	3162			21900	1868				
	6000	498			11000	938				
13	2800	232	15.43	36.89	5500	469	14.86	35.56	548+00E	South of Oakdale
	31400	2606			59200	5050			548+00P	
	32600	2706			54900	4683				
	4100	340			5100	435				
14	8100	672	14.57	34.89	13000	1109	14.29	34.22	585+00E	Between Trinity and Shady Grove
	24300	2017			45800	3907			585+00P	
	27900	2316			49500	4222				
	3100	257			4900	418				
15	4900	407	15.43	36.89	7900	674	14.86	35.56	629+00E	South of Rock Island
	25200	2092			47300	4035			629+00P	
	25800	2141			46100	3932				
	5400	448			8600	734				

NOISE ANALYSIS

NOISE ANALYSIS STUDY

FOR

PROPOSED SH 161

Section 1 (IH 20 to South of IH 30)

Section 2 (North of IH 30 to South of Rock Island Road)

Dallas County

June 2001

Texas Department of Transportation

NOISE ANALYSIS STUDY

FOR

PROPOSED SH 161

Section 1 (IH 20 to S. of IH 30)

Dallas County

June 2001

Texas Department of Transportation

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SH 161
IH 20 to Walnut Hill Lane

Introduction

This noise report analyzes noise impacts resulting from proposed State Highway 161 from IH 20 to Walnut Hill Lane in the Cities of Grand Prairie and Irving, Texas, a distance of approximately 10.8 miles (**See Exhibit A, Vicinity Map & Exhibit A1, Location Map**). The proposed facility is consistent with the area's financially constrained Metropolitan Transportation Plan known as Mobility 2025 Update and the fiscal year 2002 - 2004 Transportation Improvement Program found to conform to the CAAA of 1990 by the U.S. Department of Transportation on October 19, 2001.

The proposed facility was originally listed in the North Central Texas Council of Governments (NCTCOG) financially constrained plan Mobility 2010: Plan Update and Transportation Improvement Program (TIP), approved on October 20, 1994, as an ultimate eight (IH 20 to IH 30) and ten lane (IH 30 to Walnut Hill Lane) freeway facility. Three lane frontage roads are present along the entire length of the proposed facility except from Llama Lane to Oakdale Lane and Rock Island Road to SH 183 where there are none. This noise report addresses impacts resulting from an ultimate eight and ten lane facility as funded in that plan.

The proposed project received environmental approval by a Record of Decision (ROD) from the Federal Highway Administration on April 7, 1987 and was subsequently upheld on August 18, 1998 by court opinion of the U.S. District Court for the Northern District of Texas, Dallas Division.

A Supplemental Final Environmental Impact Statement (SFEIS) was submitted in 1996 and included a preliminary noise analysis, which identified potential noise mitigation locations and possible lengths and heights of noise barriers. The noise analysis presented in this report is a more comprehensive and updated study based on the NCTCOG projected traffic for the year 2015, which was also used in the aforementioned SFEIS. Land use changes that have occurred since the SFEIS noise analysis were considered in this study.

Land use in the project area consists of undeveloped areas, business/commercial properties, retail centers, hotels, schools, churches, libraries, community centers, parks, and residential communities (**See Exhibit B, Land Use Map**). One additional park since the SFEIS is planned within the City of Grand Prairie adjacent to SH 161 along Arkansas Lane. The City of Grand Prairie is planning to develop this park for sports and recreational uses such as various types of ball fields. Coordination with the City of Grand Prairie has been conducted and the City has planned on the construction of SH 161. The City has indicated that they will provide buffer areas as they develop site plans for the park. At this time site plans have not been completed.

Background

This analysis was accomplished in accordance with TxDOT's (FHWA approved) Guidelines for Analysis and Abatement of Highway Traffic Noise.

Sound from highway traffic is generated primarily from a vehicle's tires, engine and exhaust. It is commonly measured in decibels and is expressed as "dB."

Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore, an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. This adjustment is called A-weighting and is expressed as "dBA."

Also, because traffic sound levels are never constant due to the changing number, type and speed of vehicles, a single value is used to represent the average or equivalent sound level and is expressed as "Leq."

TABLE 1. COMMON SOUND/NOISE LEVELS

Outdoor	dBA	Indoor
Pneumatic hammer	100	Subway Train
Gas lawn mower at 3.3 feet		
	90	Food blender at 3.3 feet (1 meter)
Downtown (large city)	80	Garbage disposal at 3.3 feet (1 meter)
Lawn mower at 98.4 feet	70	Vacuum cleaner at 9.8 feet (3 meters)
		Normal speech at 3.3 feet (1 meter)
Air conditioning unit	60	Clothes dryer at 3.3 feet (1 meter)
Babbling brook		Large business office
Quiet urban (daytime)	50	Dishwasher (next room)
Quiet urban (nighttime)	40	Library

The traffic noise analysis typically includes the following elements:

- Identification of land use activity areas that might be impacted by traffic noise.
- Determination of existing noise levels.
- Prediction of future noise levels.
- Identification of possible noise impacts.
- Consideration and evaluation of measures to reduce noise impacts.

The FHWA has established the following Noise Abatement Criteria (NAC) for various land use activity areas that are used as one of two means to determine when a traffic noise impact will occur.

TABLE 2: FHWA NOISE ABATEMENT CRITERIA

Activity Category	dBA Leq	Description of Land Use Activity Areas
A	**57 (exterior)**	Lands on which serenity and quiet are of extra-ordinary 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 (exterior)**	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries and hospitals.
C	**72 (exterior)**	Developed lands, properties or activities not included in categories A or B above.
D	**--**	Undeveloped lands.
E	**52 (interior)**	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

NOTE: Primary consideration is given to exterior areas (Category A, B or C) where frequent human activity occurs. However, interior areas (Category E) are used if exterior areas are physically shielded from the roadway, or if there is little or no human activity in exterior areas adjacent to the roadway.

A noise impact occurs when either the absolute or relative criterion is met:

Absolute criterion: the predicted noise level at a receiver approaches, equals or exceeds the NAC. "Approach" is defined as one dBA below the NAC. For example, a noise impact would occur at a Category B residence if the noise level is predicted to be 66 dBA or above.

Relative criterion: the predicted noise level substantially exceeds the existing noise level at a receiver even though the predicted noise level does not approach, equal or exceed the NAC. “Substantially exceeds” is defined as more than 10 dBA. For example, a noise impact would occur at a Category B residence if the existing level is 54 dBA and the predicted level is 65 dBA (11 dBA increase).

When a traffic noise impact occurs, noise abatement measures must be considered. A noise abatement measure is any positive action taken to reduce the impact of traffic noise on an activity area.

Section 1 - IH 20 to South of IH 30

Ambient Field Noise Measurements

Field reconnaissance studies were conducted from May 9-11, 2001 in Section 1 of the SH 161 project area. Quest© Model 2900 sound level (noise) meters equipped with windscreens were utilized to conduct the field noise level measurements. The eighteen representative sites selected included seven of the previously identified receiver sites from the 1996 SH 161 Supplemental Final Environmental Impact Statement (SFEIS). In addition, eleven new receiver sites were selected for this study. Data sheets were completed and photographs of each site were taken (See Appendix A and B, respectively). The results from each representative receiver site are listed in **Table 3** below (**See Exhibit C, Schematic and Noise Receiver Map**, to locate specific receivers).

TABLE 3: AMBIENT NOISE MEASUREMENTS, SECTION 1 (dBA Leq)

Receiver	Location	Ambient 2001	Activity Category	Designation	Appendix D Sheet #
1	Meadow Park Lane and Robinson Road	53	B	residence	1
2	Robinson Road and Warrior Trail	52	B	new development	2
3	West Freeway and Pioneer Parkway	58	C	commercial	3
4	1933 West Freeway	(43)	E	apartments	4
5	1705 Robinson Road	(43)	E	church	5
6	Dickey Road and West Freeway	(43)	E	church	6
7	West Freeway and Conover Drive	(43)	E	senior center	7
8	11th and Dallas Streets	65	B	residence	8
9	12th and Fort Worth Streets	58	B	residence	9
10	13th and Fort Worth Streets	58	B	residence	10
11	12th and Dalworth Streets	62	B	residence	11
12	Cain Lane between 16th and 17th Streets	60	B	residence	12
13	1502 College Street	62	B	school playground	13
14	19th Street and Roman Road	(43)	E	apartments	14
15	Roman Road and Denmark Drive	58	B	residence	15
16	Denmark Drive and Paris Drive	57	B	residence	16
17	1919 Tarrant Road	(43)	E	apartments	17
18	1920 Tarrant Road	(43)	E	apartments	18

Note: NAC Category B activities that primarily involve indoor use (i.e., churches, apartments) were classified as Category E. and their predicted ambient interior noise level is listed in Table 3. Category E activities are listed in parenthesis to indicate an estimated interior noise reading was taken.

Section 1 - IH 20 to South of IH 30

Predicted Noise Levels

The FHWA Traffic Noise Model, Version 1.1 (TNM) software was used to calculate predicted traffic noise levels. The model primarily considers the number, type and speed of vehicles; highway alignment and grade; cuts, fills and natural berms; surrounding terrain features; and the locations of activity areas likely to be impacted by the associated traffic noise.

Predicted traffic noise levels were modeled at 82 receiver locations (**Table 4 and Exhibit C**). These receiver locations represent the land use activity areas adjacent to the proposed project that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement.

TABLE 4: TRAFFIC NOISE LEVELS, SECTION 1 (dBA Leq)

Receiver	NAC Category	NAC Level	Ambient 2001	Predicted 2015	Change (+/-)	Noise Impact	Exhibit C Page #
R-1	B	67	53	62	+9	N	3
R-2	B	67	52	56	+4	N	3
R-3, Lockheed Martin	C	72	58	70	+12	Y	4
R-4, Tree Top Apartments	E	52	(43)	(51)	+8	Y	5
R-5, New Truevine Church	E	52	(43)	(50)	+7	N	6
R-6, Dickey Road Church	E	52	(43)	(45)	+2	N	6
R-6A, Industrial	C	72	58	66	+8	N	7
R-7, Senior Citizen Center	E	52	(43)	(45)	+2	N	7
R-7A, Headstart playground	B	67	55	56	+1	N	7
R-7B, Bank	B	67	58	63	+5	N	7
R-8	B	67	65	59	-6	N	8
R-8A	B	67	65	59	-6	N	8
R-8B	B	67	65	60	-5	N	8
R-8C	B	67	65	60	-5	N	8
R-8D	B	67	65	64	-1	N	8
R-8E	B	67	62	65	+3	N	8
R-8F	B	67	62	64	+2	N	8
R-8G	B	67	62	63	+1	N	8
R-8H	B	67	58	61	+3	N	8
R-8I	B	67	62	59	-3	N	8
R-8J	B	67	62	61	-1	N	8
R-8K	B	67	62	62	--	N	8

TABLE 4: TRAFFIC NOISE LEVELS, SECTION 1 (dBA Leq)							
Receiver	**NAC Category**	**NAC Level**	**Ambient 2001**	**Predicted 2015**	**Change (+/-)**	**Noise Impact**	**Exhibit C Page #**
R-10	B	67	58	65	+7	N	8
R-10A	B	67	58	64	+6	N	8
R-10B, Memorial Chapel	E	52	(43)	(47)	+4	N	8
R-10C, Memorial Chapel	E	52	(43)	(47)	+4	N	8
R-10D	B	67	58	65	+7	N	8
R-10E	B	67	58	67	+9	Y	8
R-10F	B	67	58	69	+11	Y	8
R-10G	B	67	58	62	+4	N	8
R-10H	B	67	58	65	+7	N	8
R-10I	B	67	58	75	+17	Y	8
R-10J	B	67	58	63	+5	N	8
R-10K	B	67	58	70	+12	Y	8
R-10L	B	67	58	62	+4	N	8
R-10M	B	67	58	62	+4	N	8
R-10N	B	67	58	66	+8	Y	8
R-10O	B	67	58	69	+11	Y	8
R-11	B	67	62	76	+14	Y	8
R-11B	B	67	62	66	+4	Y	8
R-11C	B	67	62	69	+7	Y	8
R-11D	B	67	62	72	+10	Y	8
R-12A	B	67	60	78	+18	Y	8
R-12B	B	67	60	72	+12	Y	8
R-12C	B	67	60	67	+7	Y	8
R-12D	B	67	60	63	+3	N	8
R-12E	B	67	60	65	+5	N	8
R-12F	B	67	60	69	+9	Y	8
R-12G	B	67	60	73	+13	Y	8
R-12H	B	67	60	67	+7	Y	8
R-12I	B	67	60	67	+7	Y	8
R-12J, Westridge Church	E	52	(43)	(55)	+12	Y	8
R-12K	B	67	60	66	+6	Y	8
R-12L	B	67	60	68	+8	Y	8
R-12M	B	67	60	70	+10	Y	8
R-12N	B	67	60	74	+14	Y	8
R-12O	B	67	60	68	+8	Y	8
R-12P	B	67	60	71	+11	Y	8

TABLE 4: TRAFFIC NOISE LEVELS, SECTION 1 (dBA Leq)							
Receiver	**NAC Category**	**NAC Level**	**Ambient 2001**	**Predicted 2015**	**Change (+/-)**	**Noise Impact**	**Exhibit C Page #**
R-13, Sam Houston School	B	67	62	65	+3	N	8
R-13A	B	67	62	62	--	N	8
R-13B	B	67	62	74	+12	Y	8
R-13C	B	67	62	68	+6	Y	8
R-13D	B	67	62	73	+11	Y	8
R-13E	B	67	62	65	+3	N	8
R-13F	B	67	62	66	+4	Y	8
R13-G	B	67	62	65	+3	N	8
R-13H, Park	B	67	62	65	+3	N	8
R-13I	B	67	62	68	+6	Y	8
R-13J	B	67	62	68	+6	Y	8
R-13K	B	67	62	69	+7	Y	8
R-14, Roman Road Villas	E	52	(43)	(50)	+7	N	9
R-14A, Roman Road Villas	E	52	(43)	(50)	+7	N	9
R-14B, Roman Road Villas	E	52	(43)	(50)	+7	N	9
R-15	B	67	58	61	+3	N	9
R-16	B	67	57	62	+5	N	9
R-17, Quail Ridge Apts.	E	52	(43)	(47)	+4	N	9
R-17A, Quail Ridge Apts.	E	52	(43)	(47)	+4	N	9
R-17B, Quail Ridge Apts.	E	52	(43)	(47)	+4	N	9
R-17C, Quail Ridge Apts.	E	52	(43)	(45)	+2	N	9
R-18, Fox Chase Apts.	E	52	(43)	(49)	+6	N	9
R-18A, Fox Chase Apts.	E	52	(43)	(49)	+6	N	9
R-18B, Fox Chase Apts.	E	52	(43)	(49)	+6	N	9

All receivers are classified as residential unless otherwise noted. There is not an R-9, R-11A or R-12 receiver listed in Table 4. Note: NAC Category B activities that primarily involve indoor use (i.e., churches, apartments) were classified as Category E and their predicted ambient interior noise level is listed in Table 4. Traffic noise levels were modeled at 65 miles per hour (mph) design speed.

As indicated in **Table 4**, the proposed project will result in a traffic noise impact and the following noise abatement measures were considered: traffic management, alteration of horizontal and/or vertical alignments, acquisition of undeveloped property to act as a buffer zone and the construction of noise barriers.

Before any abatement measure can be incorporated into the project, it must be both feasible and reasonable. In order to be feasible, the measure should reduce noise levels by at least five dBA at impacted receivers; and to be reasonable it should not exceed $25,000 for each benefitted receiver.

Traffic management: control devices could be used to reduce the speed of the traffic; however, the minor benefit of one dBA per five mph reduction in speed does not outweigh the associated increase in congestion and air pollution. Other measures such as time or use restrictions for certain vehicles are prohibited on state highways.

Alteration of horizontal and/or vertical alignments: any alteration of the existing alignment would displace existing businesses and residences, require additional right-of-way and not be cost effective/reasonable. Depressed and elevated roadways normally result in somewhat lower levels (3-5dB) and, thereby, either eliminate the need for a noise barrier or result in a lower barrier than would be required for at-grade roadways (all other factors being equal). The design included in this noise analysis is a result of vertical and horizontal alignment alternatives, which were considered in order to minimize traffic noise.

Buffer zone: the acquisition of sufficient undeveloped land adjacent to the highway project to preclude future development that could be impacted by highway traffic noise would not be cost effective/reasonable.

Noise barriers: this is the most commonly used noise abatement measure. For this section of proposed SH 161, noise barriers were considered at heights ranging from 10-18 feet and varying lengths for the following receivers.

Topography and roadway elevations varied throughout the Dalworth neighborhood area (SH 180/Main St. to January/Hill Street), where most of these residences are located. SH 161 is proposed as a depressed facility in the Dalworth neighborhood area and the receivers are located above the proposed highway (11, 11B-D). Noise barriers are normally not effective for receivers at heights above the top of the noise barrier. A noise barrier was not feasible and therefore not proposed for these receivers. In addition to topography differences, another three feet of right-of-way would need to be acquired to meet minimum sight distance requirements for receivers 10E-F, 10I, 10K, 10N-O, according to AASHTO guidelines. A noise barrier was not feasible and therefore not proposed for these receivers.

An additional eight receivers in the Dalworth neighborhood area, 12H-I, K-P, were located above the proposed SH 161. The topography varies greatly and the receivers were situated approximately 20 feet above proposed SH 161 in this section of the neighborhood. Receivers

13D, I-K are also situated above the SH 161 facility and therefore were not able to achieve a 5 dBA reduction. Right-of-way and street closure issues would also need to be resolved. A noise barrier was not feasible and therefore not proposed for these receivers.

R-3, Lockheed Martin is a commercial facility. Noise barriers could have a detrimental impact on nearby businesses by restricting views and access by potential customers. Finally, a noise barrier would not be cost effective for an individual receiver.

Receiver 13-F is located along NW 14th Street and would be located in a gap, making the barrier ineffective. Also, a noise barrier would not be cost effective for an individual receiver and therefore not proposed for these receivers.

For these reasons, noise barriers would not be feasible and reasonable for the aforementioned receivers. However, noise barriers were determined to be both feasible and reasonable for Receivers 4, 12A-C, F-G, J, and 13B-C and are proposed for incorporation into the project design. Based on preliminary calculations, a noise barrier between NW 14th and NW 16th Streets 643 feet in length and 12 feet in height will reduce noise levels by at least 5 dBA for 6 benefitted receivers at Barrier 4 for a total cost of $139,200 or $23,200 for each benefitted receiver.

Based on preliminary calculations, a noise barrier for Tree Top Apartments totaling 1236 feet in length and 12 feet in height will reduce noise levels by at least 5 dBA for 12 benefitted receivers for a total cost of $251,600 or $20,967 for each benefitted receiver. Based on preliminary calculations, noise barriers from NW 17th to NW 14th Streets totaling 1350 feet in length and 14 feet in height will reduce noise levels by at least 5 dBA for 13 benefitted receivers at Barriers 6 and 7 for a total cost of $321,300 or $24,715 for each benefitted receiver.

Any subsequent project design changes may require a reevaluation of this proposal. The final decision to construct the proposed noise barriers will be made upon completion of the project design and the public involvement process.

TABLE 5: NOISE BARRIER PROPOSAL, SECTION 1 (Preliminary)						
Barrier	**#Benefitted Receivers**	**Length (feet)**	**Height (feet)**	**Total Cost**	**$/Benefitted Receiver**	**Exhibit C Page #**
Tree Top Apts	12	1236	12	$251,600	$20,970	5
4	6	643	12	$139,200	$23,200	8
6-7	13	1350	14	$321,300	$24,715	8

Numerous land use activity areas along proposed SH 161 are currently Category D, undeveloped land. At the time the data was gathered for this analysis no new development was planned, designed or programmed in these areas. Given the rapid growth in the area of the proposed project some of these lands could now be planned, designed or programmed for development. There is no NAC for undeveloped land; however, to avoid noise impacts that may result from future development of properties adjacent to the project, local officials responsible for land use control programs should ensure, to the maximum extent possible, no new activities are planned or constructed along or within the following predicted 2015 noise impact contours.

UNDEVELOPED AREA	IMPACT LAND USE	DISTANCE CONTOUR	from RIGHT of WAY
IH 20 to Arkansas Lane	NAC Category B	66 dBA	500 feet
	NAC Category C	71 dBA	150 feet
City of Grand Prairie Park	NAC Category B	66 dBA	550 feet
	NAC Category C	71 dBA	150 feet
South of SH 180	NAC Category B	66 dBA	600 feet
	NAC Category C	71 dBA	200 feet

NOISE ANALYSIS STUDY

FOR

PROPOSED SH 161

Section 2 (N. of IH 30 to S. of Rock Island Road)

Dallas County

October 2001

Texas
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Section 2 - IH 30 to S. of Rock Island Road

Ambient Field Noise Measurements

Field reconnaissance studies were conducted from August 13-14, 2001 in Section 2 of the SH 161 project area. Quest© Model 2900 sound level (noise) meters equipped with windscreens were utilized to conduct the field noise level measurements. The ten representative sites selected included eight of the previously identified receiver sites from the 1996 SH 161 Supplemental Final Environmental Impact Statement (SFEIS). In addition, two new receiver sites were selected for this study. Data sheets were completed and photographs of each site were taken (**See Appendix D and E** respectively). The results from each representative receiver site are listed in Table 6 below (**See Exhibit E, Schematic and Noise Receiver Map, Section 2** to locate specific receivers).

TABLE 6: AMBIENT NOISE MEASUREMENTS, SECTION 2 (dBA Leq)

Receiver	Location	Ambient 2001	Activity Category	Designation	Appendix D Sheet #
Apt-9	2301 Avenue H	(43)	E	apartments	1
R-9	NW 19th & British Blvd. (Camelot Acres)	65	B	residence	2
R-64	NW 19th & Egyptian Way (Sisters of Holy)	(43)	E	church	3
R-64a	533 Northwest 16th Street	(43)	E	church	5
R-64b	Waggoner Park Ball Fields	59	B	public park	7
R-72	NW 19th & Egyptian (residences)	59	B	residence	4
R-108	NW 19th & Ola Lane (Wedge Wood)	77	B	residence	6
R-177a	Shady Grove Academy (under construction)	(43)	E	school	8
R-183	Hardrock Road Residence	63	B	residence	10
R-184	Johnson's Mobile Home Park	71	B	residence	9

Note: NAC Category B activities that primarily involve indoor use (i.e., churches, apartments) were classified as Category E and their predicted ambient interior noise level is listed in Table 6. Category E activities are listed in parenthesis to indicate an estimated interior noise reading was taken.

Section 2 - IH 30 to S. of Rock Island Road

Predicted Noise Levels

The FHWA Traffic Noise Model (TNM), Version 1.1 software was used to calculate predicted traffic noise levels. The model primarily considers the number, type and speed of vehicles; highway alignment and grade; cuts, fills and natural berms; surrounding terrain features; and the locations of activity areas likely to be impacted by the associated traffic noise.

Predicted traffic noise levels were modeled at 206 receiver locations (**Table 7 and Exhibit E**). These receiver locations represent the land use activity areas adjacent to the proposed project that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement.

TABLE 7: TRAFFIC NOISE LEVELS, SECTION 2 (dBA Leq)

Receiver	NAC Categ	NAC Level	Ambient 2001	Predicted 2015	Change (+/-)	Noise Impact	Exhibit E Page #
Apt-1, Windridge Apartments	E	52	(43)	(47)	+4	N	1
Apt-2, Windridge Apartments	E	52	(43)	(48)	+5	N	1
Apt-3, Windridge Apartments	E	52	(43)	(50)	+7	N	1
Apt-4, Windridge Apartments	E	52	(43)	(49)	+6	N	1
Apt-5, Windridge Apartments	E	52	(43)	(48)	+5	N	1
Apt-6, Windridge Apartments	E	52	(43)	(48)	+5	N	1
Apt-7, Windridge Apartments	E	52	(43)	(45)	+2	N	1
Apt-8, Windridge Apartments	E	52	(43)	(45)	+2	N	1
Apt-9, Windridge Apartments	E	52	(43)	(45)	+2	N	1
Apt-10, Windridge Apartments	E	52	(43)	(43)	--	N	1
Apt-11, Windridge Apartments	E	52	(43)	(43)	--	N	1
R-1	B	67	65	76	+11	Y	1
R-2	B	67	65	76	+11	Y	1
R-3	B	67	65	76	+11	Y	1
R-4	B	67	65	76	+11	Y	1
R-5	B	67	65	75	+10	Y	1
R-6	B	67	65	76	+11	Y	1
R-7	B	67	65	77	+12	Y	1
R-8	B	67	65	76	+11	Y	1
R-9	B	67	65	76	+11	Y	1
R-10	B	67	65	75	+10	Y	1
R-11	B	67	65	69	+4	Y	1
R-12	B	67	65	66	+1	Y	1

TABLE 7: TRAFFIC NOISE LEVELS, SECTION 2 (dBA Leq)							
Receiver	NAC Categ	NAC Level	Ambient 2001	Predicted 2015	Change (+/-)	Noise Impact	Exhibit E Page #
R-13	B	67	65	66	+1	Y	1
R-14	B	67	57	72	+15	Y	1
R-15	B	67	57	72	+15	Y	1
R-16	B	67	57	72	+15	Y	1
R-17	B	67	57	71	+14	Y	1
R-18	B	67	57	70	+13	Y	1
R-19	B	67	57	69	+12	Y	1
R-20	B	67	57	68	+11	Y	1
R-21	B	67	57	66	+9	Y	1
R-22	B	67	57	65	+8	N	1
R-23	B	67	57	65	+8	N	1
R-24	B	67	57	66	+9	Y	1
R-25	B	67	57	66	+9	Y	1
R-26	B	67	57	64	+7	N	1
R-27	B	67	57	63	+6	N	1
R-28	B	67	57	63	+6	N	1
R-29	B	67	57	70	+13	Y	1
R-30	B	67	57	70	+13	Y	1
R-31	B	67	57	69	+12	Y	1
R-32	B	67	57	69	+12	Y	1
R-33	B	67	57	65	+8	N	1
R-34	B	67	57	65	+8	N	1
R-35	B	67	57	66	+9	Y	1
R-36	B	67	57	66	+9	Y	1
R-37	B	67	57	67	+10	Y	1
R-38	B	67	57	66	+9	Y	1
R-39	B	67	57	66	+9	Y	1
R-40	B	67	57	65	+8	N	1
R-41	B	67	57	65	+8	N	1
R-42	B	67	57	64	+7	N	1
R-43	B	67	57	63	+6	N	1
R-44	B	67	57	63	+6	N	1
R-45	B	67	57	64	+7	N	1
R-46	B	67	57	64	+7	N	1
R-47	B	67	57	64	+7	N	1

TABLE 7: TRAFFIC NOISE LEVELS, SECTION 2 (dBA Leq)							
Receiver	**NAC Categ**	**NAC Level**	**Ambient 2001**	**Predicted 2015**	**Change (+/-)**	**Noise Impact**	**Exhibit E Page #**
R-48	B	67	57	65	+8	N	1
R-49	B	67	57	64	+7	N	1
R-50	B	67	57	64	+7	N	1
R-51	B	67	57	64	+7	N	1
R-52	B	67	57	63	+6	N	1
R-53	B	67	57	63	+6	N	1
R-54	B	67	57	63	+6	N	1
R-55	B	67	57	62	+5	N	1
R-56	B	67	57	63	+6	N	1
R-57	B	67	57	63	+6	N	1
R-58	B	67	57	63	+6	N	1
R-59	B	67	57	63	+6	N	1
R-60	B	67	57	64	+7	N	1
R-61, Sisters of the Holy	B	67	57	62	+5	N	1
R-62, Sisters of the Holy	B	67	57	63	+6	N	1
R-63, Sisters of the Holy	E	(52)	(43)	48	+5	N	1
R-64, Sisters of the Holy	B	67	57	65	+8	N	1
R-64a, Westridge Baptist	B	(52)	(43)	48	+5	N	1
R-64b, Waggoner Park	B	67	59	67	+8	Y	2
R-65	B	67	59	68	+9	Y	1
R-66	B	67	59	69	+10	Y	1
R-67	B	67	59	70	+11	Y	1
R-68	B	67	59	70	+11	Y	1
R-69	B	67	59	69	+10	Y	1
R-70	B	67	59	68	+9	Y	1
R-71	B	67	59	68	+9	Y	1
R-72	B	67	59	69	+10	Y	1
R-73	B	67	59	69	+10	Y	1
R-74	B	67	59	69	+10	Y	1
R-75	B	67	59	69	+10	Y	1
R-76	B	67	59	69	+10	Y	1
R-77	B	67	59	69	+10	Y	1
R-78	B	67	59	69	+10	Y	1
R-79	B	67	59	68	+9	Y	1
R-80	B	67	59	69	+10	Y	1
R-81	B	67	59	69	+10	Y	1

TABLE 7: TRAFFIC NOISE LEVELS, SECTION 2 (dBA Leq)							
Receiver	NAC Categ	NAC Level	Ambient 2001	Predicted 2015	Change (+/-)	Noise Impact	Exhibit E Page #
R-82	B	67	59	68	+9	Y	1
R-83	B	67	59	68	+9	Y	1
R-84	B	67	59	68	+9	Y	1
R-85	B	67	59	68	+9	Y	1
R-86	B	67	59	68	+9	Y	1
R-87	B	67	59	68	+9	Y	1
R-88	B	67	59	68	+9	Y	1
R-89	B	67	59	68	+9	Y	1
R-90	B	67	59	69	+10	Y	1
R-91	B	67	59	69	+10	Y	1
R-92	B	67	59	69	+10	Y	1
R-93	B	67	59	68	+9	Y	1
R-94	B	67	59	68	+9	Y	1
R-95	B	67	59	68	+9	Y	1
R-96	B	67	59	68	+9	Y	1
R-97	B	67	59	70	+11	Y	1
R-98	B	67	59	71	+12	Y	1
R-99	B	67	59	68	+9	Y	1
R-100	B	67	59	67	+8	Y	1
R-101	B	67	59	68	+9	Y	1
R-102	B	67	59	67	+8	Y	1
R-103	B	67	59	67	+8	Y	1
R-104	B	67	59	68	+9	Y	1
R-105	B	67	59	68	+9	Y	1
R-106	B	67	59	67	+8	Y	1
R-107	B	67	59	67	+8	Y	1
R-108	B	67	77	71	-6	Y	1
R-109	B	67	59	69	+10	Y	1
R-110	B	67	59	67	+8	Y	1
R-111	B	67	59	66	+7	Y	1
R-112	B	67	59	67	+8	Y	1
R-113	B	67	59	67	+8	Y	1
R-114	B	67	59	66	+7	Y	1
R-115	B	67	59	66	+7	Y	1
R-116	B	67	60	66	+6	Y	2
R-117	B	67	60	65	+5	N	2

TABLE 7: TRAFFIC NOISE LEVELS, SECTION 2 (dBA Leq)							
Receiver	**NAC Categ**	**NAC Level**	**Ambient 2001**	**Predicted 2015**	**Change (+/-)**	**Noise Impact**	**Exhibit E Page #**
R-119	B	67	60	65	+5	N	2
R-120	B	67	60	65	+5	N	2
R-121	B	67	60	66	+6	Y	2
R-122	B	67	60	65	+5	N	2
R-123	B	67	60	65	+5	N	2
R-124	B	67	60	66	+6	Y	2
R-125	B	67	60	65	+5	N	2
R-126	B	67	60	64	+4	N	2
R-127	B	67	60	64	+4	N	2
R-128	B	67	60	64	+4	N	2
R-129	B	67	60	66	+6	Y	2
R-130	B	67	60	69	+9	Y	2
R-131, Community of Christ	E	(52)	(43)	45	+2	N	2
R-132	B	67	60	67	+7	Y	2
R-133	B	67	60	65	+5	N	2
R-134	B	67	60	64	+4	N	2
R-135	B	67	60	63	+3	N	2
R-136	B	67	60	63	+3	N	2
R-137	B	67	60	65	+5	N	2
R-138	B	67	60	64	+4	N	2
R-139	B	67	60	64	+4	N	2
R-140	B	67	60	64	+4	N	2
R-141	B	67	60	64	+4	N	2
R-142	B	67	60	66	+6	Y	2
R-143	B	67	60	67	+7	Y	2
R-144	B	67	60	64	+4	N	2
R-145	B	67	60	64	+4	N	2
R-146	B	67	60	64	+4	N	2
R-147	B	67	60	64	+4	N	2
R-148	B	67	60	65	+5	N	2
R-149	B	67	60	64	+4	N	2
R-150	B	67	60	67	+7	Y	2
R-151	B	67	60	65	+5	N	2
R-152	B	67	60	65	+5	N	2
R-153	B	67	60	65	+5	N	2
R-154	B	67	60	65	+5	N	2

TABLE 7: TRAFFIC NOISE LEVELS, SECTION 2 (dBA Leq)							
Receiver	**NAC Categ**	**NAC Level**	**Ambient 2001**	**Predicted 2015**	**Change (+/-)**	**Noise Impact**	**Exhibit E Page #**
R-155	B	67	60	65	+5	N	2
R-156	B	67	60	65	+5	N	2
R-157	B	67	60	66	+6	Y	2
R-158	B	67	60	66	+6	Y	2
R-159	B	67	60	66	+6	Y	2
R-160	B	67	60	66	+6	Y	2
R-161	B	67	60	67	+7	Y	2
R-162	B	67	60	66	+6	Y	2
R-163	B	67	60	67	+7	Y	2
R-164	B	67	60	67	+7	Y	2
R-165	B	67	60	65	+5	N	2
R-166	B	67	60	65	+5	N	2
R-167	B	67	60	66	+6	Y	2
R-168	B	67	60	66	+6	Y	2
R-169	B	67	60	65	+5	N	2
R-170	B	67	60	67	+7	Y	2
R-171	B	67	60	67	+7	Y	2
R-172	B	67	60	65	+5	N	2
R-173	B	67	60	66	+6	Y	2
R-174	B	67	60	65	+5	N	2
R-175	B	67	60	62	+2	N	2
R-176	B	67	60	63	+3	N	2
R-177	B	67	60	65	+5	N	2
R-177a, Shadygrove School	E	52	(43)	(45)	+2	N	2
R-178	B	67	63	70	+7	Y	5
R-179	B	67	63	69	+6	Y	5
R-180	B	67	63	69	+6	Y	5
R-181	B	67	63	70	+7	Y	5
R-182	B	67	63	70	+7	Y	5
R-183	B	67	63	75	+12	Y	5
R-184	B	67	71	69	-2	Y	5
R-185	B	67	71	69	-2	Y	5
R-186	B	67	71	68	-3	Y	5
R-187	B	67	63	68	+5	Y	5
R-188	B	67	63	66	+3	Y	6
R-189	B	67	63	67	+4	Y	6

TABLE 7: TRAFFIC NOISE LEVELS, SECTION 2 (dBA Leq)							
Receiver	NAC Categ	NAC Level	Ambient 2001	Predicted 2015	Change (+/-)	Noise Impact	Exhibit E Page #
R-190	B	67	63	69	+6	Y	6
R-191	B	67	63	69	+6	Y	6
R-192, Cemetery	B	67	63	71	+8	Y	5
R-193, Equestrian Center	B	67	63	70	+7	Y	3

There is not an R-118 Table 7. Note: NAC Category B activities that primarily involve indoor use (i.e. churches, apartments) were classified as Category E and their predicted ambient interior noise level is listed in parentheses in Table 7**.** Category E activities are listed in parenthesis to indicate an estimated interior noise reading was taken. Traffic noise levels were modeled at 65 miles per hour (mph) design speed. Unless otherwise noted, all receiver locations are classified as residential.

As indicated in Table 7, the proposed project will result in a traffic noise impact and the following noise abatement measures were considered: traffic management, alteration of horizontal and/or vertical alignments, acquisition of undeveloped property to act as a buffer zone and the construction of noise barriers.

Before any abatement measure can be incorporated into the project, it must be both feasible and reasonable. In order to be feasible, the measure should reduce noise levels by at least five dBA at impacted receivers; and to be reasonable it should not exceed $25,000 for each benefitted receiver.

Traffic management: control devices could be used to reduce the speed of the traffic; however, the minor benefit of one dBA per five mph reduction in speed does not outweigh the associated increase in congestion and air pollution. Other measures such as time or use restrictions for certain vehicles are prohibited on state highways.

Buffer zone: the acquisition of sufficient undeveloped land adjacent to the highway project to preclude future development that could be impacted by highway traffic noise would not be cost effective/reasonable.

Alteration of horizontal and/or vertical alignments: any alteration of the existing alignment would displace existing businesses and residences, require additional right-of-way and not be cost effective/reasonable. Depressed and elevated roadways normally result in somewhat lower levels (3-5dB) and, thereby, either eliminate the need for a noise barrier or result in a lower barrier than would be required for at-grade roadways (all other factors being equal). The design included in this noise analysis is a result of vertical and horizontal alignment alternatives, which were considered in order to minimize traffic noise.

Noise barriers: this is the most commonly used noise abatement measure. For this section of proposed SH 161, noise barriers were considered at heights ranging from 10-18 Feet and varying lengths for the following receivers.

Receivers 24-25 and 32 are residential receivers located east of proposed SH 161 between IH 30 and Egyptian Way. Receivers 24-25 are located directly behind a commercial area, therefore a noise barrier could not be located in the proposed SH 161 right-of-way. A noise barrier would not be cost effective for an individual receiver (R-32), however a noise barrier is being proposed in the neighborhood where receivers 24-25 and R-32 are located and the will receive some attenuation, but not the 5 dBA necessary to be considered a benefitted receiver.

Receiver 193 is an equestrian center. A noise barrier would not be cost effective for an individual receiver and therefore is not proposed.

Receivers 178-192 are located north of Llama Lane on the east and west side of proposed SH 161 to Rock Island Road. Most of the receivers are located between Shady Grove Road and Rock Island Road because land use is classified as undeveloped, parkland or a commercial/residential mix between Llama Lane and Shady Grove Road. Noise barriers are not feasible for these receivers because of the topography of the area. Noise barriers are normally not effective for receivers on a hillside overlooking the highway or for receivers at heights above the top of the noise barrier and therefore are not proposed for these receivers.

Receivers 65-67, 70, 97-107, 111-115, 121, 129, 167-168, 170-171, 173 are located west of proposed SH 161 between Egyptian Way to north of Llama lane. A noise barrier would not be reasonable and/or feasible for the aforementioned receivers, however a noise barrier is proposed for the other 67 benefitted receivers in their neighborhood. The majority of receivers in this group will receive some attenuation from eight noise barriers (Barriers 4-5) that are proposed in this area, however not the 5 dBA necessary to be considered a benefitted receiver.

For these reasons, a noise barrier would not be feasible and reasonable for the aforementioned receivers. However, noise barriers were determined to be both feasible and reasonable for receivers 1-21, 29-31, 35-39 and are proposed for incorporation into the project. Based on preliminary calculations, noise barriers totaling 1940 feet in length and 18 feet in height will reduce noise levels by at least 5 dBA for 29 benefitted receivers at Barriers 1 and 2 for a total cost of $628,400 or $21,670 for each benefitted receiver.

Based on preliminary calculations, noise barriers for receivers 68-69, 71-96, 108-110, 116, 124-126, 130, 132, 135-143, 145-164, 166 totaling 3,213 feet in length and 18 feet in height will reduce noise levels by at least 5 dBA for 67 benefitted receivers at Barriers 4-5 for a total cost of $1,487,200 or $22,200 for each benefitted receiver.

A noise barrier for Waggoner Park, designated 4(f), (Barrier 3) has been proposed to benefit the many park visitors. A noise barrier 995 feet in length and 18 feet in height would reduce noise levels by at least 5 dBA up to approximately 300 feet from the proposed SH 161 right-of-way. Any subsequent project design changes may require a reevaluation of this proposal. The final

decision to construct the proposed noise barriers will be made upon completion of the project design and the public involvement process.

TABLE 8: NOISE BARRIER PROPOSAL, SECTION 2 (Preliminary)

Barrier	# Benefitted Receivers	Length (feet)	Height (feet)	Total Cost	$/Benefitted Receiver	Exhibit E page #
1-2	29	1,940	18	$628,400	$21,670	1
3	Waggoner Park	995	18	$322,500	4(f)	2
4-5	67	3,213	18	$ 1,487,200	$22,200	1 & 2

Numerous land use activity areas along proposed SH 161 are currently Category D, undeveloped land. At the time the data was gathered for this analysis no new development was planned, designed or programmed in these areas. Given the rapid growth in the area of the proposed project some of these lands could now be planned, designed or programmed for development. There is no NAC for undeveloped land; however, to avoid noise impacts that may result from future development of properties adjacent to the project, local officials responsible for land use control programs should ensure, to the maximum extent possible, no new activities are planned or constructed along or within the following predicted 2015 noise impact contours.

UNDEVELOPED AREA	IMPACT LAND USE	DISTANCE CONTOUR	from RIGHT of WAY
Carrier Pkway to Llama Lane	NAC Category B	66 dBA	350 feet
	NAC Category C	71 dBA	100 feet