I-69 CORRIDOR TIER 2 STUDIES

Evansville to Indianapolis

Final Noise Report

Section 4, US 231 to SR 37

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Prepared for:

INDIANA DEPARTMENT OF TRANSPORTATION

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1.0 INTRODUCTION

Since the release of the DEIS, INDOT has finalized revisions to their new Traffic Noise Policy and has submitted this policy to FHWA for approval. The FHWA published a Notice to Proposed Rulemaking (NPRM) on September 17, 2009 (74 FR 47762) that will amend 23 CFR 772 Procedures for Abatement of Highway Traffic Noise and Construction Noise effective July 13, 2011. As part of the final rule, each state was required to revise its noise policy to incorporated all the changes that were made to 23 CFR 772. Each State was required to submit their revised noise policy to FHWA for approval by January 13, 2011.

Since a Record of Decision will not be signed by the effective date of this final rule, INDOT reviewed the findings presented in the DEIS and evaluated how the changes to 23 CFR 772 and the *INDOT Traffic Noise Analysis Procedure, dated 2011* would affect this project. It was determined that the noise study performed for the four Section 4 alternatives performed using the *INDOT Traffic Noise Policy, dated 2007* would remain as presented in the DEIS and that the Refined Preferred Alternative 2 would be evaluated in accordance with the requirements of the *INDOT Traffic Noise Analysis Procedure, dated 2011*. However, as a result, it would not be possible to effectively compare the Refined Preferred Alternative 2 to the original four Section 4 alternatives presented in the DEIS, so the Refined Preferred Alternative 2 was also evaluated using the *INDOT Traffic Noise Analysis Procedure, dated 2007*. This evaluation has been included in this document and was only performed for comparison purposes. Noise impacts and abatement analysis of the noise impacts were based on the evaluation of the Refined Preferred Alternative 2 using the *INDOT Traffic Noise Analysis Procedure, dated 2011*. A discussion of the evaluation of the Refined Preferred Alternative 2 in accordance with the INDOT *Traffic Noise Analysis Procedure, dated 2011* is contained in **Appendix Q**.

DLZ Indiana, LLC (DLZ) was retained by INDOT to perform a planning level traffic noise study and abatement analysis as a requirement of the Interstate 69 (I-69) Tier 2 EIS. The I-69 Tier 2 Study Area was divided into six sections from south to north. This report evaluates noise impacts and mitigation measures for the portion identified by INDOT as Section 4, located in Greene and Monroe Counties.

The south terminus of Section 4 begins at approximately 1300 feet west of CR 200E in Greene County. The approximate 27-mile Section 4 corridor extends to the east/northeast through eastern Greene County into southwestern Monroe County. The north terminus is at the intersection of That Road and SR 37 in Monroe County. The project is located in the Indiana Department of Transportation's (INDOT) Vincennes and Seymour Districts. The proposed interstate runs on new alignment through the Section 4 Corridor and is shown on **Figure 1** (**Appendix A)**.

The 2000-foot wide study corridor is composed of eight subsections that were identified early in the screening phase where the proposed alignments crossed. The subsections were used to construct Section 4 end-to-end Alternatives.

The major objectives of this planning level noise analysis and abatement analysis study are defined as follows:

- Identify areas of potential noise impacts associated with the Proposed Action
- Evaluate measures to mitigate noise impacts, as necessary

- Compare the various mitigation alternatives on the basis of potential noise impact and the associated mitigation costs.

The *INDOT Traffic Noise Policy* was developed to implement the requirements of 23 Code of Federal Regulations (CFR) Part 772 *Procedures for Abatement of Highway Traffic Noise and Construction Noise* (August 11, 1997), Federal Highway Administration's (FHWA) *Highway Traffic Noise Analysis and Abatement Policy and Guidance* (June 1995), and the noise related requirements of The National Environmental Policy Act of 1969. The INDOT *Traffic Noise Policy* received FHWA approval on February 26, 2007.

2.0 LEGISLATION AND NOISE FUNDAMENTALS

2.1 Regulatory Requirements

Effective control of undesirable traffic noise focuses upon three areas of responsibility. These are the control of land uses adjacent to a highway, regulation of vehicle noise emission levels, and mitigating noise impacts resulting from certain types of highway improvement projects.

The authority to implement planning and land use control in the State of Indiana is under the jurisdiction of local governments. Both FHWA and INDOT encourage local governments to regulate land uses in such a manner that noise sensitive developments are either prohibited from being located adjacent to major transportation facilities, or that developments are planned, designed, and built in such a manner that potential noise impacts can be avoided or minimized.

The Noise Control Act of 1972 gives the US Environmental Protection Agency (USEPA) the authority to establish noise regulations to control major noise sources, including motor vehicles and construction equipment. Furthermore, the USEPA is required to set noise emission standards for motor vehicles used for interstate commerce and the FHWA is required to enforce the USEPA noise emission standards through the Office of Motor Carrier Safety.

The National Environmental Policy Act (NEPA) of 1969 gives broad authority and responsibility to Federal agencies to evaluate and mitigate adverse environmental impacts caused by Federal actions. FHWA is required to comply with NEPA including mitigating adverse highway traffic noise effects. The Federal-Aid Highway Act of 1970 mandates FHWA to develop standards for mitigating highway traffic noise. It also requires FHWA to establish traffic noise level criteria for various types of land uses. The Act prohibits FHWA approval of federal-aid highway projects unless adequate consideration has been made for noise abatement measures to comply with the standards.

FHWA regulations for highway traffic noise for federal-aid highway projects are contained in 23 CFR 772. The regulations contain noise abatement criteria, which represent the maximum acceptable level of highway traffic noise for specific types of land uses. The regulations do not mandate that the abatement criteria be met in all situations, but rather require that reasonable and feasible efforts be made to provide noise mitigation when the abatement criteria are approached or exceeded.

The *INDOT Traffic Noise Policy* was approved by FHWA on February 26, 2007. This policy is applicable to Type I federal-aid highway projects which involve the construction of a highway on a new location, or which involves the physical alteration of an existing highway that significantly

changes either the horizontal or vertical alignment or increases the number of through traffic lanes. The policy is not applicable to Type II federal-aid highway projects for the abatement of noise on existing highways.

2.2 Traffic Noise Descriptors

Noise is generally defined as unwanted or annoying sound. Airborne sound occurs by a rapid fluctuation of air pressure above and below atmospheric pressure. Sound pressure levels are usually measured and expressed in decibels (dB). The decibel scale is logarithmic and expresses the ratio of the sound pressure unit being measured to a standard reference level.

Most sounds occurring in the environment do not consist of a single frequency, but rather a broad band of differing frequencies. The intensities of each frequency add to generate sound. Because the human ear does not respond to all frequencies equally, the method commonly used to quantify environmental noise consists of evaluating all of the frequencies of a sound according to a weighting system. It has been found that the A-weighted filter on a sound level meter, which includes circuits to differentially measure selected audible frequencies, best approximates the frequency response of the human ear.

Although the A-weighted noise level may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources, creating a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of traffic noise, a statistical noise descriptor called the equivalent hourly sound level, or L_{eq} (h), is commonly used. L_{eq} (h) describes a noise sensitive receiver's cumulative exposure from all noise-producing events over a one-hour period.

Because decibels are logarithmic units, sound levels cannot be added by ordinary arithmetic means. The following general relationships provide a basic understanding of sound generation and propagation:

- An increase, or decrease, of 10 dB will be perceived by a receiver to be a doubling, or halving, of the sound level
- Doubling the distance between a highway and receiver will produce a 3 dB sound level decrease
- A 3 dB sound level increase is barely detectable by the human ear

3.0 IMPACT CRITERIA

3.1 Noise Abatement Criteria

The *INDOT Traffic Noise Policy* has adopted the noise abatement criteria (NAC) that have been established by FHWA (23 CFR 772) for determining noise impacts for a variety of land uses. The land-use Activity Categories along with the criteria are presented in **Table 1**.

The NAC sound levels are only to be used to determine a roadway noise impact. These are the absolute values where abatement must be considered. .

Table 1 INDOT Noise Abatement Criteria (NAC) Hourly A-Weighted Sound Levels in Decibels (dBA)		
Activity Category	**L_{eq}(h)**	**Description of Activity Category**
A	57 (Exterior)	Lands where serenity and quiet are of extraordinary significance and serve an important public need. 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. No NAC has been defined.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums where no outside activity occurs.

3.2 INDOT Definition of Traffic Noise Impacts

Traffic noise impacts occur if either of the following two conditions is met:

- The predicted traffic noise levels approach or exceed the NAC, as shown in **Table 1**. The *INDOT Highway Traffic Noise Policy* defines "approach or exceed" as meaning that future levels are higher than 1 dBA below the appropriate NAC activity category. For example, for a category B receiver, 66 dBA would be approaching 67 dBA and would be considered an impact.

- The predicted traffic noise levels substantially exceed the existing noise level. The *INDOT Highway Traffic Noise Policy* defines "substantially exceed" as meaning when predicted traffic noise levels exceed existing noise levels by 15 dBA or more. For example, if a receiver's existing noise level is 50 dBA, and if the future noise level is 65 dBA, then it would be considered an impact.

4.0 NOISE STUDY METHODOLOGY

4.1 Determination of Existing Noise Levels

Existing noise levels is defined in 23 CFR 772- Procedures for Abatement of Highway Traffic Noise and Construction Noise as "Noise, resulting from the natural and mechanical sources and human activity, considered to be usually present in a particular area during the period of the noise analysis". In accordance with the *INDOT Traffic Noise Policy Chapter II.C – Determination of Existing Noise Levels*, the existing noise levels are to be determined by the measurements taken at a time of the day that reflects the loudest hourly highway traffic noise levels occurring on a regular basis under normal traffic conditions at each receiver or representative set of receivers. A receiver represents a point where noise levels are measured or modeled for each applicable Activity Category land-use classification located within the limits of the noise analysis. Since there was over 500 receivers located within the Section 4 corridor, it was determined that existing measurements would be taken at locations that represent specific groups of receivers. An evaluation of the topography, the level of service of the existing local roadway and highways, and the density and proximity of the receivers to the local roadways and highways was performed so as to establish groupings of receivers and the

existing measurement locations that best represented these groupings. The ambient noise monitoring locations can be found on **Figure 2** in **Appendix A**. Only the existing noise level measurement locations that represented receivers within the limits of the noise analysis for the alignments of the four Alternatives are identified on this figure.

Prior to taking existing noise level measurements, an evaluation of the level of service for the roadways within the Section 4 corridor was performed to determine when the anticipated loudest hourly traffic noise levels may occur under normal traffic conditions. It was determined that this condition would most likely occur at locations along SR 45, SR 54, SR 445, and SR 37 during the normal A.M. and/or P.M. peak hour traffic periods between the time frames of the Monday P.M peak hour through the Friday A.M. peak hour. The A.M. and P.M. peak hour traffic for these types of roadways typically occurs between 7:00 AM to 9:00 AM and 4:00 P.M. to 6:00 P.M, respectively. The weekend days along with the Monday A.M. and Friday P.M. were excluded since traffic volumes during these times may have the potential to be elevated and not indicative of the normal traffic conditions. Noise level measurements recorded at representative locations along these roadways were collected on weekdays between the Monday P.M. peak hour to the Friday A.M. peak hour.

For receivers located along the remaining roadways within the Section 4 corridor, it was determined that based on their rural setting and the anticipated low daily traffic counts, that these roadways did not have a peak period of the day that would represent the loudest hourly traffic noise levels. Therefore, the existing noise level measurements were recorded along these roadways Monday through Friday from approximately 7:00 AM to 6:00 PM.

The collection of existing noise level field measurements was conducted in accordance with the *INDOT Traffic Noise Policy* and the Federal Highway Administration (FHWA) Report FHWA-PD-96-046, "Measurement of Highway-Related Noise." Measurement of the existing noise levels at the representative sites was conducted during the week of February 13 – 17, 2006 and on March 26, 2006 using a Quest 2900 Type II meter. Additional existing noise level measurements were conducted on March 15, 2010 using a Quest SoundPro DL Type II meter. The additional existing noise level measurements were warranted in portions of the Section 4 corridor where representative sets of receivers were further sub-divided into smaller groupings based upon further evaluation of the topographic conditions and the proximity of the receivers to the roadways.

The Quest SoundPro DL Type II meter used to record the March 15, 2010 measurement is a newer version of the Quest 2900 Type II meter and was used since the Quest 2900 Type II meter was no longer readily accessible. The Quest SoundPro DL meter utilizes digital circuitry and was developed to replace the analog circuitry used in the Quest 2900 meter. However, both meters are type II meters, use the same microphone, and record and calculate the sound pressure level and equivalent sound exposure levels the same way. Both sound level meters were calibrated at 114 decibels using a Quest QC-10 Calibrator. In 2006, the sound level meter was field calibrated at the start and completion of each day. In 2010, the sound level meter was field calibrated before and after each individual measurement was collected. **Table 2** shows the daily calibration results for the days when the ambient readings were collected. The drift of the noise meter was negligible for the readings. Copies of the manufacturers Certificate of Calibration for both the sound level meter and the calibrator are enclosed in **Appendix B.** All of the existing noise level measurements were recorded at approximately 4.9 feet above grade and at locations representing outdoor activities nearest the predominant ambient noise source.

Table 2 Noise Meter Calibration		
Date	**Noise Meter Drift (dB)**	**Existing Noise Level Sites Recorded on Each Date**
02/13/2006	+0.2	M-42, M-45, M-46
02/14/2006	-0.2	M-2, M-3, M-4, M-8, M-11, M-22, M-27, M-32, M-36, M-44
02/15/2006	0.0	M-12, M-15, M-18, M-19, M-47, M-21, M-23, M-25, M-28, M-31, M-38, M-40, M-43
02/17/2006	+0.1	M-54, M-53, M-55, M-49, M-50
03/23/2006	0.0	C-1, C-2, C-3, C-4
03/15/2010	0.0	M-56, M-57, M-58, M-59, M-60, M-61, M-62, M-63, M-64

Existing noise measurements were conducted under meteorologically acceptable conditions when the pavement was dry and winds were calm or light. Printouts of the weather forecasts containing the wind speed and temperature data for the days in 2006 that the existing noise level measurements were collected are also included in **Appendix B**. Wind speed and temperature readings collected using a Pocket Hygro-Thermo Anemometer (Extech Model 45160) during the existing noise level measurements collected on March 15, 2010 are noted on the Ambient Noise Measurement Logs in **Appendix C**.

A total of 68 existing noise level measurements were collected at the representative receiver locations throughout the corridor. However, only 44 of the existing noise level measurements were located within the limits of the noise analysis based on their proximity to the alignments of the four Alternatives. There were forty-one 15-minute measurements and three 30-minute measurements recorded. Both measurement periods are acceptable for collecting existing noise level readings according to the Federal Highway Administration (FHWA) Report FHWA-PD-96-046, "Measurement of Highway Related Noise." A summary of the existing noise level measurements used as part of this analysis are included in **Table 3** and copies of the Ambient Noise Measurement Logs are included in **Appendix C.**

Traffic data was simultaneously recorded during the noise measurements and classified into four vehicle types— buses, automobiles (2 axles with four wheels), medium trucks (two-axles with six wheels), and heavy trucks (three or more axles)—for subsequent entry into the TNM 2.5 noise prediction computer model. There were no known festivals, events, or other extra-ordinary circumstances occurring on these dates that would have the potential to result in abnormal traffic conditions that would result in atypical existing noise level conditions.

Table 3
Existing Noise Level Readings

Site I.D.	Site Description and Land Use Category Classification	Time		Noise Meter Reading (dBA)		
		Start	End	L_{eq}	L_{min}	L_{max}
M-2	The front yard of a residence located approximately 100 feet from SR 45/58, 2100 feet from Alternatives 1, 2, and 4, and 2,620-2,670 feet from Alternative 3. Land use category B: 3 residences	8:04 am	8:19 am	59.2	43.2	71.6
M-3	The front yard of a residence located approximately 120 feet from County Road 200 E, 40-90 feet from Alternative 3 and (60-70 feet from the S-line for County Road 200 E), and 300-350 feet from Alternatives 1,2, and 4 (125-140 feet from the S-line for County Road 200 E). Land use category B: 3 residences.	8:32 am	8:48 am	42.2	36.7	50.6
M-4	The front yard of a residence located approximately 190 feet from County Road 625 S, 370-410 feet from Alternatives 3, and 450-490 feet from Alternatives 1, 2, and 4. Land use category B: 7 residences and 2 cemeteries (Hasler Cemetery and the Shoptaw Cemetery)	9:06 am	9:21 am	41.3	35.3	56.3
M-8	The front yard of a residence located approximately 70 feet from County Road 450 S, 1250-1360 feet from Alternatives 1 and 4 (1020 feet from the S-line for Taylor Ridge Road), and is located within the right-of-way of Alternatives 2 and 3. Land use category B: 31 residences and 2 cemeteries (Taylor Ridge Cemetery and Cooper Cemetery).	9:54 am	10:09 am	38.9	32.7	51.6
M-11	The front of Ashcraft Chapel and Cemetery located approximately 40 feet from County Road 360 S, and 615-840 feet from the Alternatives. Land use category B: Ashcraft Chapel and Cemetery.	10:59 am	11:14 am	43.1	28.2	66.8
M-12	The front yard of a residence located approximately 40 feet from County Road 920 S (Old Clifty Road), and 910-925 feet from the Alternatives. Land use category B: 8 residences	12:19 pm	12:34 pm	42.9	24.9	66.4
M-15	The front yard of a residence located approximately 30 feet from State Route 45, and is located inside the right-of-way of the Alternatives. Land use category B: 14 residences	7:49 am	8:04 am	61.8	40.7	73.9
M-18	The front yard of a residence located approximately 60 feet from County Road 1250 E, and 150-200 feet from the Alternatives (50 feet from the S-line for County Road 1250 E). Land use category B: 7 residences	8:21 am	8:36 am	49.5	31.7	67.3
M-19	The front yard of a residence located approximately 65 feet from State Route 54, and is located inside the right-of-way of the Alternatives. Land use category B: 10 residences	7:15 am	7:30 am	57.3	34.7	71.3
M-21	Adjacent to a seasonal residence located on a private drive approximately 2200 feet from County Road 1375 E. The site is 90 feet from Alternatives 1 and 3, and 620-685 feet from Alternatives 2 and 4. Land use category B: 13 residences and 1 cemetery (Storm Cemetery) Land use category C: 1 commercial business.	9:15 am	9:30 am	39.7	32.4	53.4
M-22	The front yard of a residence located approximately 35 feet from Carmichael Road, located inside the right-of-way of Alternatives 1 and 3, 650-800 feet from Alternative 2 and 4 (365-390 feet from the S-line for Carmichael Road). Land use Category B: 8 residences and 1 cemetery (Carmichael Cemetery)	12:59 pm	1:14 pm	46.5	32.4	67.7
M-23	The front yard of a residence located in Whippoorwill Estates. This site is approximately 1200 feet from Carmichael Road, approximately 955-970 feet from Alternative 1, 770-860 feet from Alternative 3, 1410-1475 feet from Alternative 4, and 1380 feet from Alternative 2. Land use category B: 21 residences Land use category C: 1 commercial business	9:56 am	10:11 am	40.9	32.2	60.5
M-25	The front yard of a residence located approximately 90 feet from Carter Road, 1650-1680 feet from Alternative 1, 1665-1700 feet from Alternative 4, and is located inside the right-of-way of Alternatives 2 and 3. Land use category B: 20 residences	1:39 pm	1:54 pm	39.3	25.0	54.2
M-27	The front yard of a residence located approximately 70 feet from	2:05	2:20	50.1	32.9	65.4

Table 3
Existing Noise Level Readings

Site I.D.	Site Description and Land Use Category Classification	Time		Noise Meter Reading (dBA)		
		Start	End	L_{eq}	L_{min}	L_{max}
	Breeden Road, and 270-340 feet from the Alternatives (130 feet from the S-Line for State Breeden Road.) Land use category B: 6 residences	pm	pm			
M-28	The front yard of a residence located approximately 45 feet from Burch Road, and is located inside the right-of-way of the Alternatives. Land use category B: 8 residences	2:12 pm	2:27 pm	37.5	27.0	57.4
M-31	The front yard of a residence located approximately 45 feet from West Evans Road, and 390-465 feet from the Alternatives. Land use category B: 7 residences	2:46 pm	3:01 pm	44.3	29.3	63.3
M-32	The front yard of a residence located approximately 55 feet from Harmony Road, and is located inside the right-of-way of the Alternatives. Land use category B: 14 residences	5:56 pm	6:11 pm	49.6	33.6	62.2
M-36	The back yard of a residence located approximately 40 feet from Rockport Road, and is located inside the right-of-way of the Alternatives. Land use category B: 11 residences	4:02 pm	4:17 pm	49.7	35.7	68.6
M-38	The front yard of a residence located approximately 110 feet from Lodge Road, and 540-610 feet from the Alternatives. Land use category B: 7 residences	3:23 pm	3:38 pm	40.7	31.1	57.4
M-40	The front yard of a residence located approximately 90 feet from Tramway Road, 165-190 feet from Alternative 1, 740 -785 feet from Alternatives 2 and 4, and 1610-1700 feet from Alternative 3. Land use category B: 2 residences	3:48 pm	4:03 pm	43.2	32.1	59.8
M-42	The front yard of a residence located approximately 45 feet from Bolin Lane, 245-310 feet from Alternative 1, and 875-975 feet from Alternatives 2, 3, and 4. Land use category B: 8 residences	5:27 pm	5:42 pm	52.0	40.0	68.6
M-43	The front yard of a residence in Farmers Field subdivision located approximately 1350 feet from Bolin Lane, 365-440 feet from Alternative 1, and 1085 feet from Alternatives 2, 3, and 4. Land use category B: 33 residences	4:18 pm	4:33 pm	43.0	37.7	63.3
M-44	The front yard of a residence located approximately 65 feet from Victor Pike Drive, 1050-1100 feet from Alternative 1, and 595-610 feet from Alternatives 2, 3, 4. Land use category B: 10 residences	5:08 pm	5:23 pm	53.7	44.1	67.1
M-45	The back yard of a residence located on Jeremy Drive, approximately 135 feet from State Route 37, and 30 feet from the Alternatives. Land use category B: 7 residences	4:55 pm	5:10 pm	61.2	46.4	71.8
M-46	The front yard of a residence located on Big Sky Lane, approximately 240 feet from State Route 37, and is located within the right-of-way of the Alternatives. Land use category B: 9 residences	4:01 pm	4:16 pm	57.4	47.7	66.8
M-47	The front yard of a residence located approximately 80 feet from Hobbieville Road, 650-700 feet from Alternatives 1 and 3, and 565 feet from Alternatives 2 and 4 (60-75 feet from the S-line for Hobbieville Road). Land use category B: 12 residences	8:50 am	9:05 am	40.5	32.0	61.2
M-49	The back yard of a residence located on Nicole Drive, approximately 495 feet from State Route 37, and 245 feet from the Alternatives. Land use category B: 11 residences	8:02 am	8:17 am	54.4	48.4	63.4
M-50	The front yard of a residence located approximately 75 feet from That Road, and is 765-780 feet from the Alternatives. Land use category B: 2 residences	8:34 pm	8:49 pm	60.8	43.3	77.1
M-53	The back yard of a residence located approximately 100 feet from County Road 350 N, approximately 950-1000 feet from Alternatives 1 and 4, and 1150-1200 feet from Alternatives 2 and 3. Land use category B: 13 residences and 1 cemetery (Sparks Cemetery).	10:54 am	11:24 am	39.0	32.1	57.0

Table 3
Existing Noise Level Readings

Site I.D.	Site Description and Land Use Category Classification	Time		Noise Meter Reading (dBA)		
		Start	End	L_{eq}	L_{min}	L_{max}
M-54	The front yard of a residence located approximately 50 feet from County Road 920 S (Old Clifty Road), and 145-190 feet from the Alternatives (30 feet from the S-line for County Road 920 S). Land use category B: 1 residence	1:59 pm	2:29 pm	43.9	26.6	63.6
M-55	An un-built lot in the Rolling Glen subdivision located approximately 860 feet from Victor Pike Drive, 530-655 feet from Alternatives 2, 3, and 4 and 1330-1360 feet from Alternative 1. Land use category B: 58 residences	3:47 pm	4:02 pm	40.0	35.3	50.7
M-56	Adjacent to the playground at the Fern Hills Club Campground and is located approximately 1,110 feet from Rockport Road, and is located 575-730 feet from the Alternatives. Land use category B: 7 residences Land use Category C: 1 commercial operation	12:29 pm	12:59 pm	43.6	36.3	55.3
M-57	The front yard of a residence located approximately 250 feet from Evans Rd, and is located 885-965 feet from the Alternatives. Land use category B: 7 residences	1:26 pm	1:41 pm	42.3	29.1	60.7
M-58	The front yard of a residence located approximately 640 feet from Tramway Rd, and is within the right-of-way limits for Alternative 1, 340-350 feet from Alternatives 2 and 4, and 1095 feet from Alternative 3. Land use category B: 1 residence	2:05 pm	2:20 pm	57.9	31.3	85.6
M-59	The front yard of a residence located approximately 370 feet from Bolin Lane, and is located 60-110 feet from Alternative 1, and 790-865 feet from Alternatives 2, 3, and 4. Land use category B: 4 residences	2:40 pm	2:55 pm	44.7	38.4	59.0
M-60	The front yard of a residence located approximately 475 feet from Victor Pike, and is located 620-680 feet from Alternative 1, and 135 feet from Alternatives 2, 3, and 4. Land use category B: 4 residences	3:08 pm	3:23 pm	43.2	35.8	52.5
M-61	The front yard of a residence located approximately 800 feet from That Rd. and 1030 feet from SR 37, and is located 270 feet from the Alternatives. Land use category B: 12 residences	3:42 pm	3:57 pm	47.3	40.3	54.4
M-62	The front yard of a residence located approximately 2,400 feet from State Route 45 (north of State Route 445), and is located 155-175 feet from the Alternatives. Land use category B: 12 residences	4:37 pm	4:52 pm	52.1	37.2	72.8
M-63	The front yard of a residence located approximately 980 feet from Carmichael Road, and is located 380 feet from the Alternatives. Land use category B: 3 residences and 1 cemetery (Adams Cemetery)	5:22 pm	5:37 pm	45.0	33.4	55.0
M-64	The front yard of a residence located approximately 1,290 feet from Evans Lane, and is located 310-340 feet from the Alternatives. Land use category B 8 residences	5:55 pm	6:10 pm	33.2	30.2	53.7
C-1	The front yard of a residence located approximately 60 feet from State Route 45 (south of State Route 445), and is located inside the right-of-way of the Alternatives. Land use category B: 1 residence	4:53 pm	5:08 pm	66.1	45.3	79.2
C-2	The front yard of a residence located in Shea Estates. This site is approximately 1430 feet from State Route 45, 70 feet from the south connector road of the Alternatives. Land use category B: 10 residences	5:19 pm	5:34 pm	50.4	40.8	62.9
C-3	The front yard of a residence located in Shady Meadows. This site is approximately 610 feet from State Route 45, 1970 feet from the south connector road of the Alternatives. Land use category B: 7 residences	4:00 pm	4:15 pm	50.7	44.1	57.8
C-4	The front yard of a residence located approximately 125 feet from State Route 45 (north of State Route 445), and 2990 feet from the south connector road of the Alternatives. Land use category B 18 residences Land use category C: 4 commercial operations	4:26 pm	4:41 pm	61.3	37.2	71.6

The existing noise level L_{eq} measurements within the project corridor ranged from 33.2 dBA (M-64) to 66.1 dBA (C-1.) The minimum (L_{min}) level recorded was 24.9 dBA (at M-12) and the maximum level (L_{max}) was 85.6 dBA (at M-58.) Of the 44 ambient locations, seven sites had L_{min} values that were recorded below 30 dBA. These L_{min} values were recorded below the low range setting (30 dBA) for both of the sound level meters, which may have resulted in the over prediction of these ambient levels. However, the low values recorded illustrate the quiet conditions present throughout much of the corridor.

4.2 Traffic Noise Model

The traffic noise analysis for this Tier 2 study was performed using the FHWA Traffic Noise Model (TNM), Version 2.5. The FHWA TNM was first released in March 1998. Version 2.5 of the model was released in April 2004 and is the latest approved version.

TNM estimates vehicle noise emissions and resulting noise levels based on reference energy mean emission levels. The existing and proposed alignments (horizontal and vertical), as well as the traffic volumes, vehicle type, average vehicle speeds, pavement type and traffic control devices are input into the model. TNM uses its acoustic algorithms to predict noise levels at the selected receiver locations by taking into account sound propagation variables such as, atmospheric absorption, divergence, intervening ground, barriers, building rows, and heavy vegetation.

4.2.1 Traffic Data

Traffic that was input into the existing condition runs used to validate the model came from the traffic observed during the ambient measurements. **Appendix D-2** shows the traffic inputs that were used for the existing TNM runs.

Traffic for the Future No-Build was provided to DLZ by INDOT. **Appendix D-3** shows the traffic inputs that were used in the 2030 Future No-Build TNM runs.

The Proposed Traffic (2030) and Future No-Build Traffic (2030) were forecasted for this study by a hierarchy of traffic models. Both Version 4 of the Indiana Statewide Travel Demand Model (ISTDM) and a more detailed corridor model were used. The corridor model includes the counties through which the approved corridor for I-69 passes, as well as all or part of other nearby counties.

The Section 4 highway noise analysis utilized data derived from Traffic Option 1, which is based on the interchange option that has an interchange at SR 45 and at the Greene/Monroe County Line (South Connector). The traffic associated with this interchange option is forecasted to be 23,619 vehicles per day (VPD) between the US 231 and SR 45 interchanges, 24,101 VPD between the SR 45 and Greene/Monroe County line interchanges, and 29,578 VPD between the Greene/Monroe County line and SR 37 interchanges.

The 2030 P.M traffic volumes were used in the noise analysis for the Section 4 Alternatives and the associated abatement analysis. The 2030 P.M. traffic volumes generally resulted in the higher projected traffic volumes, except for the northbound lanes for existing SR 37. Available traffic data did not differentiate between medium and heavy trucks, or include buses. The proposed traffic volumes were divided by the functional classification of the roadway into 4

classes: cars (2 axles and four tires,) medium trucks (2 axles and 6 tires), heavy trucks (three or more axles), and buses. A summary of the 2030 Future Proposed Traffic Volumes (Traffic Option 2) is provided in **Appendix D-4**.

A traffic speed of 70 mph was used for cars, medium trucks, heavy trucks, and buses on the proposed I-69. On SR 37, a speed of 60 mph was used for cars, medium trucks, heavy trucks, and buses. SR 45 and SR 54 were modeled using speeds of 50 mph for cars, medium trucks, heavy trucks, and buses. All other local roads were modeled using speeds of 40 mph for cars, medium trucks, heavy trucks, and buses. Local road speeds were based on posted limits and field observations. Ramp speeds for off-ramps were steadily decreased from freeway speed to either a stop condition or a merge speed, depending on the roadway configuration. The ramp speeds for the on-ramps were increased to the design speed using the on-ramp function within TNM.

4.2.2 Alignment

The proposed alignments for the four Alternatives were developed by DLZ. The alignments (I-69) were converted to 3D-DXF files that were then imported into the TNM with elevations already included. All other roadways including state routes and local roads were input manually through available existing GIS elevation data. INDOT provided DLZ with aerials (2005) and 2-foot contours for the areas inside the Section 4 Corridor. USGS (10-foot) contours were used to supplement the 2-foot contours where it was necessary to go outside the corridor to model receivers and intervening terrain. Other GIS data (parcels, roadways) for Greene County (2005) was provided to DLZ from WTH Engineering. The Monroe County GIS data was obtained from the Indiana Spatial Data Portal (ISDP.)

Flow control devices, such as stop signs and traffic lights were not included in the modeling. Directional traffic was modeled for I-69 and SR 37 only. All other state and local bi-directional roads were modeled as one lane having the width of two lanes with the opposing traffic volumes added together. For the proposed action, I-69 northbound and southbound were each modeled using a single lane, with separate inner and outer roadways (no traffic volumes assigned) to act as paved shoulders.

4.2.3 Receivers

A total of 474 receivers representing 474 dwelling units and other noise sensitive entities (i.e., cemeteries and commercial facilities) were modeled. The location of all the receivers modeled in TNM can be found on **Figure 3 and Figure 4 (Appendix A).** There are 456 single family residences, 2 residential units at Fern Hills Club, and 9 cemeteries that have an Activity Category B NAC Classification. There are 7 commercial operations modeled that have an Activity Category C NAC Classification. A default height of 4.9 feet above the base ground elevation was used for all receivers. Specific receiver placement in the model is generally based on exterior areas where normal human occupation is expected to occur on the property. The receiver input data is included in **Appendix E**. **Figure 4** shows the layout of the modeled TNM receivers along with the topographic data that was used for the receiver elevations.

4.2.4 Tree Zones and Surface Objects

There were no tree zones or surface objects input into the TNM runs for this project.

4.2.5 Terrain Lines

Terrain lines were used extensively in the model to represent the existing topography and intervening terrain features and the proposed cut and fill sections associated with the proposed alignments throughout the corridor. Terrain Lines were used not only as elevation contours, but were also used to define the construction limits and all of the proposed ditches. Terrain lines input into the model were based on two-foot topographic contours created for the I-69 project and were provided to DLZ from INDOT. Terrain line features for areas beyond the limits of the two-foot contour coverage were based on USGS topographic data.

4.2.6 Barriers

Barriers were used in the noise abatement evaluation. A maximum height of 20 feet was used in accordance with the requirements set forth in the *INDOT Traffic Noise Policy*.

4.3 TNM 2.5 Validation

Model validation is a process for testing a model to ensure that it produces reliable results and to confirm that traffic noise is the predominant noise source at the receiver locations. In general, validation involves comparing actual noise measurements obtained with the sound level meter to the noise levels predicted by the model for existing conditions at the same location. The model is considered to be verified if the model results are within ±3 dBA of the field measurements recorded at the site for the same conditions. In rural situations where there is no nearby traffic or traffic volumes are very low even under peak hour conditions, validation of TNM 2.5 by this method is not possible since non-traffic existing noises not accounted for in the model (e.g. birds chirping, insects, tree leaves rustling in the wind, dogs barking, air conditioner condenser units, etc.) are the predominant noise component, rather than roadway traffic.

5.0 PROPOSED ACTION

5.1 Project Description

The Proposed Action involves the selection of a Preferred Alternative from the four Alternatives. Alternative 2 is the Preferred Alternative for Section 4. Following the distribution of the DEIS, Alternative 2 was further refined into the Refined Preferred Alternative 2 in the FEIS. The 27-mile corridor extends from 1300 feet west of CR 200E in Greene County to That Road along existing SR 37 in Bloomington (Monroe County). The proposed interstate runs on new alignment except for the section along existing SR 37.

Section 4 of the I-69 Evansville to Indianapolis corridor traverses a mixture of farmed land, mostly pasture with a lesser amount of row crops, and forested land. A majority of the project lies within a physiographic region that is characterized by gently sloping or moderately sloping ridges that are separated by valleys that have steep or very steep sides. The corridor crosses several named streams such as Doans Creek, Black Ankle Creek, Plummer Creek, and Indian Creek, and many unnamed intermittent and ephemeral streams as it traverses the ridges and

valleys.

The Section 4 corridor is composed of eight subsections that were identified early in the screening phase where the alignments crossed. The subsections were used to construct the following end-to-end Alternatives:

- **Alternative 1:** 4A-2 + 4B-1 + 4C-1 + 4D-1 + Hybrid 4E-1/4E-2 with SR 45 Interchange + 4F-1 with Greene/Monroe County Line Interchange (South Connector Road) + 4G-2 + 4H-1

- **Alternative 2:** 4A-2 + 4B-1 + 4C-2 + 4D-1 + Hybrid 4E-1/4E-2 with SR 45 Interchange + 4F-3 with Greene/Monroe County Line Interchange (South Connector Road) + 4G-2 + 4H-2

- **Alternative 3:** Hybrid 4A-1/4A-2 + 4B-1 + 4C-2 + 4D-1 + Hybrid 4E-1/4E-2 with SR 45 Interchange + 4F-4 with Greene/Monroe County Line Interchange (South Connector Road) + 4G-2 + 4H-3

- **Alternative 4:** 4A-2 + 4B-1 + 4C-1 + 4D-1 + Hybrid 4E-1/4E-2 with SR 45 Interchange + 4F-5 with Greene/Monroe County Line Interchange (South Connector Road) + 4G-2 + 4H-2

The subsections used to construct the Refined Preferred Alternative 2 consist of the following:

- **Refined Preferred Alternative 2:** Refined Preferred 4A-2 + Refined Preferred 4B-1 + Refined Preferred 4C-2 + Refined Preferred 4D-1 + Refined Preferred Hybrid 4E-1/4E-2 with SR 45 Interchange + Refined Preferred 4F-3 with Greene/Monroe County Line Interchange (South Connector Road) + Refined Preferred 4G-2 + Refined Preferred 4H-2.

These Alternatives were all screened using both the initial design criteria and the low-cost design criteria.

Initial Design Criteria

Based on a typical cross section for I-69, the proposed interstate consists of two 12-foot wide lanes in each direction separated by a 60-foot wide depressed median located within an approximate 490-foot wide right-of-way (precise dimensions will vary, depending on alignment and terrain features). The median includes two 7-foot wide usable inside shoulders (6 feet paved). To the outside of each pair of travel lanes there is a minimum 35-foot wide outside clear zone containing 11-foot wide usable shoulders (10 feet paved).

Low-Cost Design Criteria

Under this set of design criteria, there are two 12-foot lanes in each direction separated by a 60-foot wide depressed median located within an approximate 370-foot wide right-of-way (the precise dimension will vary, depending on alignment and terrain features).The median includes two 5-foot wide usable inside shoulders (4 feet paved). To the outside of each pair of travel lanes there is a minimum 30-foot wide outside clear zone containing 11-foot wide usable shoulders (10 feet paved). The low-cost design criteria increases the critical length of grade speed reduction to 20 mph, utilizes rock-cut benching, and increases the high embankment foreslopes from 3:1 to 2:1. These design criteria changes will result in a different vertical profile of the roadway (increased roadway grades) and will affect the line of sight, shielding attenuation

of the back slopes and ground attenuation associated with the foreslopes.

SR 45 Interchange

The Alternatives being evaluated included an interchange at SR 45. A standard rural diamond interchange configuration is being considered at this location. All ramps will be single lane (12-foot) with two ramp terminal intersections on SR 45. An at-grade intersection with a one-way stop sign at SR 45 is the proposed flow control mechanism.

Greene-Monroe County Line Interchange – South Connector

The Alternatives being evaluated included the Greene/Monroe County Line Interchange (South Connector Road) a three-leg rural trumpet interchange, with single lane ramps (12-foot) will be used for the County Line interchange. The ramps will merge together to form a new approximate 1.3 mile two-lane connector road (12-foot lanes) that intersects with SR 45 at or near the junction of SR 445 in eastern Greene County.

SR 37 Interchange

The Alternatives being evaluated included an interchange at SR 37. The proposed interchange at existing SR 37 will be a 3-leg system interchange. Route continuity will be maintained for I-69 as the alignment transitions from the new terrain alignment to follow the existing SR 37 corridor northward. A combination of single lane (12-foot) directional ramps for the higher volume movements and lower speed loop ramps for the lower volume movements will connect I-69 with SR 37 to the south.

All of the SR 37 interchange ramps are freeway-to-freeway connections so there are no intersections within the interchange. The SR 37 / Victor Pike intersection is located within close proximity of the proposed interchange. It is assumed that the intersection will remain signalized with no additional improvements.

5.2 Existing Roadways

Existing transportation facilities within the Section 4 corridor include two rural state highways (SR 45 and SR 54), one multi-lane divided state highway (SR 37), and numerous local county roads. There are no interstate highways within the Section 4 corridor.

SR 45 is a two-lane north-south highway, with 12-foot-wide travel lanes in each direction that connects US 231, in southern Greene County, to SR 37 on the west side of Bloomington. SR 45 is functionally classified as a Rural Major Collector and is a major route that connects the southwest side of Bloomington to Crane NSWC as well as the City of Bloomfield.

SR 54 is a two-lane east-west highway, with 12-foot-wide travel lanes in each direction and is functionally classified as a Rural Major Collector. It is the major east-west route out of the City of Bloomfield and also serves northwest Lawrence County and the City of Bedford.

SR 37 is a major north-south highway that connects the City of Bloomington with Indianapolis to the north and communities like Bedford to the south. Within the Section 4 Corridor, SR 37 is functionally classified as a Rural Principal Arterial. Approximately one mile to the north, at

Fullerton Pike, SR 37 becomes an Urban Freeway. SR 37 is a four-lane divided highway with two 12-foot-wide travel lanes in each direction. It has a 50-foot depressed median. Left turn lanes exist at most of the at-grade intersections.

The following rural local roads and local rural collectors are found within or near the Section 4 corridor: CR 200E, CR 215E, CR 600S, CR 440E, CR 450S, CR 475E, CR 600E, CR 750E (Dry Branch Road), CR 360S, CR 975E (Old Clifty Road), CR 1250E, CR 1260E (Hobbieville Road), CR 35N (Carmichael Road), CR 150N (Carter Road), Breeden Road, Burch Road, Evans Lane, Harmony Road, Rockport Road, Lodge Road, Tramway Road, Bolin Lane and Victor Pike. These roadways consist of two lane roads, with 7-12 foot wide travel lanes in each direction. **Appendix D-1** provides additional information on each of these roads including: county, functional classification, posted speed limit, travel way width and surface type, and shoulder width and surface type.

5.3 Proposed Alignments

A summary of the alignments per subsection that were modeled are identified below in **Table 4**:

Table 4
Proposed Alignments

Subsection	Alignment	Alignment Length (feet)	Alternative
4A	Hybrid 4A-1/4A-2	8,955	3
	4A-2	8,746	1, 2, 4
	Refined Preferred 4A-2	8,746	Refined Preferred 2
4B	4B-1	6,300	1,2,3,4
	Refined Preferred 4B-1	6,300	Refined Preferred 2
4C	4C-1	13,999	1,4
	4C-2	13,202	2,3
	Refined Preferred 4C-2	13,202	Refined Preferred 2
4D	4D-1	13,000	1,2,3,4
	Refined Preferred 4D-1	13,000	Refined Preferred 2
4E	Hybrid 4E-1/4E-2	26,099	1,2,3,4
	Refined Preferred Hybrid 4E-1/4E-2	26.099	Refined Preferred 2

Table 4 Proposed Alignments			
Subsection	**Alignment**	**Alignment Length (feet)**	**Alternative**
4F	4F-1	31,350	1
	4F-3	31,667	2
	4F-4	31,734	3
	4F-5	31,113	4
	Refined Preferred 4F-3	31,667	Refined Preferred 2
4G	4G-2	22,199	1,2,3,4
	Refined Preferred 4G-2	22,199	Refined Preferred 2
4H	4H-1	18,946	1
	4H-2	19,499	2,4
	4H-3	19,969	3
	Refined Preferred 4H-2	19,499	Refined Preferred 2

5.4 Receivers

The Section 4 Corridor consists of three primary land uses including developed land, agriculture, and forested land. Developed areas include residences, a wide array of commercial operations, cemeteries, churches, and a volunteer fire station. These developed areas are scattered throughout the corridor with higher concentrations near the City of Bloomington and the unincorporated Towns of Hobbieville, Koleen and Scotland. Agricultural uses within the study area are dominated by pastures, row crops, and hayfields. In addition to the presence of developed areas and agriculture, much of the middle portion of the corridor is comprised mainly of mature forested land. TNM receiver locations for modeling are located on **Figures 3 (Appendix A)** with 2008 aerials (courtesy of ISDP - NAIP program) and **Figure 4 (Appendix A**) with contours. The terrain of the project area consists of many hills and valleys that create line of sight issues between the roadways and receivers. Displacements are anticipated as a result of the Proposed Action and will be discussed in **Section 6.4**.

All receivers located within 500 feet of the edge of pavement of an Alternative were assessed for potential noise impacts per the *INDOT Traffic Noise Policy*. Based on the existing topography, the proposed vertical profile of the new alignments and the low existing ambient conditions encountered throughout the corridor substantial increase impacts extended beyond the normal modeling limits set forth in INDOT's Noise Policy. As a result, additional receivers were modeled at distances greater than 500 feet, as necessary, to define the extent of the

receivers predicted to experience a substantial increase impact. Receivers were also assessed based upon consideration of roadway and receiver elevations and intervening terrain features. In most cases, there is little line-of-sight (LOS) between the roadway and the receivers, due to the terrain and the elevation of the alignments. Receivers are identified and categorized by subsection.

Subsection 4A

Subsection 4A extends northeast from approximately 1,300 feet west of CR 200E to approximately 1,200 feet southwest of CR 600S. Land use for this subsection includes developed land (residences), agricultural, and forest land. This subsection is approximately 8970 feet (1.7 miles) in length and contains 11 receivers, which represent 10 residences and Hasler Cemetery (R-18.) The receivers all have an Activity Category B NAC Classification.

Subsection 4B

Subsection 4B extends northeast from approximately 1,200 feet southwest of CR 600S to approximately 5,100 feet north east of CR 600S. Land use for this subsection includes developed land (residences), agricultural, and forest land. This subsection is approximately 6,300 feet (1.2 miles) in length, and contains 2 receivers, which represent two residences. The receivers all have an Activity Category B NAC Classification.

Subsection 4C

Subsection 4C extends northeast from approximately 5,100 feet north east of CR 600S to approximately 720 feet east of CR 600E. Land use for this subsection includes developed land (residences), agricultural, and forest land. This subsection is approximately 2.6 miles in length (depending on alignment,) and contains 8 receivers, which represent 7 residences and Taylor Ridge Cemetery (R-16.) The receivers all have an Activity Category B NAC Classification.

Subsection 4D

Subsection 4D extends northeast from approximately 720 feet east of CR 600E to approximately 725 feet east of CR 360S. Land use for this subsection includes developed land (residences), agricultural, and forest land. This subsection is approximately 13,000 feet (2.5 miles) in length, and contains 5 receivers, which represent 4 residences and Cooper Cemetery (R-452). The receivers all have an Activity Category B NAC Classification.

Subsection 4E

Subsection 4E extends northeast from approximately 725 feet east of CR 360S to approximately 600 feet southwest of Hobbieville Road. Land use for this subsection includes developed land (residences), agricultural, and forest land. This subsection is approximately 26,099 feet (4.9 miles) in length, contains 65 receivers that represent 63 residences, including a subdivision with un-built lots (Clifty Hills), Shoptaw Cemetery (R-70) and Ashcraft Cemetery and Chapel (M-11). The receivers all have an Activity Category B NAC Classification.

Subsection 4F

Subsection F extends north from approximately 600 feet southwest of Hobbieville Road to approximately 1000 feet east of Breeden Road. Land use for this subsection includes developed land (residences), agricultural, and forest land. This subsection is approximately 6.0 miles in length contains 141 receivers that are described as follows:

- There are 132 residences, including 4 subdivisions: Shady Meadows, Shea Estates, Whippoorwill, and Timber Trace. The residences all have an Activity Category B NAC Classification.
- There are four cemeteries located within this subsection that include Storm Cemetery (R-453,) Carmichael Cemetery (R-278,) Sparks Cemetery (R-125,) and Adams Cemetery (R-451). All four cemeteries have an Activity Category B NAC Classification.
- There are 5 commercial operations including the Crossroads Cafe and Gas Station (R-262,) Crossroads Collectibles (R-256,) JM Electronics (R-246,) Bloomfield State Bank (R-255,) and the Monroe County Volunteer Fire Department (R-280) located within this subsection. These five commercial operations all have an Activity Category C NAC Classification.

Subsection 4G

Subsection 4G extends northeast from approximately 1000 feet east of Breeden Road to approximately 400 feet east of Lodge Road. Land use for this subsection includes developed land (residences), agricultural, and forest land. This subsection is approximately 22,199 feet (4.2 miles) in length, and contains 76 receivers representing 76 residential and commercial locations including the Fern Hills Club (seasonal campground) that are described as follows:

- There are 72 receivers representing 72 residences located within this subsection. All of the residences have an Activity Category B NAC Classification.
- The Fern Hills Club contains 2 receivers that represent 2 residential locations that have an Activity Category B NAC Classification.
- Two commercial properties were located within this subsection and consist of the Pic-A-Chic Farms (R-183) and the lumberyard/mill (R-172) off Rockport Road. These two commercial properties have an Activity Category C NAC classification.

Subsection 4H

Subsection 4H extends northeast from approximately 400 feet east of Lodge Road to the SR 37 / That Road Intersection. Land use for this subsection includes developed land (residences), agricultural, and forest land. This subsection is approximately 3.7 miles in length and contains 166 receivers, which represent 166 residences throughout the subsection including 5 subdivisions: Sierra Hills, Rolling Glen Estates, Farmers Field Acres, Bailey West/Glenview and Victor Heights. All of the receivers in this subsection have an Activity Category B NAC Classification.

5.5 Planned Development

23 CFR 772.9b (1) requires that a noise analysis be performed for undeveloped lands for which development is “planned, designed, and programmed. In accordance with the *INDOT Traffic*

Noise Policy, an undeveloped lot is considered to be planned, designed, and programmed if a building permit has been issued by the local authorities prior to the Date of Public Knowledge for the relevant project. If no zoning or building permit process is in place then land is considered undeveloped unless foundations for new buildings are in place. INDOT considers the Date of Public Knowledge as the date that the final NEPA approval is made. In the case of I-69 Section 4, the date of the ROD will be considered the Date of Public Knowledge. INDOT has no obligation to provide noise mitigation for any undeveloped land that is planned, designed, or programmed after this date.

Subdivisions result from the division of land into two or more lots that are recorded and then made available for sale. Traditional, or modern, residential subdivisions are typically developed in accordance with a local zoning ordinance that implements a community's land use or comprehensive plan. Such subdivisions often include areas dedicated for public roads and utilities in addition to the platted lots. Prior to March 16, 2009, Greene County did not implement local planning jurisdiction, however, several large tracts of land have been subdivided into multiple lots with defined locations of identity (unrecorded subdivisions). In Monroe County, both major and minor subdivisions are regulated by a local subdivision ordinance. Ten subdivisions were identified within or adjacent to Section 4 Corridor.

Unrecorded subdivisions within or adjacent to the Section 4 corridor in Greene County (developed prior to March 1, 2011) are as follows.

- **Clifty Hills** is located in Subsection 4E, north of Plummer Creek between Koleen and SR 45 (**Figure 3: Page 13 of 47**). Proposed Alignment Hybrid 4E-1/4E-2 passes through the southeast corner of this subdivision. Twenty-six receivers were used to represent the developed and undeveloped lots within this subdivision that were located within the modeling limits for all the Section 4 Alternatives. **Figure 5-1** shows the location of the subdivision, the undeveloped lots, and the receivers that were modeled in the TNM. Not all of the residences and/or undeveloped lots were modeled if they were located outside the modeling limits.

- **Whippoorwill** is located in Subsection 4F and consists of about 16 mobile and modular homes on 1 to 5 acre lots located along the north side of CR 35N (Carmichael Road) (**Figure 3: Page 25 & 26 of 47**). Thirteen receivers were used to represent 13 residences located within the modeling limits for all of the Section 4 Alternatives. Not all of the homes in this area were modeled since some of them were located outside of the modeling limits.

- **Shady Meadows** is located in Subsection 4F, adjacent to the east side of SR 45 in the vicinity of Cincinnati (**Figure 3: Page 31 & 33 of 47**). This subdivision is located adjacent to the proposed South Connector Road corridor that is under consideration for connecting the proposed Green/Monroe County Line Interchange with SR 45 and contains approximately 45 to 50 mobile and/or modular homes situated on 1 to 2 acre lots. Thirteen receivers were used to represent the twelve residences and one undeveloped lot within the modeling limits for the proposed South Connector Road. Not all of the homes in the subdivision were modeled since they were located outside the modeling limits.

- **Shea Estates** is located in Subsection 4F, adjacent to the east side of SR 45 in the vicinity of Cincinnati (**Figure 3: Page 33 of 47**). This subdivision is located adjacent to

the south connector road corridor that is under consideration for connecting the proposed Green/Monroe County Line Interchange with SR 45. There are approximately 13 homes situated on 0.5 to 2 acre lots within this subdivision. Twelve receivers were used to represent the twelve residential homes that were located within the modeling limits for the proposed South Connector Road. Not all of the homes in the subdivision were modeled since they were located outside of the modeling limits.

- **Timber Trace** is located in Subsection 4F and consists of about 46 homes situated on 0.5 to 2 acre lots. This subdivision is located between SR 45 and the Greene/Monroe County Line at CR 350N. (**Figure 3: Page 35 & 36 of 47**) Twelve receivers were used to represent twelve residences located within the modeling limits for all of the Section 4 Alternatives. Not all of the homes in the subdivision were modeled since they were located outside of the modeling limits.

Residential subdivisions within or adjacent to the Section 4 corridor in Monroe County are as follows.

- **Sierra Hills** is located in Subsection 4H, just south of Bolin Lane and east of Rockport Road (**Figure 3: Page 45 of 47**). There are six homes located along Boruff Road in this subdivision. Three receivers were modeled to represent the three homes located on Boruff Road that were within the modeling limits for all of the Section 4 Alternatives. Not all of the homes and undeveloped lots were modeled since they were located outside of the modeling limits. **Figure 5-4** shows the location of the subdivision and the receivers that were modeled in the TNM.

- **Farmers Field Acres** is located in Subsection 4H, on the north side of Bolin Lane between Rockport Road and Victor Pike (**Figure 3: Page 45 of 47**). This subdivision includes about 25 homes situated on 1 to 2.5 acre lots, and about 22 platted undeveloped lots. Alignment 4H-1 passes though the southeast corner of this subdivision. Thirty-five receivers were used to represent the developed and undeveloped lots that were located within the noise modeling limits for all of the Section 4 Alternatives. Not all of the homes and undeveloped lots were modeled since they were located outside of the modeling limits. **Figure 5-2** shows the location of the subdivision, undeveloped lots, and the receivers that were modeled in the TNM.

- **Rolling Glen Estates** is located in Subsection 4H, just south of Bolin Lane and west of Victor Pike (**Figure 3: Page 45 of 47**). This subdivision currently includes about 23 homes situated on 1 to 2.25 acre lots and about 20 undeveloped lots. Alignments 4H-2 and 4H-3 pass through the northwest portion of this subdivision. Forty-three receivers were used to represent all of the homes and undeveloped lots that were located within the noise modeling limits for all of the Section 4 Alternatives. **Figure 5-3** shows the location of the subdivision, undeveloped lots, and the receivers that were modeled in the TNM.

- **Victor Heights** is located in Subsection 4H, on the west side of Victor Pike just north of Bolin Lane (**Figure 3: Page 45 of 47**). There are eight homes in this subdivision located along Victor Heights Drive, with lots ranging from 0.25 to 0.5 acres. Eight receivers were used to represent all eight of the homes located within this subdivision, which are located within the modeling limits for all of the Section 4 Alternatives. **Figure 5-5** shows the location of the subdivision and the receivers that were modeled in the TNM.

- **Bailey West/Glenview** is located Subsection 4H, on the south side of That Road between SR 37 and Victor Pike (**Figure 3: Page 47 of 47**). There are 23 homes and two undeveloped lots in the Bailey West subdivision and eight homes in the adjacent Glenview subdivision to the west. Twenty-five receivers were used to represent the residences and the undeveloped lot in these subdivisions that were located within the modeling limits for all of the Section 4 Alternatives. Not all of the homes and undeveloped lots were modeled since they were located outside of the modeling limits. **Figures 5-6 and 5-7** shows the location of the subdivision and the receivers that were modeled in the TNM.

5.6 Special Use Properties

Fern Hills Club, Inc. is a seasonal campground with one year-round residence. This facility experiences varying seasonal (summer) long term occupancy and seasonal short term weekend occupancy. It is identified as a NAC Category B property. Using an algorithm developed by INDOT for properties of this nature, a total of 2 receivers was assigned for this facility. **Figure 6-1** is a map that was provided to DLZ from the Fern Hills Club that shows the actual layout of the campground.

6.0 PREDICTED NOISE LEVELS

6.1 TNM Validation and Existing Noise Levels

Receivers representing the existing noise measurement locations were modeled using the TNM with the same traffic observed during the noise measurements to confirm that the model accurately replicates the sound environment at each particular location and to confirm that traffic noise is the predominant source of noise at each location. Receivers used in the model to represent the ambient conditions of specified areas are labeled either with an “M” or a “C”. A comparison of the existing ambient measured sound levels to the predicted sound levels for each site is summarized in **Table 5** and the TNM output table is included in **Appendix G**. This validation involves comparing actual noise measurements with the noise levels predicted by the model for present conditions at the same location. The model is considered to be verified if the model results are within ±3 dBA of the field measurements recorded at the site for the same conditions. In rural situations where there is no nearby traffic or traffic volumes are very low even under peak hour conditions, validation of TNM 2.5 by this method is not possible since non-traffic ambient noises not accounted for in the model (e.g. birds chirping, insects, leaves rustling in the wind, barking dogs, air conditioner condensers, etc.) are the predominant noise component, rather than roadway traffic.

Based on field observations collected during the existing noise level measurements, ambient sounds such as birds chirping, insects, tree leaves rustling in the wind, and occasional barking dogs were considered to be the dominant source of noise at the measurement locations M-4, M-8, M-11, M-12, M-21, M-23, M-27, M-25, M-38, M-42, M-47, M-50, M-53, M-54, M-55, M-56, M-57, M-58, M-59, M-62, M-63, M-64, C-2, and C-3. The measured noise levels recorded at these 24 locations were all more than 3 dBA greater than the corresponding modeled noise level. Based on these results, the noise model confirms that the predominant noise component at these representative existing noise measurement sites is the non-highway ambient conditions, which were unable to be accounted for in the noise model.

For Sites M-2, M-3, M-15, M-18, M-19, M-22, C-1, C-4, M-28, M-31, M-32, M-36, M-40, M-43, M-44, M-45, M-46, M-49, M-60 and M-61, where traffic was identified as the dominant source of existing noise, a comparison of existing measured noise levels against modeled levels under the same conditions shows the model results to be within ±3 dBA of the measured readings at 19 of the 20 sites. The one site where the predicted noise level was not within ±3 dBA of the measured level was at Site C-1, which was located along SR 45 near SR 445. The difference between the two readings is believed to be a result of noise being generated by traffic on the nearby SR 445 roadway, which could not be accurately accounted for in the model since a traffic volume for this roadway was unable to be confirmed during the existing measurement period. As a result, the noise model is confirming that the predominant source of noise at these existing noise measurement sites is related to traffic noise.

As shown in **Table 5**, the existing measured L_{eq} noise levels within the project corridor ranged from 66.1 dBA at Site C-1 to 33.2 dBA at Site M-64. The existing measured L_{eq} for Site C-1 (located along SR 45 near SR 445) approaches the NAC of 67 dBA and is considered an existing traffic noise impact as defined by the INDOT *Highway Traffic Noise Policy*. None of the other existing noise levels recorded at the representative measurement sites approach or exceed the NAC.

Table 5
Existing Noise Levels and Existing Predicted Noise Levels (dBA Leq) Comparison

Site No.	Activity Category	Noise Abatement Criterion	Existing Measured L_{eq} (dBA)	Existing Modeled L_{eq} (dBA)	Measured Minus Modeled L_{eq} (dBA)	Dominant Noise Source at Site
M-2	B	67	59.2	59.3	-0.1	Traffic noise from SR 45 / SR 58
M-3	B	67	42.2	39.3	2.9	Traffic noise from SR 45 / SR 58
M-4	B	67	41.3	31.7	9.6	Ambient noise and traffic noise from SR 45 / SR 58
M-8	B	67	38.9	0.0	38.9	Ambient noise; No traffic during reading
M-11	B	67	43.1	32.2	10.9	Ambient noise; Airplane flew overhead during reading
M-12	B	67	42.9	38.7	4.2	Ambient noise; Dog barking on adjoining property
M-15	B	67	61.8	59.6	2.2	Traffic noise from SR 45
M-18	B	67	49.5	50.9	-1.4	Traffic noise from CR 1250 & SR 54
M-19	B	67	57.3	55.7	1.6	Traffic noise from SR 54
M-21	B	67	39.7	9.7	30.0	Ambient noise; No traffic (approx. 2,220 ft from road)
M-22	B	67	46.5	44.4	2.1	Traffic noise from Carmichael Rd
M-23	B	67	40.9	30.4	10.5	Ambient noise; 1 vehicle observed during reading
M-25	B	67	39.3	33.7	5.6	Ambient noise; 1 vehicle observed during reading
M-27	B	67	50.1	44.7	5.4	Ambient Noise &traffic noise from Breeden Rd
M-28	B	67	37.5	37.2	0.3	Traffic noise; 1 vehicle observed during reading
M-31	B	67	44.3	47.1	-2.8	Traffic noise from West Evans Rd
M-32	B	67	49.6	48.8	0.8	Traffic noise from Harmony Rd
M-36	B	67	49.7	51.9	-2.2	Traffic noise from Rockport Rd

Table 5
Existing Noise Levels and Existing Predicted Noise Levels (dBA Leq) Comparison

Site No.	Activity Category	Noise Abatement Criterion	Existing Measured L_{eq} (dBA)	Existing Modeled L_{eq} (dBA)	Measured Minus Modeled L_{eq} (dBA)	Dominant Noise Source at Site
M-38	B	67	40.7	35.8	4.9	Ambient noise (quarry background noise)
M-40	B	67	43.2	45.9	-2.7	Traffic noise from Tramway Rd
M-42	B	67	52.0	47.1	4.9	Ambient noise & traffic noise from Bolin Lane
M-43	B	67	43.0	41.3	1.7	Traffic noise from SR 37
M-44	B	67	53.7	54.6	-0.9	Traffic noise from Victor Pike
M-45	B	67	61.2	61.6	-0.4	Traffic noise from SR 37
M-46	B	67	57.4	58.3	-0.9	Traffic noise from SR 37
M-47	B	67	40.5	36.9	3.6	Ambient noise; 1 vehicle observed during reading
M-49	B	67	54.4	53.7	0.7	Traffic noise from SR 37
M-50	B	67	60.8	51.3	9.5	Ambient noise (talking) & traffic noise from That Rd & SR 37
M-53	B	67	39.0	34.7	4.3	Ambient noise
M-54	B	67	43.9	35.8	8.1	Ambient noise; Dog barking on adjoining property
M-55	B	67	40.0	34.7	5.3	Ambient noise & traffic noise from Victor Pike Dr.
M-56	B	67	43.6	33.2	10.4	Ambient noise (birds and construction work on Rockport Road)
M-57	B	67	42.3	32.9	9.4	Ambient noise (barking) and traffic noise From Evans Road
M-58	B	67	57.9	37.6	20.3	Very noisy ambient sounds (dogs barking, chickens, birds)
M-59	B	67	44.7	40.2	4.5	Ambient noise (birds) and traffic from Bolin Lane, Farmers Field Drive and SR 37 in the distance
M-60	B	67	43.2	44.0	-0.8	Traffic noise from Victor Pike
M-61	B	67	47.3	48.7	-1.4	Traffic noise from That Road and SR 37
M-62	B	67	52.1	37.1	15.0	Ambient noise (dogs barking, and kids playing outside) with SR 45 audibly in the distance
M-63	B	67	45.0	34.1	10.9	Traffic noise on Breeden Road with SR 45 audibly in the distance
M-64	B	67	33.2	16.8	16.4	Ambient noise (wind); no traffic observed during reading.
C-1	B	67	66.1	61.0	5.1	Ambient noise and traffic noise from SR 45
C-2	B	67	50.4	39.4	11.0	Ambient noise
C-3	B	67	50.7	42.0	8.7	Ambient noise & traffic noise from SR 45
C-4	B	67	61.3	64.3	3.0	Traffic noise from SR 45

6.2 Future No-Build Noise Levels

The existing noise levels at the representative measurement locations and the predicted future

No-Build levels that were modeled at the same sites are summarized in **Table 6**. The results of the noise analysis conducted for the Future No-Build scenario indicate that the year 2030 predicted noise levels at the existing representative measurement locations would range from 15.3 dBA L_{eq} at Site M-21 to 66.5 dBA L_{eq} at Site C-4. A comparison of the existing measured levels to the modeled predicted design year 2030 Future No-Build noise levels indicate that the future No-Build noise levels decrease by as much as 34.4 dBA and would increase by as much as 12.1 dBA. The reason that the modeled design year Future No-Build noise levels are shown to be lower than the measured existing noise levels at some of the sites can be attributed to two possible factors: (1) the traffic volume experienced at the time of the existing condition measurement might be greater than the predicted hourly traffic data available from the traffic model used as input into TNM to determine the Future No-Build 2030 levels; (2) the ambient component observed during the existing noise level measurements could not be taken into account in the noise model for the predict year 2030 Future No-Build condition.

Table 6: Future No-Build (2030) and Existing Conditions Noise Levels (dBA Leq) Comparison

Site No.	Activity Category	Noise Abatement Criterion	Existing Measured L_{eq} (dBA)	Future No-Build (2030) Modeled L_{eq} (dBA)	Increase and decrease from Existing L_{eq} (dBA)
M-2	B	67	59.2	60.9	1.7
M-3	B	67	42.2	40.6	-1.6
M-4	B	67	41.3	36.5	-4.8
M-8	B	67	38.9	31.2	-7.7
M-11	B	67	43.1	40.4	-2.7
M-12	B	67	42.9	41.6	-1.3
M-15	B	67	61.8	59.4	-2.4
M-18	B	67	49.5	42.5	-7.0
M-19	B	67	57.3	57.8	0.5
M-21	B	67	39.7	15.3	-24.4
M-22	B	67	46.5	51.3	4.8
M-23	B	67	40.9	41.2	0.3
M-25	B	67	39.3	30.9	-8.4
M-27	B	67	50.1	50.3	0.2
M-28	B	67	37.5	39.6	2.1
M-31	B	67	44.3	51.8	7.5
M-32	B	67	49.6	41.1	-8.5
M-36	B	67	49.7	49.6	-0.1
M-38	B	67	40.7	46.1	5.4
M-40	B	67	43.2	32.2	-11.0
M-42	B	67	52.0	40.6	-11.4
M-43	B	67	43.0	41.1	-1.9

Table 6: Future No-Build (2030) and Existing Conditions Noise Levels (dBA Leq) Comparison					
Site No.	**Activity Category**	**Noise Abatement Criterion**	**Existing Measured L_{eq} (dBA)**	**Future No-Build (2030) Modeled L_{eq} (dBA)**	**Increase and decrease from Existing L_{eq} (dBA)**
M-44	B	67	53.7	50.9	-2.8
M-45	B	67	61.2	62.8	0.6
M-46	B	67	57.4	60.0	2.6
M-47	B	67	40.5	38.0	-2.5
M-49	B	67	54.4	55.0	0.6
M-50	B	67	60.8	52.8	-8.0
M-53	B	67	39.0	51.1	12.1
M-54	B	67	43.9	37.6	-6.3
M-55	B	67	40.0	35.2	-4.8
M-56	B	67	43.6	26.4	-17.2
M-57	B	67	42.3	38.6	-3.7
M-58	B	67	57.9	23.5	-34.4
M-59	B	67	44.7	39.8	-4.9
M-60	B	67	43.2	44.3	1.1
M-61	B	67	47.3	50.2	2.9
M-62	B	67	52.1	40.7	-11.4
M-63	B	67	45.0	33.8	-11.2
M-64	B	67	33.2	33.6	0.4
C-1	B	67	66.1	62.1	-4.0
C-2	B	67	50.4	42.6	-7.8
C-3	B	67	50.7	47.1	-3.6
C-4	B	67	61.3	66.5	5.2

An evaluation of the predicted year 2030 Future No-Build noise levels at all of the receiver locations indicate that two of the modeled sites are anticipated to have noise levels that approach or exceed the NAC of 67 dBA $L_{eq.}$ The two predicted impacts (R-265 and C-4) are located along SR 45 near the SR 45/SR 445 intersection and are residences that have an Activity Category B Classification. The year 2030 future No-Build predicted noise levels are presented in **Appendix F** and the TNM output tables are included in **Appendix H**.

6.3 Predicted Design Year Build Alternative Noise Levels

A noise analysis was performed to determine the predicted noise levels for the receivers located within the modeling limits for the proposed alignments that comprise the Section 4 Alternatives using the initial design criteria and the low-cost design criteria. For the purpose of the following discussions, predicted design year noise levels associated with the initial design criteria

Alternatives are discussed first and then followed by the predicted design year noise levels for the low-cost design criteria Alternatives in parentheses. Within a subsection, the total number of receivers modeled may vary between the different Alternatives and the two design criteria since the vertical alignments and the right-of-way limits for the alignments and the two design criteria are different. Since the alignments and the design criteria have different right-of-way-limits, the number of displacements may also be different.

Due to the physical limitations of the TNM, not all of the predicted future proposed sound levels were modeled in the same run. Thirty-one runs were modeled per the initial design criteria (30 runs were modeled per the low-cost design criteria) to identify the predicted future proposed 2030 build noise levels for Alternatives 1 through 4, and fifteen runs were modeled for the Refined Preferred Alternative 2 for each of the design criteria. A summary of the predicted modeling results for the year 2030 Alternatives and identification of the specific receivers experiencing traffic noise impacts are summarized in **Appendix F**. Copies of the TNM output tables for the initial design criteria are included in **Appendix I** and the TNM output tables for the low-cost design criteria are included in **Appendix J**. Copies of the TNM output tables for the Refined Preferred Alternative 2 with the initial design criteria are included in **Appendix M** and the Refined Preferred Alternative 2 with the low-cost design criteria are included in **Appendix N**.

Subsection 4A

This subsection contains two alignments that consist of Alignment Hybrid 4A-1/4A-2 and Alignment 4A-2. Following the distribution of the DEIS, Alignment 4A-2 was further refined into the Refined Preferred Alignment 4A-2. **Table 7** summarizes the range of anticipated future predicted sound levels and identifies the number of impacts for these alignments and the design criteria.

Table 7
Subsection 4A Results

Alignment	Number of Receivers Evaluated	Design Criteria	Range of Predicted Levels (dBA)	Displacements	Impacts			
					NAC Only	Substantial Criteria Only	NAC and Substantial (Both)	Total
Hybrid 4A-1/4A-2	6	Low-Cost	54.2-65.0	2	0	4	0	**4**
Hybrid 4A-1/4A-2	6	Initial	54.4-64.4	2	0	4	0	**4**
4A-2	9	Low Cost	46.6-64.9	0	0	4	0	**4**
4A-2	9	Initial	47.3-66.6	0	0	5	1	**6**
Refined Preferred 4A-2	9	Low Cost	47.2-65.6	0	0	6	0	**6**
Refined Preferred 4A-2	9	Initial	47.3-66.6	0	0	5	1	**6**

Alignment Hybrid 4A-1/4A-2 will impact 4 (4) Activity Category B NAC sites, and Alignment 4A-2 will impact 6 (4) Activity Category B NAC sites. The Refined Preferred Alignment 4A-2 will

impact 6 (6) Activity Category B NAC sites. Hasler Cemetery (R-18) is located within this subsection and will be impacted by all of the alignments utilizing both of the design criteria.

Subsection 4B

This subsection contains one alignment that consists of Alignment 4B-1. Following the distribution of the DEIS, Alignment 4B-1 was further refined into the Refined Preferred Alignment 4B-1. **Table 8** summarizes the comparison of the predicted sound levels and impacts between the two design criteria for this alignment.

Table 8
Subsection 4B Results

Alignment	Number of Receivers Evaluated	Design Criteria	Range of Predicted Levels (dBA)	Displacements	Impacts			
					NAC Only	Substantial Criteria Only	NAC and Substantial (Both)	Total
4B-1	2	Low-Cost	54.9-62.7	0	0	2	0	**2**
4B-1	2	Initial	55.7-63.8	0	0	2	0	**2**
Refined Preferred 4B-1	2	Low-Cost	54.9-62.8	0	0	2	0	**2**
Refined Preferred 4B-1	2	Initial	55.4-63.6	0	0	2	0	**2**

Alignment 4B-1 and the Refined Preferred Alignment 4B-1 will impact 2 (2) residential sites with an Activity Category B NAC Classification.

Subsection 4C

This subsection contains two alignments that consist of Alignment 4C-1 and Alignment 4C-2. Following the distribution of the DEIS, Alignment 4C-2 was further refined into the Refined Preferred Alignment 4C-2. **Table 9** summarizes a comparison of the predicted sound levels and the impacts between these proposed alignments using the different design criteria.

Table 9
Subsection 4C Results

Alignment	Number of Receivers Evaluated	Design Criteria	Range of Predicted Levels (dBA)	Displacements	Impacts			
					NAC Only	Substantial Criteria Only	NAC and Substantial (Both)	Total
4C-1	5	Low-Cost	44.7-60.8	1	0	4	0	**4**
4C-1	5	Initial	43.0-59.5	1	0	4	0	**4**
4C-2	6	Low-Cost	55.3-62.8	1	0	6	0	**6**

Table 9 Subsection 4C Results								
4C-2	6	Initial	53.1-59.5	1	0	5	0	**5**
Refined Preferred 4C-2	6	Low-Cost	55.6-61.5	1	0	6	0	**6**
Refined Preferred 4C-2	6	Initial	53.1-59.9	1	0	5	0	**5**

Alignment C-1 will impact 4 (4) Activity Category B NAC sites. Alignment 4C-2 and Refined Preferred Alignment 4C-2 will both impact 5 (6) Activity Category B NAC sites. Taylor Ridge Cemetery (R-16) is located within the subsection and will be impacted by all three of the alignments using both of the design criteria. .

Subsection 4D

This subsection contains one alignment consisting of Alignment 4D-1. Following the distribution of the DEIS, Alignment 4D-1 was further refined into the Refined Preferred Alignment 4D-1. **Table 10** summarizes a comparison of the predicted sound levels and impacts between these design criteria.

Table 10 Subsection 4D Results								
Alignment	**Number of Receivers Evaluated**	**Design Criteria**	**Range of Predicted Levels (dBA)**	**Displacements**	**Impacts**			
					NAC Only	**Substantial Criteria Only**	**NAC and Substantial (Both)**	**Total**
4D-1	3	Low-Cost	53.1-59.5	2	0	2	0	**2**
4D-1	3	Initial	53.6-59.7	2	0	2	0	**2**
Refined Preferred 4D-1	3	Low-Cost	52.3-59.2	2	0	2	0	**2**
Refined Preferred 4D-1	3	Initial	53.5-59.7	2	0	2	0	**2**

Alignment 4D-1 and Refined Preferred Alignment 4D-1 will impact 2 (2) sites with a Category B NAC classification. Cooper Cemetery (R-452) is not impacted using either design criteria by Alignment 4D-1 or by the Refined Preferred Alignment 4D-1.

Subsection 4E

This subsection contains one alignment consisting of Alignment Hybrid 4E-1/4E-2. Following the distribution of the DEIS, Alignment Hybrid 4E-1/4E-2 was further refined into the Refined Preferred Alignment Hybrid 4E-1/4E-2. **Table 11** shows a comparison of the predicted sound levels and impacts between the two design criteria for both alignments.

Table 11 Subsection 4E Results								
Alignment	Number of Receivers Evaluated	Design Criteria	Range of Predicted Levels (dBA)	Displacements	Impacts			
					NAC Only	Substantial Criteria Only	NAC and Substantial (Both)	Total
Hybrid 4E-1/ 4E-2	53	Low-Cost	45.7-66.5	11	0	17	2	**19**
Hybrid 4E-1/ 4E-2	53	Initial	46.1-68.3	11	0	17	4	**21**
Refined Preferred Hybrid 4E-1/ 4E-2	53	Low-Cost	52.3-66.6	11	0	17	2	**19**
Refined Preferred Hybrid 4E-1/ 4E-2	53	Initial	47.5-67.6	11	0	17	3	**20**

Alignment Hybrid 4E-1/4E-2 will impact 21 (19) residential sites with an Activity Category B NAC Classification. The Refined Preferred Hybrid 4E-1/4E-2 will impact 20 (19) residential sites with an Activity Category B NAC Classification. Shoptaw Cemetery (R-70) is impacted using both design criteria for both alignments. Ashcraft Cemetery and Chapel (M-11) are not impacted using either of the design criteria.

Subsection 4F

This subsection contains four alignments that consist of Alignment 4F-1, Alignment 4F-3, Alignment 4F-4 and Alignment 4F-5. Following the distribution of the DEIS, Alignment 4F-3 was further refined into the Refined Preferred Alignment 4F-3. **Table 12** summarizes a comparison of the future predicted sound levels and the noise impacts between these alignments using the different design criteria.

Table 12 Subsection 4F Results								
Alignment	Number of Receivers Evaluated	Design Criteria	Range of Predicted Levels (dBA)	Displacements	Impacts			
					NAC Only	Substantial Criteria Only	NAC and Substantial (Both)	Total
4F-1	94	Low-Cost	41.5-65.9	36	0	28	0	**28**
4F-1	93	Initial	42.3-65.0	36	0	29	0	**29**
4F-3	96	Low-Cost	44.8-67.6	24	0	30	1	**31**
4F-3	95	Initial	44.8-66.1.0	25	0	30	1	**32**
4F-4	104	Low-Cost	44.4-67.8	31	0	33	1	**34**

Table 12 Subsection 4F Results								
Alignment	Number of Receivers Evaluated	Design Criteria	Range of Predicted Levels (dBA)	Displacements	Impacts			
					NAC Only	Substantial Criteria Only	NAC and Substantial (Both)	Total
4F-4	102	Initial	44.7-65.0	33	0	36	0	**36**
4F-5	79	Low-Cost	43.2-65.8	30	0	17	0	**17**
4F-5	79	Initial	41.8-65.4	30	0	19	0	**19**
Refined Preferred 4F-3	95	Low	44.7-67.7	24	0	28	2	**30**
Refined Preferred 4F-3	95	Initial	44.7-67.7	25	0	31	1	**32**

Alignment 4F-1 will impact 26 (25) residential sites, Alignment 4F-3 will impact 31 (30) residential sites, Alignment 4F-4 will impact 34 (33) sites, and Alignment 4F-5 will impact 18 (16) residential sites with an Activity Category B NAC Classification. The Refined Preferred 4F-3 will impact 31 (29) residential sites with an Activity Category B NAC Classification. Storm Cemetery (R-453) is impacted by Alignment 4F-1 and Alignment 4F-4 using the initial design criteria and Alignment 4F-1 using the low-cost design criteria. Sparks Cemetery (R-125) is impacted by all these alignments using both design criteria, including the Refined Preferred 4F-3. Carmichael Cemetery (R-278) and Adams Cemetery (R-451) are not impacted by any of the alignments. In addition, Alignment 4F-1, using the initial design criteria and the low-cost design criteria, will impact the Volunteer Fire Department (R-280) located on Carmichael Road, which has an Activity Category C NAC Classification.

Subsection 4G

This subsection contains one alignment that consists of Alignment Hybrid 4G-2. Following the distribution of the DEIS, Alignment 4G-2 was further refined into the Refined Preferred Alignment 4G-2. **Table 13** summarizes a comparison of the future predicted sound levels and the noise impacts between these alignments for the two design criteria.

Table 13 Subsection 4G Results								
Alignment	Number of Receivers Evaluated	Design Criteria	Range of Predicted Levels (dBA)	Displacements	Impacts			
					NAC Only	Substantial Criteria Only	NAC and Substantial (Both)	Total
4G-2	58	Low-Cost	49.5-68.1	17	0	33	3	**36**
4G-2	53	Initial	45.2-67.9	22	0	22	3	**25**

Table 13 Subsection 4G Results								
Alignment	Number of Receivers Evaluated	Design Criteria	Range of Predicted Levels (dBA)	Displacements	Impacts			
					NAC Only	Substantial Criteria Only	NAC and Substantial (Both)	Total
Refined Preferred 4G-2	51	Low	50.8-68.4	24	0	23	3	**26**
Refined Preferred 4G-2	48	Initial	51.2-68.4	27	0	22	3	**25**

Alignment 4G-2 will impact 25 (36) modeled receivers. Twenty-five (35) of the impacted sites have an Activity Category B NAC Classification, with 2 (2) of these sites being part of the Fern Hills Club (seasonal campground). There is one impacted site (R-172, lumberyard\mill) that has an Activity Category C NAC Classification. This site is impacted utilizing the low-cost design criteria and will be acquired using the initial design criteria.

Refined Preferred Alignment 4G-2 will impact 25 (26) modeled receivers. Twenty-four (25) on the impacted sites have an Activity Category B NAC Classification, with 2 (2) of these sites being part of the Fern Hills Club (seasonal campground). There is one impacted site (R-172, lumberyard\mill) that has an Activity Category C NAC Classification. This site is impacted utilizing both the low-cost and the initial design criteria.

Subsection 4H

This subsection contains three alignments that consist of Alignment 4H-1, Alignment 4H-2, and Alignment 4H-3. Following the distribution of the DEIS, Alignment 4H-2 was further refined into the Refined Preferred Alignment 4H-2. **Table 14** summarizes the comparison of the future predicted sound levels and the noise impacts between these alignments using the different design criteria.

Table 14 Subsection 4H Results								
Alignment	Number of Receivers Evaluated	Design Criteria	Range of Predicted Levels (dBA)	Displacements	Impacts			
					NAC Only	Substantial Criteria Only	NAC and Substantial (Both)	Total
4H-1	142	Low-Cost	45.0-68.1	19	0	52	3	**55**
4H-1	142	Initial	46.5-67.1	19	1	77	3	**81**
4H-2	147	Low-Cost	45.8-69.0	15	0	60	3	**63**
4H-2	146	Initial	46.5-67.5	16	0	68	4	**72**
4H-3	149	Low-Cost	43.1-68.7	15	0	50	3	**53**

Table 14 Subsection 4H Results								
Alignment	Number of Receivers Evaluated	Design Criteria	Range of Predicted Levels (dBA)	Displacements	Impacts			
					NAC Only	Substantial Criteria Only	NAC and Substantial (Both)	Total
4H-3	148	Initial	46.8-67.5	16	0	66	4	**70**
Refined Preferred 4H-2	147	Low-Cost	46.0-69.2	15	0	58	3	**61**
Refined Preferred 4H-2	146	Initial	47.0-68.2	16	1	68	4	**73**

Alignment 4H-1 will impact 81 (55) residential sites. Alignment 4H-2 will impact 72 (63) residential sites. Alignment Hybrid 4H-3 will impact 70 (53) residential sites. Refined Preferred Alignment 4H-2 will impact 73 (61) residential sites. All of the impacted receivers have an Activity Category B NAC Classification.

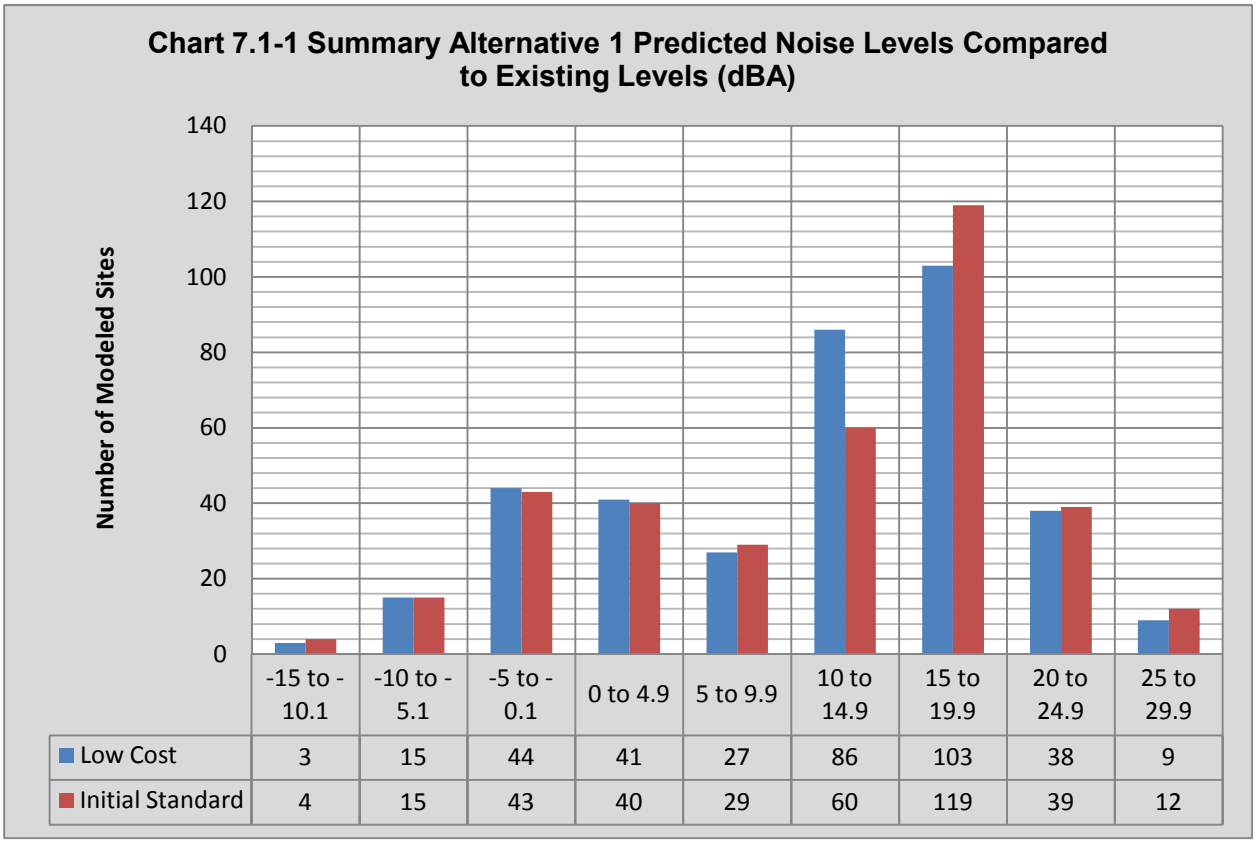
7.0 PREDICTED YEAR 2030 NOISE RESULTS COMPARITIVE ANALYSIS

7.1 Comparison of Predicted Year 2030 Noise Levels With Existing Conditions

For the purpose of the following discussions, results of the noise analysis associated with the initial design criteria are discussed first and then followed by the results of the noise analysis for the low-cost design criteria in parentheses. Within an Alternative, the total number of receivers modeled using the initial design criteria may not equal the total number of receivers modeled using the low-cost design criteria since the vertical alignments and the right-of-way limits for the two design criteria are different.

Alternative 1

The results of the noise analysis conducted for Alternative 1 indicate that the year 2030 predicted noise levels for the build condition would range from 42.3 dBA L_{eq} to 68.3 dBA L_{eq} for 483 modeled receivers (41.5 dBA L_{eq} to 68.1 dBA L_{eq} for 490 modeled receivers). These predicted noise levels represent a difference from existing noise levels ranging from -11.9 dBA L_{eq} to 28.9 dBA $L_{eq.}$ (-12.6 dBA L_{eq} to 29.9 dBA L_{eq}). **Chart 7.1-1** summarizes the number of receivers that are expected to experience increases and decreases from existing noise levels in 5 dBA increments. The maximum -11.9 dBA (-12.6 dBA) decrease is predicted at site R-2, which is located along SR45/SR 58 near CR 200E in Greene County. The decrease in the noise level being predicted at this location is believed to be a result of several factors: (1) The existing noise level at R-2 being lower than what was recorded at this sites representative existing measurement location (M-2),which may be attributed to differences in the distance from the roadway, topography differences, and differences in the roadway geometry between the two sites, (2) A decrease in the future traffic volumes predicted for SR 45/58, and (3) The proposed I-69 alignment being significantly elevated above the elevation of this receiver, which is likely causing a shadow effect at this location. The 28.9 dBA (29.9 dBA) increase is predicted to occur at R-137 on Evans Lane southeast of Stanford.

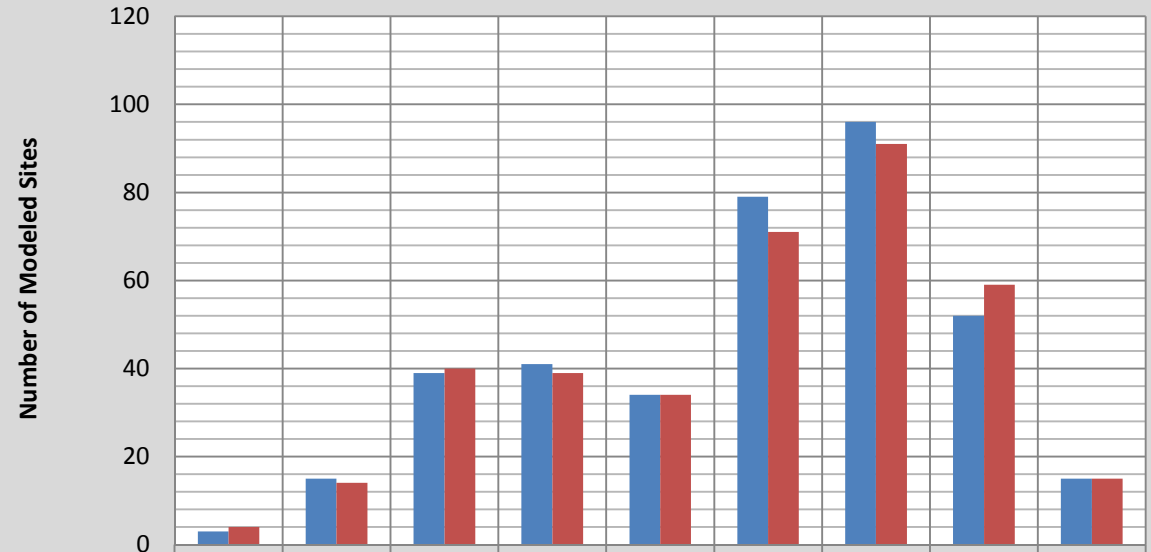


	-15 to -10.1	-10 to -5.1	-5 to -0.1	0 to 4.9	5 to 9.9	10 to 14.9	15 to 19.9	20 to 24.9	25 to 29.9
Low Cost	3	15	44	41	27	86	103	38	9
Initial Standard	4	15	43	40	29	60	119	39	12

Alternative 2

The results of the noise analysis indicate that the year 2030 proposed noise levels would range from 44.8 dBA L_{eq} to 68.3 dBA L_{eq} for 487 modeled receivers (44.8 dBA L_{eq} to 69.0 dBA $L_{eq.}$ for 494 modeled receivers). These predicted noise levels represent a difference from existing noise levels ranging from -11.9dBA L_{eq} to 28.9 dBA $L_{eq.}$ (-12.6dBA L_{eq} to 29.9 dBA L_{eq}). **Chart 7.1-2** summarizes the number of receivers that are expected to experience increases and decreases from existing noise levels in 5 dBA increments. The maximum -11.9 dBA (-12.6 dBA) decrease is predicted at site R-2, which is located along SR45/SR 58 near CR 200E in Greene County. The decrease in the noise level being predicted at this location is believed to be a result of several factors: (1) The existing noise level at R-2 being lower than what was recorded at this sites representative existing measurement location (M-2), which may be attributed to differences in the distance from the roadway, topography differences, and differences in the roadway geometry between the two sites, (2) A decrease in the future traffic volumes predicted for SR 45/58, and (3) The proposed I-69 alignment being significantly elevated above the elevation of this receiver, which is likely causing a shadow effect at this location. The 28.9 dBA (29.9 dBA) increase is predicted to occur at R-137 on Evans Lane southeast of Stanford.

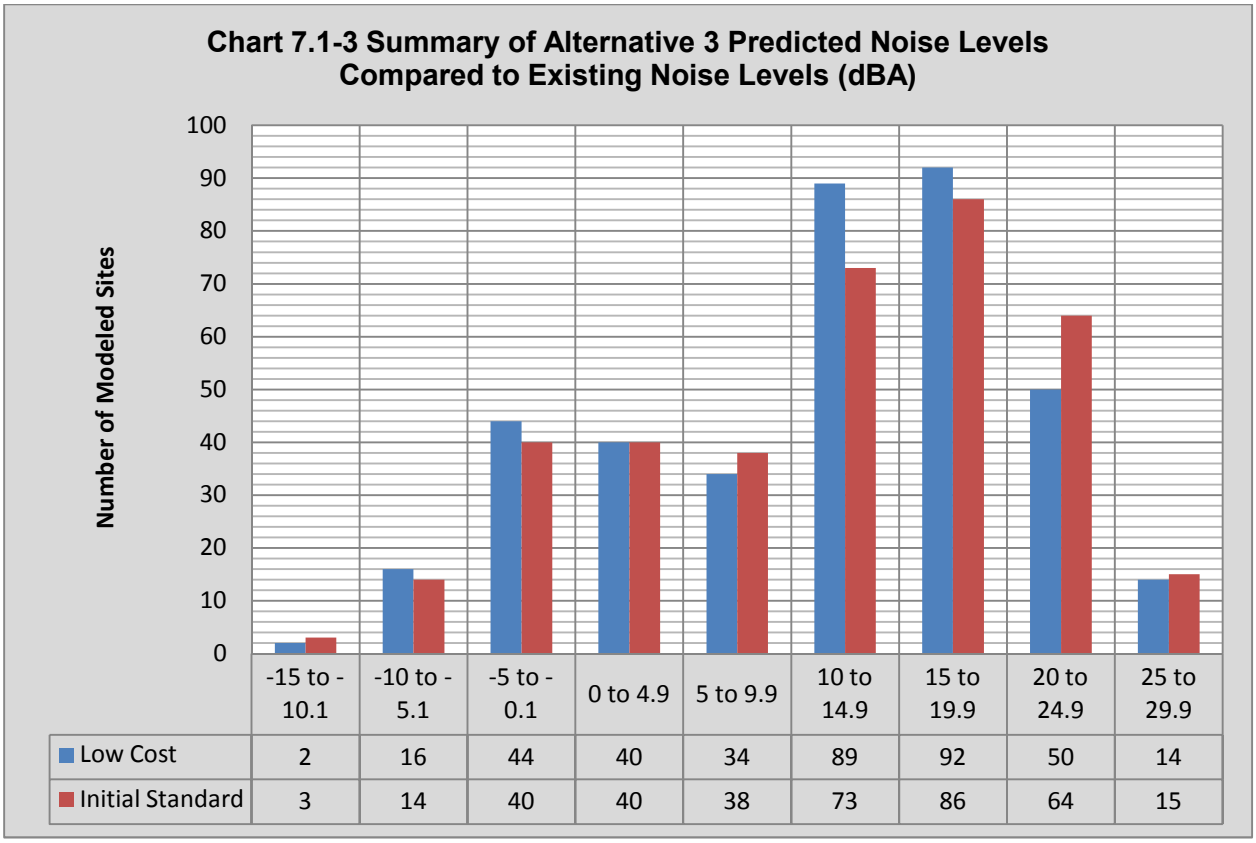
Chart 7.1-2 Summary of Alternnative 2 Predicted Noise Levels Compared to Existing Noise Levels (dBA)



	-15 to -10.1	-10 to -5.1	-5 to -0.1	0 to 4.9	5 to 9.9	10 to 14.9	15 to 19.9	20 to 24.9	25 to 29.9
Low Cost	3	15	39	41	34	79	96	52	15
Initial Standard	4	14	40	39	34	71	91	59	15

Alternative 3

The results of the noise analysis indicate that the year 2030 proposed noise levels would range from 44.7 dBA L_{eq} to 68.3 dBA L_{eq} for 494 modeled receivers (43.1 dBA L_{eq} to 68.7 dBA $L_{eq.}$ for 502 modeled receivers). These predicted noise levels represent a difference from existing noise levels ranging from -11.3 dBA L_{eq} to 28.9 dBA $L_{eq.}$ (-10.9 dBA L_{eq} to 29.9 dBA L_{eq}). **Chart 7.1-3** summarizes the number of receivers that are expected to experience increases and decreases from existing noise levels in 5 dBA increments. The maximum -11.3 dBA decrease for the initial design criteria is located at site R-254, and the maximum 10.9 decrease for the low-cost design criteria is located at site R-254. Both of these sites are located near the SR 45/SR 445 intersection. The decrease in predicted noise levels when compared to the existing noise levels is attributed to a decrease in the traffic volumes on the local roads. The 28.9 dBA (29.9 dBA) increase is predicted to occur at R-137 on Evans Lane southeast of Stanford.

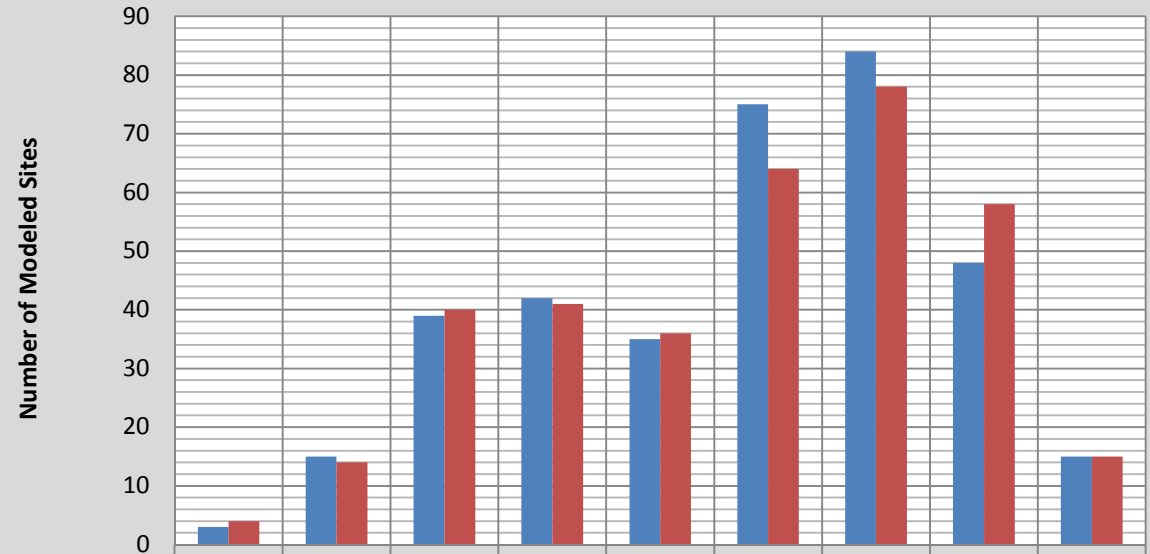


	-15 to -10.1	-10 to -5.1	-5 to -0.1	0 to 4.9	5 to 9.9	10 to 14.9	15 to 19.9	20 to 24.9	25 to 29.9
Low Cost	2	16	44	40	34	89	92	50	14
Initial Standard	3	14	40	40	38	73	86	64	15

Alternative 4

The results of the noise analysis indicate that the year 2030 proposed noise levels would range from 41.8 dBA L_{eq} to 68.3 dBA L_{eq} for 472 modeled receivers (43.2 dBA L_{eq} to 69.0 dBA $L_{eq.}$ for 478 modeled receivers). These predicted noise levels represent a difference from existing noise levels ranging from -11.9 dBA L_{eq} to 28.9 dBA $L_{eq.}$ (-12.6 dBA L_{eq} to 29.9 dBA L_{eq}). **Chart 7.1-4** summarizes the number of receivers that are expected to experience increases and decreases from existing noise levels in 5 dBA increments. The maximum -11.9 dBA (-12.6 dBA) decrease is predicted at site R-2, which is located along SR45/SR 58 near CR 200E in Greene County. The decrease in the noise level being predicted at this location is believed to be a result of several factors: (1) The existing noise level at R-2 being lower than what was recorded at this sites representative existing measurement location (M-2), which may be attributed to differences in the distance from the roadway, topography differences, and differences in the roadway geometry between the two sites, (2) A decrease in the future traffic volumes predicted for SR 45/58, and (3) The proposed I-69 alignment is significantly elevated above the elevation of this receiver, which is likely causing a shadow effect at this location. The 28.9 dBA (29.9 dBA) increase is predicted to occur at R-137 on Evans Lane southeast of Stanford.

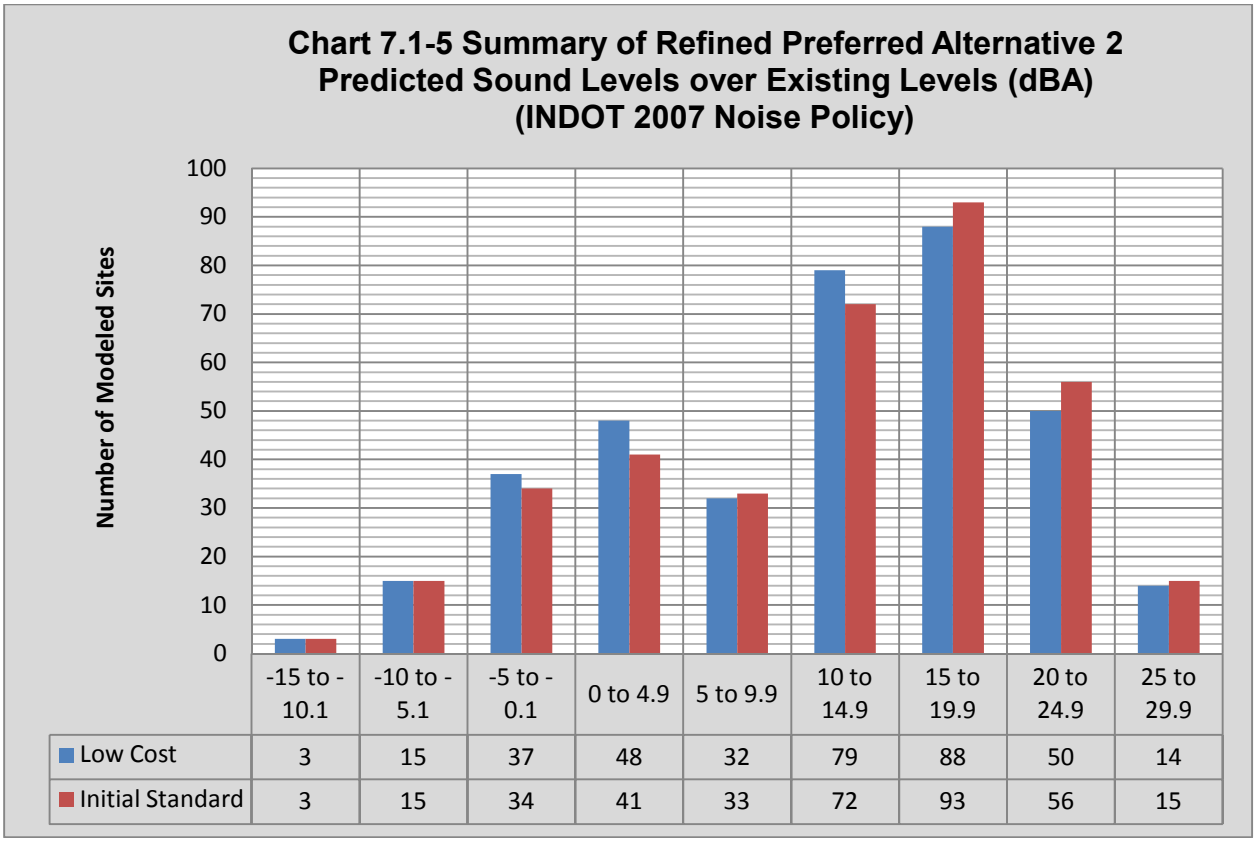
Chart 7.1-4 Summary of Alternative 4 Predicted Noise Levels Compared to Existing Noise Levels (dBA)



	-15 to -10.1	-10 to -5.1	-5 to -0.1	0 to 4.9	5 to 9.9	10 to 14.9	15 to 19.9	20 to 24.9	25 to 29.9
Low Cost	3	15	39	42	35	75	84	48	15
Initial Standard	4	14	40	41	36	64	78	58	15

Refined Preferred Alternative 2 (INDOT Noise Policy, 2007)

The results of the noise analysis for the Refined Preferred Alternative 2 using the INDOT *Noise Policy, 2007* indicate that the year 2030 proposed noise levels would range from 44.7 dBA L_{eq} to 68.4 dBA L_{eq} for 484 modeled receivers (44.7 dBA L_{eq} to 69.2 dBA $L_{eq.}$ for 489 modeled receivers). These predicted noise levels represent a difference from existing noise levels ranging from -11.9 dBA L_{eq} to 28.7 dBA $L_{eq.}$ (-12 dBA L_{eq} to 29.2 dBA L_{eq}). **Chart 7.1-5** summarizes the number of receivers that are expected to experience increases and decreases from existing noise levels in 5 dBA increments. The maximum -11.9 dBA (-12 dBA) decrease is predicted at site R-2, which is located along SR45/SR 58 near CR 200E in Greene County. The decrease in the noise level being predicted at this location is believed to be a result of several factors: (1) The existing noise level at R-2 being lower than what was recorded at this sites representative existing measurement location (M-2), which may be attributed to differences in the distance from the roadway, topography differences, and differences in the roadway geometry between the two sites, (2) A decrease in the future traffic volumes predicted for SR 45/58, and (3) The proposed I-69 alignment being significantly elevated above the elevation of this receiver, which is likely causing a shadow effect at this location. The 28.7 dBA increase predicted to occur using the initial design criteria was identified at R-125, which represents Sparks Cemetery in Subsection F. The 29.2 dBA increase predicted to occur using the low-cost design criteria was identified at R-317, which is located in the Rolling Glen Subdivision.



	-15 to -10.1	-10 to -5.1	-5 to -0.1	0 to 4.9	5 to 9.9	10 to 14.9	15 to 19.9	20 to 24.9	25 to 29.9
Low Cost	3	15	37	48	32	79	88	50	14
Initial Standard	3	15	34	41	33	72	93	56	15

7.2 Comparison of Predicted Year 2030 Traffic Noise Impacts by Alternative

For the purpose of the following discussions, predicted noise levels associated with the initial design criteria are discussed first and then followed by the predicted noise levels for the low-cost design criteria in parentheses.

Table 15 contains a summary of the number of predicted year 2030 impacts associated with each of the alignments that comprise the different Alternatives.

Table 15: Comparison of Noise Level Impacts Between Alignments for the Section 4 Alternatives

Alignment	2030 Noise Level Impacts									
	Alternatives									
	1		2		3		4		Refined Preferred Alt 2	
	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria
Hybrid 4A-1/4A-2	-	-	-	-	4	4	-	-	-	-
4A-2	4	6	4	6	-	-	4	6	-	-
Refined Preferred 4A-2	-	-	-	-	-	-	-	-	6	6
4B-1	2	2	2	2	2	2	2	2	-	-
Refined Preferred 4B-1	-	-	-	-	-	-	-	-	2	2
4C-1	4	4	-	-	-	-	4	4	-	-
4C-2	-	-	6	5	6	5	-	-	-	-
Refined Preferred 4C-2	-	-	-	-	-	-	-	-	6	5
4D-1	2	2	2	2	2	2	2	2	-	-
Refined Preferred 4D-1	-	-	-	-	-	-	-	-	2	2
Hybrid 4E-1/4E-2	19	21	19	21	19	21	19	21	-	-
Refined Preferred Hybrid 4E-1/4E-2	-	-	-	-	-	-	-	-	19	20
4F-1	28	29	-	-	-	-	-	-	-	-
4F-3	-	-	31	32	-	-	-	-	-	-
4F-4	-	-	-	-	34	36	-	-	-	-
4F-5	-	-	-	-	-	-	17	19	-	-
Refined Preferred 4F-3	-	-	-	-	-	-	-	-	30	32
4G-2	36	25	36	25	36	25	36	25	-	-
Refined Preferred 4G-2	-	-	-	-	-	-	-	-	26	25
4H-1	55	81	-	-	-	-	-	-	-	-
4H-2	-	-	63	72	-	-	63	72	-	-
4H-3	-	-	-	-	53	70	-	-	-	-
Refined Preferred 4H-2	-	-	-	-	-	-	-	-	61	73
Total	**150**	**170**	**163**	**165**	**156**	**165**	**147**	**151**	**152**	**165**

Note: Alignments that contain the symbol "-" for an Alternative indicates that alignment is not part of that specific Alternative.

Table 16 contains a summary of the impacted receiver types located in each of the Alternatives.

Table 16: Comparison of Noise Level Impacts for Alternatives											
Receiver Type	2030 Noise Level Impacts										
	No-Build Condition	Alternatives									
		1		2		3		4		Refined Preferred Alt 2	
		Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria
Residences	2	143	164	158	161	151	160	142	147	147	160
Churches	0	0	0	0	0	0	0	0	0	0	0
Cemeteries	0	5	5	4	4	4	5	4	4	4	4
Schools	0	0	0	0	0	0	0	0	0	0	0
Parks	0	0	0	0	0	0	0	0	0	0	0
Historic Sites	0	0	0	0	0	0	0	0	0	0	0
Nat'l. Historic Landmarks	0	0	0	0	0	0	0	0	0	0	0
Commercial	0	2	1	1	0	1	0	1	0	1	1
Industrial	0	0	0	0	0	0	0	0	0	0	0
Total	**2**	**150**	**170**	**163**	**165**	**156**	**165**	**147**	**151**	**152**	**165**

Table 17 contains a summary of the impacted receivers that have predicted noise levels that are expected to exceed the NAC and are expected to have both NAC and substantial increase impacts.

Table 17: Summary of NAC and NAC & Substantial Increase Impacts for Alternatives											
Receiver ID	2030 Predicted Noise Levels (dBA)										
	Subsection	Alternatives									
		1		2		3		4		Refined Preferred Alt 2	
		Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria
R-4	Subsection A	-	66.6	-	66.6	-	-	-	66.6	-	66.6
R-41	Subsection E	-	67.6	-	67.6	-	67.6	-	67.6	-	67.6
R-42	Subsection E	-	67.2	-	67.2	-	67.2	-	67.2	-	67.2
R-43	Subsection E	-	66.5	-	66.5	-	66.5	-	66.5	-	66.6
R-59	Subsection E	66.4	-	66.4	-	66.4	-	66.4	-	66.6	-

Table 17: Summary of NAC and NAC & Substantial Increase Impacts for Alternatives											
Receiver ID	Subsection	2030 Predicted Noise Levels (dBA)									
		Alternatives									
		1		2		3		4		Refined Preferred Alt 2	
		Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria
R-60	Subsection E	66.5	-	66.5	-	66.5	-	66.5	-	66.6	-
R-111	Subsection F	-	-	-	-	-	-	-	-	-	-
R-125	Subsection F	-	-	67.6	-	67.8	-	-	-	67.7	67.7
R-210	Subsection F	-	-	-	66.1	-	-	-	-	66.1	-
R-186	Subsection G	67.9	66.1	67.9	66.1	67.9	66.1	67.9	66.1	68.3	68.2
R-189A	Subsection G	68.1	67.9	68.1	67.9	68.1	67.9	68.1	67.9	68.4	68.4
R-308	Subsection H	-	-	67.5	-	67.4	-	67.5	-	67.8	-
R-315	Subsection H	**-**	**-**	-	66.5	-	66.6	-	66.5	**-**	**67.3**
R-316	Subsection H	**-**	**-**	66.7	67.5	66.5	67.5	66.7	67.5	67.1	68.2
R-317	Subsection H	**-**	**-**	69.0	67.3	68.7	67.0	69.0	67.3	69.2	67.0
R-328 (M-60)	Subsection H	**-**	**-**	-	66.3	-	67.0	-	66.3	**-**	**66.9**
R-349	Subsection H	-	-	-	-	-	-	-	-	--	66.0
R-387	Subsection H	66.2	66.8	-	-	-	-	-	-	-	-
R-390 (M-59)	Subsection H	68.1	-	-	-	-	-	-	-	-	-
R-392 (M-42)	Subsection H	-	67.1	-	-	-	-	-	-	-	-
R-399	Subsection H	-	66.4	-	-	-	-	-	-	-	-
M-18	Subsection E	-	68.3	-	68.3	-	68.3	-	68.3	-	-
M-40	Subsection H	66.4	67.1	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
R-456	Subsection G	66.4	66.4	**66.4**	**66.4**	**66.4**	**66.4**	**66.4**	**66.4**	**66.4**	**66.7**
Total NAC Impacts		8	12	9	13	9	11	8	12	10	13

Alternative 1

This Alternative will result in 170 (150) noise impacts. Of these, 158 (142) are substantial increase impacts, 1 (0) is a NAC impact, and 11 (8) are both NAC and substantial increase impacts. An evaluation of the substantial increase impacts indicate that 118 (103) receivers will experience a substantial increase between 15 and 20 dBA, 39 (38) between 20 and 25 dBA, and 12 (9) with impacts 25 dBA or greater. Since none of these impacted receivers exceed the NAC by 15 dBA or more, they are not considered to be severely impacted.

Alternative 2

This Alternative will result in 165 (163) traffic noise impacts. Of these, 152 (154) are substantial increase impacts only and 13 (9) are both NAC and substantial increase impacts. An evaluation of the substantial increase impacts indicate that 91 (97) of the impacts will experience a substantial increases between 15 and 20 dBA, 59 (52) of the impacts have substantial increases between 20 and 25 dBA, and 15 (14) of the impacts have substantial increases of 25 dBA or greater. Since none of these impacted receivers exceed the NAC by 15 dBA or more, they are not considered to be severely impacted.

Alternative 3

This Alternative will result in 165 (156) traffic noise impacts. Of these, 154 (147) are substantial increase impacts only and 11 (9) are both NAC and substantial increase impacts. An evaluation of the substantial increase impacts indicate that 86 (93) of the impacts will experience a substantial increases between 15 and 20 dBA, 64 (49) of the impacts have substantial increases between 20 and 25 dBA, and 15 (14) of the impacts have substantial increases of 25 dBA or greater. Since none of these impacted receivers exceed the NAC by 15 dBA or more, they are not considered to be severely impacted.

Alternative 4

This Alternative will result in 151 (147) traffic noise impacts. Of these, 139 (139) are substantial increase impacts only and 12 (8) are considered both NAC and substantial increase impacts. An evaluation of the substantial increase impacts indicate that 78 (85) of the impacts will experience a substantial increases between 15 and 20 dBA, 58 (48) of the impacts have substantial increases between 20 and 25 dBA, and 15 (14) of the impacts have substantial increases of 25 dBA or greater. Since none of the impacted receivers exceed the NAC by 15 dBA or more, they are not considered to be severely impacted.

Refined Preferred Alternative 2 (INDOT Noise Policy, 2007)

The Refined Preferred Alternative 2 evaluated using the INDOT Noise Policy 2007 will result in 165 (152) traffic noise impacts. Of these, 152 (142) are substantial increase impacts only, 1 (0) is a NAC impact only and 12 (10) are both NAC and substantial increase impacts. An evaluation of the substantial increase impacts indicate that 93 (88) of the impacts will experience a substantial increases between 15 and 20 dBA, 56 (50) of the impacts have substantial increases between 20 and 25 dBA, and 15 (14) of the impacts have substantial increases of 25 dBA or greater. Since none of these impacted receivers exceed the NAC by 15 dBA or more, they are not considered to be severely impacted.

8.0 NOISE ABATEMENT EVALUATION

8.1 INDOT Noise Abatement Policy

The INDOT Noise Policy states that when traffic noise impacts have been predicted to occur, reasonable and feasible measures that will abate the traffic noise impacts must be considered. INDOT has defined “feasible” to mean that a barrier can be constructed by using standard engineering practices to produce a substantial noise reduction. A substantial noise reduction has been defined as a reduction in noise levels for impacted first row receivers by at least 7 dBA

in the design year. INDOT is aware that conflicts with adjacent property uses may result in lower levels of protection for some of the receivers. As a result, for INDOT to consider noise abatement to be feasible, a majority (50% +1) of the first row receivers must experience at least a 7 dBA reduction in the design year.

"Reasonable" is defined as an INDOT determination that abatement of traffic noise impacts is prudent considering the following criteria:

- ***Cost Effectiveness***: The cost of abatement shall be evaluated on a benefited receiver basis. Benefited receivers are those for whom mitigation will benefit by at least 5 dBA Leq (h) at the noisiest hour condition. INDOT has set the acceptable cost per benefited receiver at $25,000 or less. In addition, the INDOT Noise Policy gives additional consideration to development in which a majority (50% +1) of the receivers was in place prior to the construction of the highway. The cost-effectiveness criteria to be used for these cases are $30,000. This cost per benefited receiver should be arrived at by calculating the square footage of the proposed noise barrier and then multiplying by a square footage cost provided by INDOT and then dividing by the total number of benefited receivers. The current INDOT barrier cost is $30 per square foot.

  Severe noise impacts, predicted noise levels exceeding the NAC by greater than 15 dBA, may warrant special consideration beyond what would normally be considered.

  - ***Views of Impacted/Benefited Receivers*:** The views of potentially affected property owners will be surveyed to determine if the noise abatement is wanted. For a barrier to be considered reasonable, a majority (50% +1) of the total impacted and/or benefited receivers must indicate that they want the barrier constructed. If a majority (50% +1) of the residents surveyed does not respond, then INDOT will base their decision on the responses received. Residents and businesses that qualify for noise abatement (i.e., cost effective) will be given the opportunity to express their opinion and may elect to decline such mitigation if they believe the positive benefits outweigh the potential negative impacts of noise barriers (i.e., unsightliness, shortened daylight, poor air circulation, degradation by weather, reduced safety, vandalism, and restriction of access for emergency vehicles.

8.2 Abatement Measures Evaluation

According to the INDOT Noise Policy, noise abatement must be considered for the receiver locations that were identified in the Alternatives (2030) scenario with predicted noise levels that exceeded the NAC. General noise abatement methods considered include the following:

- **Traffic Control Measures (TCM):** Traffic control measures, such as speed limit restrictions, truck traffic restrictions, and other traffic control measures were not considered for the reduction of noise emission levels. Measures such as installation of additional traffic control devices, prohibition of vehicle types, time-use restrictions, speed limit reductions, and exclusive lane designations would be adversely detrimental to the proposed project's ability to function as a freeway and major north-south route.

- **Alteration of Horizontal and Vertical Alignments:** The final design of the preferred alternative may include shifting the alternative both vertically and horizontally, wherever feasible, to minimize impacts to adjacent land uses. Both vertical and horizontal

alignments may be altered to minimize noise impacts where other factors are not prohibitive.

- **Acquisition of Buffering Land:** The purchase of property and/or buildings for noise barrier construction or the creation of a "buffer zone" to reduce noise impacts was considered. The amount of property required for this option to be effective would create significant additional impacts (*e.g.*, in terms of residential displacements), which were determined to outweigh the benefits of land acquisition.

- **Insulation:** This noise abatement measure option applies only to public and institutional use buildings. Since no public use or institutional structures are anticipated to have interior noise levels exceeding FHWA's interior NAC, this noise abatement option will not be applied.

- **Coordination Among Local Planning Authorities:** Since a portion of the proposed project would be located on a new roadway, the potential does exist for local officials and developers to help minimize adverse noise impacts through the use of careful land use planning. With regard to currently undeveloped land, the creation of a "buffer zone" or locating noise sensitive developments a reasonable distance away from the project would help minimize future noise impacts. Included in the FEIS is a commitment to provide local planning authorities an approximate 66 dBA noise contour map capable of being used to develop noise compatible land uses along or in the immediate vicinity of I-69. The approximate 66 dBA contour was generated using TNM 2.5 and modeling the proposed alignment for the Refined Preferred Alternative 2 using the initial design criteria, **FEIS Appendix II**. Copies of this EIS will be provided to Greene and Monroe county officials for use in noise-sensitive land use planning.

- **Construction of Noise Barriers:** Construction of noise barriers can be an effective way to reduce noise levels at areas of outdoor activity. Noise barriers can be wall structures, earthen berms, or a combination of the two. The effectiveness of a noise barrier depends on the distance and elevation difference between roadway and receptor and the available placement location for a barrier. Gaps between overlapping noise barriers also decrease the effectiveness of the barrier, as opposed to a single connected barrier. The barrier's ability to attenuate noise decreases as the gap width increases. Locations and details of all evaluated barriers are depicted in **Figure 7 (Appendix A.)**

8.3 Noise Barrier Evaluation

Using INDOT's *Highway Traffic Noise Policy*, receivers that were categorized as having design year (2030) traffic noise impacts for the Section 4 Alternatives were assessed to determine if the construction of noise barriers would be a feasible and reasonable form of noise abatement. As part of the barrier analysis, the location of the impacted receivers along with the topographic conditions and surrounding land uses were taken into consideration. Based on this evaluation, it was determined that a majority of the impacted receivers were located in sparsely populated areas. Although a noise barrier may be feasible for these sites, it would not likely be reasonable because any acoustically effective noise barrier would fail to meet the cost-effectiveness criterion. However, there were several locations where there was a grouping of impacted receivers where such noise barrier mitigation could be possible. In those locations, a barrier analysis was performed to determine if the construction of a noise barrier was a feasible and reasonable form of noise mitigation.

Collectively, noise barrier analysis was conducted at seven locations for the alternatives. The areas where barrier analyses were performed are depicted in **Figure 7**. Barrier Area E-1 involves impacted receivers along Pine Road off of Old Clifty Road. Barrier Area F-1 involves impacted receivers along Carter Road. Barrier Area F-3 involves impacted receivers along CR350. Barrier Area G-1 involves impacted receivers at Fern Hills Club and east of Rockport Road. Barrier Area G-2 involves impacted receivers off of Evans Lane. Barrier Area H-1 involves impacted receivers at Farmers Field Subdivision. Barrier Area H-2 involves impacted receivers at Rolling Glen Subdivision. Copies of the TNM output tables for the Barrier Analysis for Alternatives 1 through 4 using the initial design criteria are included in **Appendix K** and the TNM output tables for the Barrier Analysis for Alternatives 1 through 4 using the low-cost design criteria are included in **Appendix L**. Copies of the TNM output tables for the Barrier Analysis for the Refined Preferred Alternative 2 using the initial design criteria are included in **Appendix O** and the Barrier Analysis TNM Output tables for the Refined Preferred Alternative 2 using the low-cost design criteria are included in **Appendix P**.

Alternative 1

The results of the barrier analysis per the initial design criteria and the low-cost design criteria are shown in **Table 18**. Five of the six evaluated noise barrier walls (Barrier Areas E-1, F-3, G-1, H-1 and H-2) meet INDOT's criterion for "feasibility" for both sets of design criteria. Barrier Area G-2 does not meet the feasibility criteria for either the low-cost design criteria of the initial design criteria because a 7 dBA reduction was unable to be achieved at 50% +1 of the first row receivers using a maximum barrier height of 20 feet.

The cost per benefited receiver for Barrier Area H-2 was $35,224 ($35,794) and is above INDOT's cost per benefited criterion of $30,000 for both design criteria, but only exceeds the criteria by approximately $5,000 per benefitted receiver. If final design information results in a significant change in the preliminary design information that was used in the barrier analysis, then the noise barriers shall be re-evaluated. The cost per benefitted receiver for the other four barriers that do not meet the cost-effectiveness "reasonable" criteria, range from $94,782 to $225,939 for the low-cost design criteria and $92,977 to $190,114 for the initial design criteria. None one of these evaluated barriers were close to meeting INDOT's cost per benefitted receiver criteria.

Alternative 2

The results of the barrier analysis per the initial design criteria and the low-cost design criteria are shown in **Table 19**. Six of the seven evaluated noise barrier walls (Barrier Areas E-1, F-1, F-3, G-1, H-1 and H-2) meet INDOT's criterion for "feasibility" for both sets of design criteria. Barrier Area G-2 does not meet the feasibility criteria for either the low-cost design criteria or the initial design criteria because a 7 dBA reduction was unable to be achieved at 50% +1 of the first row receivers using a maximum barrier height of 20 feet.

The cost per benefitted receiver for Noise Barrier H-2 was $36,058 ($45,764) and is above INDOT's cost per benefited criterion of $30,000 for both design criteria. If final design information results in a significant change in the preliminary design information that was used in the barrier analysis, then the noise barriers shall be re-evaluated. The cost per benefitted receiver for the other five barriers that do not meet the cost effectiveness "reasonable" criteria, range from $74,555 to $230,529 for the low cost design criteria and $79,571 to $342,057 for the initial design criteria. None of these evaluated barriers were close to meeting INDOT's cost per benefitted receiver criteria.

Alternative 3

The results of the barrier analysis per the initial design criteria and the low-cost design criteria are shown in **Table 20**. Six of the evaluated noise barrier walls (Barrier Areas E-1, F-3, G-1, G-2, H-1 and H-2) were analyzed using the initial design criteria and seven evaluated noise barrier walls (Barrier Areas E-1, F-1, F-3, G-1, G-2, H-1 and H-2) were analyzed using the low-cost design criteria. Barrier Area G-2 does not meet the feasibility criteria for either the low cost design criteria or the initial design criteria because a 7 dBA reduction was unable to be achieved at 50% +1 of the first row receivers using a maximum barrier height of 20 feet.

The cost per benefitted receiver for the other five (initial design criteria) to six (low cost design criteria) barriers that do not meet the cost effectiveness "reasonable" criteria, range from $47,317 to $253,815 for the low-cost design criteria and $41,904 to $182,273 for the initial design criteria. None of these evaluated barriers were close to meeting INDOT's cost per benefitted receiver criteria.

Alternative 4

The results of the barrier analysis per the initial design criteria and the low-cost design criteria are shown in **Table 21**. Five of the six evaluated noise barrier walls (Barrier Areas E-1, F-3, G-1, H-1 and H-2) meet INDOT's criterion for "feasibility" for both sets of design criteria. Barrier Area G-2 does not meet the feasibility criteria for either the low-cost design criteria or the initial design criteria because a 7 dBA reduction was unable to be achieved at 50% +1 of the first row receivers using a maximum barrier height of 20 feet.

The cost per benefitted receiver for Barrier Area H-2 was $36,058 ($45,764) and is above INDOT's cost per benefited criterion of $30,000 for both design criteria. If final design information results in a significant change in the preliminary design information that was used in the barrier analysis, then the noise barriers shall be re-evaluated. The cost per benefitted receiver for the other barriers that do not meet the cost effectiveness "reasonable" criteria, range from $86,527 to $245,232 for the low cost design criteria and $120,782 to $182,273 for the initial design criteria. None of these evaluated barriers were close to meeting INDOT's cost per benefitted receiver criteria.

Refined Preferred Alternative 2 (INDOT Noise Policy, 2007)

The results of the barrier analysis per the initial design criteria and the low-cost design criteria for the Refined Preferred Alternative using the INDOT Noise Policy, 2007 are shown in **Table 22**. Six of the seven evaluated noise barrier walls (Barrier Areas E-1, F-1, F-3, G-1, H-1 and H-2) meet INDOT's criterion for "feasibility" for both sets of design criteria. Barrier Area G-2 was not evaluated since the receivers located in this area are being acquired as part of this design alternative using both initial and the low-cost design criteria.

The cost per benefited receiver for Barrier Area H-2 was $34,590 ($43,105) and is above INDOT's cost per benefited criterion of $30,000 for both design criteria. If final design information results in a significant change in the preliminary design information that was used in the barrier analysis, then the noise barriers shall be re-evaluated. The cost per benefitted receiver for the other five barriers that do not meet the cost effectiveness "reasonable" criteria, range from $62,649 to $307,666 for the low cost design criteria and $93,270 to $273,329 for the initial design criteria. None of these evaluated barriers were close to meeting INDOT's cost per benefitted receiver criteria.

Table 18: Alternative 1 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)		Average Height (feet)		No. of Impacted Receivers		Impacts Benefitted		Additional Benefits		No. of Benefited Receivers		Feasibility Criteria Met?		Cost of Barrier ($30/sq ft)		Cost per Benefited Receiver	
	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria
E-1	5682	6053	17	16	15	16	11	14	2	2	13	16	Yes	Yes	$2,937,207	$2,916,378	$225,939	$182,273
F-3	1228	1932	18	19	9	9	6	5	1	1	7	6	Yes	Yes	$663,477	$1,140,687	$94,782	$190,114
G-1	3202	2602	12	12	8	8	6	5	4	3	10	8	Yes	Yes	$1,159,242	$966,259	$115,924	$120,782
G-2	-	-	-	-	7	6	0	0	0	0	0	0	No	No	-	-	-	-
H-1	3377	2732	13.5	13	16	24	10	12	2	0	12	12	Yes	Yes	$1,492,243	$1,115,719	$124,354	$92,977
H-2	3577	3141	15	17	27	46	22	40	25	7	47	47	Yes	Yes	$1,682,329	$1,655,515	$35,794	$35,224

Table 19: Alternative 2 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)		Average Height (feet)		No. of Impacted Receivers		Impacts Benefitted		Additional Benefits		No. of Benefited Receivers		Feasibility Criteria Met?		Cost of Barrier ($30/sq ft)		Cost per Benefited Receiver	
	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria
E-1	5682	6053	17	16	15	16	11	14	2	2	13	16	Yes	Yes	$2,937,207	$2,916,378	$225,939	$182,273
F-1	3768	4438	15	14	5	4	5	4	2	2	7	6	Yes	Yes	$1,613,707	$2,052,341	$230,529	$342,057
F-3	1233	1129	18	19	11	11	8	7	1	1	9	8	Yes	Yes	$671,000	$636,572	$74,555	$79,571
G-1	3202	2602	12	12	8	8	6	5	4	3	10	8	Yes	Yes	$1,159,242	$966,259	$115,924	$120,782
G-2	-	-	-	-	7	6	0	0	0	0	0	0	No	No	-	-	-	-
H-1	3543	3805	16.5	14	3	12	3	10	15	5	18	15	Yes	Yes	$1,826,188	$1,935,623	$101,455	$129,042
H-2	4104	4000	17	14	51	53	42	46	2	1	44	47	Yes	Yes	$2,013,621	$1,694,714	$45,764	$36,058

Table 20: Alternative 3 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)		Average Height (feet)		No. of Impacted Receivers		Impacts Benefitted		Additional Benefits		No. of Benefited Receivers		Feasibility Criteria Met?		Cost of Barrier ($30/sq ft)		Cost per Benefited Receiver	
	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria
E-1	5682	6053	17	16	15	16	11	14	2	2	13	16	Yes	Yes	$2,937,207	$2,916,378	$225,939	$182,273
F-1	3511	*	16.5	*	4	*	4	*	3	*	7	*	Yes	*	$1,716,624	*	$245,232	*
F-3	1130	1124	18	18	11	11	8	7	1	1	9	8	Yes	Yes	$523,678	$557,727	$58,186	$69,716
G-1	3202	2602	12	12	8	8	6	5	4	3	10	8	Yes	Yes	$1,159,242	$966,259	$115,924	$120,782
G-2	-	-	-	-	7	6	0	0	0	0	0	0	No	No	-	-	-	-
H-1	3656	3876	15.5	16.5	3	10	3	9	22	13	25	22	Yes	Yes	$1,808,429	$2,072,149	$72,337	$94,189
H-2	4103	4592	18	14	43	52	38	45	10	1	48	46	Yes	Yes	$2,271,203	$1,927,600	$47,317	$41,904

** This barrier was not modeled based on that there were no noise impacts that warranted abatement*

Table 21: Alternative 4 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)		Average Height (feet)		No. of Impacted Receivers		Impacts Benefitted		Additional Benefits		No. of Benefited Receivers		Feasibility Criteria Met?		Cost of Barrier ($30/sq ft)		Cost per Benefited Receiver	
	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria
E-1	5682	6053	17	16	15	16	11	14	2	2	13	16	Yes	Yes	$2,937,207	$2,916,378	$225,939	$182,273
F-3	1328	2034	17	18	9	9	7	7	1	1	8	8	Yes	Yes	$692,216	$1,122,680	$86,527	$140,335
G-1	3202	2602	12	12	8	8	6	5	4	3	10	8	Yes	Yes	$1,159,242	$966,259	$115,924	$120,782
G-2	-	-	-	-	7	6	0	0	0	0	0	0	No	No	-	-	-	-
H-1	3543	3805	16.5	14	3	12	3	10	15	5	18	15	Yes	Yes	$1,826,188	$1,935,623	$101,455	$129,042
H-2	4104	4000	17	14	51	53	42	46	2	1	44	47	Yes	Yes	$2,013,621	$1,694,714	$45,764	$36,058

Table 22: Refined Preferred Alternative 2 Noise Barrier Abatement Analysis (INDOT Noise Policy, 2007)

Proposed Barrier Location	Total Barrier Length (feet)		Average Height (feet)		No. of Impacted Receivers		Impacts Benefitted		Additional Benefits		No. of Benefited Receivers		Feasibility Criteria Met?		Cost of Barrier ($30/sq ft)		Cost per Benefited Receiver	
	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria	Low Cost Design Criteria	Initial Design Criteria
E-1	3287	5386	18	16	15	16	10	13	3	2	13	15	Yes	Yes	$1,821,897	$2,685,982	$140,146	$179,065
F-1	3490	3839	16	13.5	6	5	6	5	1	1	7	6	Yes	Yes	$1,643,088	$1,639,974	$234,726	$273,329
F-3	1021	1634	18	17	11	11	8	8	1	1	9	9	Yes	Yes	$563,842	$839,433	$62,649	$93,270
G-1	2001	2100	14	14	8	8	4	4	4	4	8	8	Yes	Yes	$876,282	$888,048	$109,535	$111,006
G-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H-1	3404	3819	17	16.5	3	10	1	9	5	6	6	15	Yes	Yes	$1,845,996	$1,912,875	$307,666	$127,525
H-2	3896	3800	17	14	51	51	46	46	1	1	47	47	Yes	Yes	$2,025,948	$1,625,745	$43,105	$34,590

- Barrier G-2 was not modeled since the receivers located in this area are being acquired.

9.0 CONSTRUCTION NOISE

Construction of the proposed project will result in a temporary increase in the ambient noise level in the vicinity of the roadway. Equipment associated with construction generally includes backhoes, graders, pavers, concrete trucks, compressors, and other miscellaneous heavy equipment. Construction noise on this project should be controlled by measures including but not limited to the following:

- The construction contract specifications should require that the contractor adhere with all Federal, state, and local noise abatement and control requirements.
- Construction activity in the vicinity of residences should be limited to the hours between 7:00 am and 7:00 pm or as specified by local requirements.
- A responsive communication process should be established with local residents. A telephone number should be posted at the construction site for inquiries concerning project activity.
- Equipment such as generators, which may be used during the nighttime hours, should be enclosed.
- Construction equipment should be in good repair and fitted with “manufacturer recommended” mufflers.
- Consideration will be made to provide reasonable and feasible noise abatement early in construction for the added benefit of mitigating construction noise.

10.0 NOISE COMPATIBLE PLANNING

Through advance planning and shared responsibility, local governments and developers, working cooperatively with Federal and State governments, can plan, design, and construct new development projects and roadways that minimize the adverse effects of noise from highway traffic. Noise-compatible land-use planning encourages the location of less noise-sensitive land uses near highways, promotes the use of open space separating roads from developments, and may even suggest special construction techniques that could possibly minimize the impact of noise from highway traffic. While there is no NAC set up for undeveloped lands (Category D,) as described in **Table 1**, INDOT noise policy (February, 2007) requires noise contours to be developed for undeveloped lands and provided to local governments and planning agencies so that future land-use planning efforts can be performed in such a way that noise-sensitive land uses are either prohibited from being located adjacent to a highway, or that the developments are planned, designed, and constructed in such a way that noise impacts are minimized.

The undeveloped lands located along the proposed alignment for the Refined Preferred Alternative 2 based on the initial design criteria were modeled using TNM 2.5 to generate an approximate 66 dBA contour line in these areas. In order to generate predicted sound levels in the undeveloped areas, receivers were placed approximately every 50 feet perpendicular to the proposed alignment out to a distance of approximately 300 feet from the proposed edge of pavement approximately every 500 feet along the proposed alignment and also in areas where a change in topography occurred, such as the tops of ridges and bottoms of valleys. Based on the initial results, a loosely spaced secondary grid was created in the areas that were identified where the noise levels were predicted to approach or exceed 66 dBA in order to more accurately identify the location of the 66 dBA contours. Additional receivers were also added to the noise models at distances greater than 300 feet in areas where the setback distance from the proposed roadway had not been defined. Additional modeling was also performed in the

areas where the location of the 66 dBA contour appeared to be affected by the changes in the surrounding topography.

Due to the existing topography and the geometry of the I-69 alignment, the contours are often unpredictable to locate and very complex in nature. In some instances, the 66 dBA noise contour does not touch the proposed right-of-way limits due to the relationship between the elevation of the roadway, the fill/cut slopes and the existing topography and often the contours are very irregular in shape**.** In order to present the noise contour information in a useable clear format that could be readily useable by the land-use planning agencies, the area under the 66 dBA contours and the gap areas were combined and called, "Areas of Potential Noise Levels of 66 dBA or Greater." The location of the approximate 66 dBA noise contour and the Areas of Potential Noise Levels of 66dBA or Greater are depicted in **Figure 8 (Appendix A).** The 66 dBA noise contours and the Areas of Potential Noise Levels of 66 dBA or Greater are only shown where they extend past the proposed right-of-way limits.

11.0 SUMMARY

A Noise Analysis was performed for the Section 4 Alternatives to determine the traffic noise impacts per the initial design criteria and the low-cost design criteria. For the purpose of the following discussions, traffic noise impacts associated with the initial design criteria are discussed first and then followed by the traffic noise impacts for the low-cost design criteria in parentheses.

Forty-four existing noise level measurements were recorded within Section 4 of the I-69 project. Only one of the ambient levels approached the NAC of 67 dBA and is the only existing condition traffic noise impact that was identified. An evaluation of the Future No-Build scenario resulted in the identification of two NAC impacts.

The predicted noise levels for the year 2030 Alternatives ranged from 41.8 dBA L_{eq} to 68.4 dBA L_{eq}. (41.5 dBA L_{eq} to 69.2 dBA L_{eq}). These predicted noise levels represent a difference from existing noise levels ranging from -11.9 dBA L_{eq} to +28.7 dBA L_{eq} (-12.9 dBA L_{eq} to +29.9 dBA L_{eq}). The decrease in predicted noise levels when compared to existing noise levels is attributed to a decrease of traffic volumes on the local roads and the ambient component not being calculated by the TNM.

Alternative 1: This Alternative will result in 170 (150) noise impacts. Of these, 158 (142) are substantial increase impacts, 1 (0) is a NAC impact, and 11 (8) are both NAC and substantial increase impacts. An abatement analysis utilizing both the initial design criteria and the low-cost design criteria resulted in five barriers meeting INDOT's criterion for "feasibility" for both sets of design criteria. However, none of the five barriers meet INDOT's "reasonable" criteria for cost-effectiveness.

Alternative 2: This Alternative will result in 165 (163) traffic noise impacts. Of these, 152 (154) are substantial increase impacts only and 13 (9) are both NAC and substantial increase impacts. An abatement analysis utilizing both the initial design criteria and the low-cost design criteria resulted in six barriers meeting INDOT's criterion for "feasibility" for both sets of design criteria. However, none of the five barriers meet INDOT's "reasonable" criteria for cost-effectiveness.

Alternative 3: This Alternative will result in 165 (156) traffic noise impacts. Of these, 152 (147) are substantial increase impacts only and 11 (9) are both NAC and substantial increase impacts. An abatement analysis utilizing both the initial design criteria and the low-cost design criteria resulted in six barriers meeting INDOT's criterion for "feasibility" for both sets of design criteria. However, none of the five barriers meet INDOT's "reasonable" criteria for cost-effectiveness.

Alternative 4: This Alternative will result in 151 (147) traffic noise impacts. Of these, 139 (139) are substantial increase impacts only and 12 (8) are considered both NAC and substantial increase impacts. An abatement analysis utilizing both the initial design criteria and the low-cost design criteria resulted in five barriers meeting INDOT's criterion for "feasibility" for both sets of design criteria. However, none of the five barriers meet INDOT's "reasonable" criteria for cost-effectiveness.

Refined Preferred Alternative 2

The Refined Preferred Alternative 2, evaluated using the INDOT *Traffic Noise Policy, dated 2007* is predicted to result in 165 (152) traffic noise impacts. Of these, 152 (142) are substantial increase impacts only, 1 (0) is a NAC impact only and 12 (10) are both NAC and substantial increase impacts. An abatement analysis utilizing both the initial design criteria and the low-cost design criteria resulted in six barriers meeting INDOT's criterion for "feasibility" for both sets of design criteria. However, none of the five barriers meet INDOT's "reasonable" criteria for cost-effectiveness.

Refer to **Appendix Q** to find the discussion of the predicted noise impacts and the results of the impact analysis for the Refined Preferred Alternative 2 based on the INDOT *Traffic Noise Policy, dated 2011*.

12.0 REFERENCES

Environmental Protection Agency Publication EPAPB 206717, December 1971, *Noise from Construction Equipment and Operations.*

Federal Highway Program Manual, Volume 7, Section 3, August 9, 1982.

23 CFR Part 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, August 11, 1997.

FHWA Policy Memorandum *Highway Traffic Noise Analysis and Abatement - Policy and Guidance*, June 12, 1995.

Indiana Department of Transportation Highway Traffic Noise Policy, February, 2007.

Indiana Department of Transportation Traffic Noise Analysis Procedure,2011