APPENDIX W
FINAL NOISE TECHNICAL REPORT

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I-69 CORRIDOR TIER 2 STUDIES
Evansville to Indianapolis
Final Noise Technical Report
Section 5, SR 37 to SR 39 March 22, 2013

Prepared for:

INDIANA DEPARTMENT OF TRANSPORTATION

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1.0 INTRODUCTION

Michael Baker Jr., Inc. (Baker) 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 5, located in Monroe and Morgan Counties.

Section 5 begins at just north of the intersection of SR 37 and Victor Pike, south of Bloomington, and continues northward to just south of the existing interchange of SR 37 and SR 39 in Martinsville. This section of the I-69 project is approximately 21 miles in length and extends through Monroe and Morgan Counties, Indiana, along the alignment of existing SR 37, a multi-lane divided principal arterial highway with partial access control (refer to Figure 1, Appendix A). The majority of the corridor is in Monroe County.

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 Analysis Procedure* 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 Guidance* (June 2010), and the noise related requirements of the *National Environmental Policy Act of 1969.* The INDOT *Traffic Noise Analysis Procedure* received FHWA approval in July 2011.

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 U.S. 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 of 1969* (NEPA) 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 Part 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 traffic noise standards and the description of highway traffic noise prediction requirements, noise analyses, noise abatement criteria, and requirements for informing local officials are found in 23 CFR Part 772. (Procedures for Abatement of Highway Traffic Noise and Construction Noise). Also, FHWA policy requires each state Department of Transportation to adopt a state-specific noise policy, approved by FHWA, which defines specific terms and describes how the state implements the noise standard.

The effective date of the most recent FHWA-approved *INDOT Traffic Noise Analysis Procedure* is July 13, 2011. 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. The structure of the policy focuses on the following principal elements:

1. Identification of Noise-Sensitive Land Uses.
2. Determination of Existing Noise Levels.
3. Prediction of Future Noise Levels.
4. Identification of Traffic Noise Impacts.
5. Identification and Consideration of Abatement.
6. Consideration of Construction Noise.
7. Coordination with Local Government Officials.

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. The A-weighted sound level in decibels is identified as dBA.

Although the dBA 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 receptor'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 receptor to be a doubling, or halving, of the sound level.
- Doubling the distance between a highway and receptor 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 Analysis Procedure* has adopted the noise abatement criteria (NAC) that have been established by FHWA (23 CFR Part 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 (refer to page 4). 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.

3.2 INDOT Definition of Noise Impacts

Traffic noise impacts occur if <u>either</u> of the following two conditions is met:

- The predicted traffic noise levels approach or exceed the NAC, as shown in Table 1. The INDOT *Traffic Noise Analysis Procedure* 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 receptor, 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

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

Table 1
FHWA Noise Abatement Criteria (NAC)
Hourly A-Weighted Sound Levels in Decibels (dBA)

Activity Category	Activity $L_{eq}(h)$	Evaluation Location	Description of Activity Category
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67	Exterior	Residential
C	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A-D or F.
F			Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G			Undeveloped lands that are not permitted.

Source: Federal Highway Administration (23 CFR Part 772)
Note: These sound levels are only to be used to determine impact. These are the absolute levels above which abatement must be considered. Noise abatement is designed to achieve a substantial noise reduction. Noise abatement is not designed to achieve the noise abatement criteria.

4.0 NOISE STUDY METHODOLOGY

4.1 Determination of Existing Noise Levels

Existing noise levels are defined in 23 CFR Part 772 as the 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 Analysis Procedure* Traffic Noise Prediction, the existing noise levels are to be determined by the measurements taken at a time of the day that reflects the worst (noisiest) traffic hour. This period is generally the design hourly volume (DHV).

Since there were 2,327 receptors located within the Section 5 corridor, it was determined that existing measurements would be collected at representative sets of receptors. The representative sets were developed based on an evaluation of the topography, the level of service of the existing local roadway and highways, and the density and proximity of the receptors to the local roadways and highways.

The 31 existing noise level measurement locations and the number of receptors and the land-use activity category description being represented by that location are shown on Figure 2 of Appendix A and described in Table 2. Note: Receptor labels 19, 30 and 33 are not listed. These locations were established early in the noise study planning phase and ultimately were not needed for the assessment. The table was not renumbered to keep the continuity of the other number labels intact.

Table 2: Existing Noise Level Measurement Locations

Site No.	Site Description and Land Use Classification	Time		Noise Meter Reading (L_{eq}, in dBA)
		Start	Stop	
M-1	One-story, vinyl sided / bricked, single-family residential home with attached garage offset to the side of home. Front porch faces SR 37. Residence located approximately 340' off of SR 37 at 3139 Big Sky Road. Site near STA. 1061+00 to WB side of existing SR 37.The site is classified as land use category B, and represents one receptor for validation purposes only.	3:55 PM	4:15 PM	59.5
M-2	Split level, single-family residential home with attached garage. Residence located at 3300 Wood Creek Court in Woodhaven Estates subdivision. Measurement taken in backyard at the base of patio approximately 140' from SR 37. Site near STA. 1124+00 to WB side of existing SR 37. This site is classified as land use category B, and represents one receptor for validation purposes only.	4:31 PM	4:51 PM	59.5
M-3	One-story, single-family residential brick home located at 3131 South Yonkers Street in Van Buren subdivision. Site near STA. 1147+00, approximately 230' to WB side of existing SR 37. This site is classified as land use category B, and represents one receptor for validation purposes only.	5:08 PM	5:28 PM	64.8
M-4	Two-story, vinyl sided (2nd floor) / bricked (1st floor), six unit apartment residence. Part of Oakdale Square Apartment Complex. The six residential units are listed as 1602 – 1610 Oakdale West Drive. Measurement taken at sidewalk entrance location to apartment unit # 1602. Site near STA. 1195+00, approximately 210' to EB side of existing SR-37. This site is classified as land use category B, and represents one receptor for validation purposes only.	7:33 AM	7:53 AM	61.6
M-5	Tennis courts located at the Basswood Apartment Complex. Tennis courts located in open grassy area between apartment units. Site near STA. 1214+00, approximately 380' to EB side of existing SR 37. This site is classified as land use category C, and represents one receptor for validation purposes only.	7:48 AM	8:08 AM	60.3
M-6	Children's basketball court with park bench and surrounding open grassy play area. Recreational area located between 90-degree corner-bend of two apartment building units within the Canterbury House Townhouse Complex. Site near STA. 1249+00, approximately 650' to EB side of existing SR 37. This site is classified as land use category C, and represents one receptor for validation purposes only.	8:17 AM	8:37 AM	51.7
M-7	One-story, vinyl sided, single-family residential home. Residence located at intersection of Evergreen Drive and Kimble Drive in the Kimble Drive Neighborhood. Site near STA. 1292+00, approximately 260' to EB side of existing SR 37. This site is classified as land use category B, and represents one receptor for validation purposes only.	5:40 PM	6:00 PM	58.9
M-8	One-story, vinyl sided, single-family residential home with porch that extends entire front length of home, facing SR 37. Residence located at end of Hickory Lane. Site near STA. 1357+00, approximately 380' to EB side of existing SR 37. This site is classified as land use category B, and represents one receptor for validation purposes only.	6:18 PM	6:38 PM	66.7
M-9	Calvary Baptist Church located at 3501 N. Prow Road. Church is brick building. Measurement taken at playground area on south side of church. Site near STA. 1416+00, approximately 290' to EB side of SR 37. The site is classified as land use category C, and represents one receptor for validation purposes only.	6:48 PM	7:08 PM	57.3
M-10	Northside Christian Church located at 3993 N. Prow Road. Site near STA. 1435+00, approximately 190' to EB side of existing SR 37. Church is brick building. Measurement taken at playground area on north side of church. The site is classified as land use category C, and represents one receptor for validation purposes only.	4:27 PM	4:47 PM	62.1

Table 2: Existing Noise Level Measurement Locations

Site No.	Site Description and Land Use Classification	Time		Noise Meter Reading ($L_{eq,}$ in dBA)
		Start	Stop	
M-11	One-story, bricked, single-family residential home with attached garage. Residence located off of Kinser Pike. Site near STA. 1495+50, approximately 140' to EB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.	3:51 PM	4:11 PM	67.0
M-12	One-story, vinyl-sided, single-family residential home with attached garage. Residence located on Purcell Drive. Site near STA. 1620+50, approximately 80' to EB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.	6:14 PM	6:34 PM	65.5
M-13	One-story, vinyl sided, single-family residential home with elevated wooden deck on backside of house. Residence located on East Sample Road. Site near STA. 1677+00, approximately 480' to EB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.	9:50 AM	10:10 AM	59.2
M-14	One-story, bricked, single-family residential home with attached garage. Residence located at 7809 Wildrose Road. Site near STA. 1705+00, approximately 690' to WB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.	4:34 PM	4:54 PM	54.3
M-15	Simpson Chapel Methodist Church and cemetery located on Williams Road, directly behind the Candle Factory Outlet. No outside activities noted on the Church grounds. Site near STA. 1720+50, approximately 640' to WB side of existing SR 37. The site is classified as land use category C, and represents one receptor for validation purposes only.	7:06 AM	7:26 AM	58.5
M-16	One-story, vinyl-sided, single-family residential home with attached garage on Fox Hollow Road immediately adjacent to south of the United Pentecostal Assembly Worship Center located on Fox Hollow Road. Site near STA. 1749+00, approximately 270' to EB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.	5:09 PM	5:29 PM	64.6
M-17	One-story, wood-sided, single-family residential home with attached garage. Residence located at end of N. Norm Anderson Road, south of utility substation. Site near STA. 1789+50, approximately 210' to WB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes.	6:45 PM	7:05 PM	60.2
M-18	One-story, split-level, vinyl-sided, single-family residential home with detached garage situated beside and to the back corner of the house. Residence located at the intersection of Chambers Pike and SR 37. Site near STA. 1814+00, approximately 200' to EB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.	7:03 AM	7:23 AM	66.9
M-20	Mobile home located off Wyatt Road. Gravel access entrance to residence. Partial (minimal) visual blockage by trees to SR 37 from residence. Site near STA. 1942+50, approximately 200' to WB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.	7:38 AM	7:58 AM	65.1
M-21	One-story, bricked, single-family residential home with attached garage. Residence located at 5185 Turkey Track Road. Site near STA. 1993+00, approximately 310' to WB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.	5:27 PM	5:47 PM	64.6
M-22	Two-story, vinyl-sided, single-family residential home—no garage, only half-circle gravel driveway to the side of the house. Residence located on unnamed road off Paragon Road. Front of residence faces Paragon Road. Site near STA. 2004+50, approximately 120' to WB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.	5:02 PM	5:22 PM	66.9
M-23	One-story, wood-sided, single-family residential home with detached garage. Residence located off SR 37. Partial visual blockage by trees to SR-37 along property line between residence and highway (minimal vegetative barrier) on north side. Measurement taken in playground area by detached garage. Site near STA. 2046+50, approximately 120' to EB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.	6:07 PM	6:27 PM	62.0
M-24	New Testament Baptist Church located on unnamed road that parallels SR 37 highway. Lower half of church building is fieldstone with upper half covered with red-stained veneer wood paneling. Site near STA. 2064+00, approximately 200' to WB side of existing SR 37. The site is classified as land use category C, and represents one receptor for validation purposes only.	7:44 AM	8:04 AM	69.6

Table 2: Existing Noise Level Measurement Locations				
Site No.	**Site Description and Land Use Classification**	**Time**		**Noise Meter Reading ($L_{eq,}$ in dBA)**
		Start	**Stop**	
M-25	Two-story, vinyl-sided, single-family residential home with attached garage—2nd story over garage only. Residence located on Old State Road 37 with back yard facing SR 37. Site near STA. 2080+00, approximately 170' to EB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.	4:24 PM	4:44 PM	62.9
M-26	Hillview Motel located at intersection of Old State Road 37 and SR 37 highway. Site near STA. 2169+00, approximately 100' to EB side of existing SR 37. The site is classified as land use category E, and represents one receptor for validation purposes only.	6:00 PM	6:20 PM	68.1
M-27	One-story, bricked, single-family residential home. Residence in retirement community and located at 925 Plaza Drive. Site near STA. 2255+00, approximately 170' to WB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.	3:45 PM	4:12 PM	62.3
M-28	Bloomington High School (North) softball field. Softball field is situated between actual school building and Prow Road. Site near STA. 1409+00, approximately 760' to EB side of existing SR 37. The site is classified as land use Category C, and represents one receptor for validation purposes only.	8:38 AM	8:58 AM	51.7
M-29	One-story, single-family residential home with front porch. Residence located in the Maple Grove Historic District at 3888 N. Maple Grove Road, at the corner of Acuff Road and Maple Grove Road, approximately 1000' from SR 37. The site is classified as land use Category B, and represents one receptor for validation purposes only.	8:35 AM	8:58 AM	55.8
M-31	Wapehani Mountain Bike Park. Site is at closest point to SR 37 highway. Site near STA. 1179+50, approximately 190' to EB side of existing SR 37. The site is classified as land use Category C (Section 4(f) Resource), and represents one receptor for validation purposes only.	7:22 AM	7:48 AM	57.7
M-32	The Oliver Winery Shop, outdoor garden area. Site near STA. 1731+50, approximately 130' to EB side of existing SR 37. The site is classified as land use Category E, and represents one receptor for validation purposes only.	5:15 PM	5:41 PM	66.3
M-34	Graceway Community Church and cemetery located on Maple Grove Road in the Maple Grove Historic District. Evidence of exterior activities—playground swing set located on the west side of church—use exterior noise level. Cemetery is located on the west side of church building. The site is classified as land use Category C, approximately 8440' feet from SR 37, and represents one receptor for validation purposes only.	9:06 AM	9:26 AM	42.5
NOTE: Measurements were taken during the week of May 21, 2012.				

Measurement of the existing noise levels at the representative sites were collected during the week of May 21st, 2012, using a Norsonics 132 Sound Level Meter. Copies of the Calibration Certificates for the sound level meter, microphone and acoustic calibrator are included in Appendix B. In addition, a table depicting the before and after sound level calibration levels for each site is included in Appendix B. All of the existing noise level measurements were recorded at approximately 4.9 feet above the surface of the ground and at location representing outdoor activities nearest the predominant ambient noise source. The operation of the calibrator was utilized according to manufacturer's specifications and there was no drift in the measurements.

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 that the existing noise level measurements were collected are also included in Appendix B. Ambient measurements were conducted for a period of 20 minutes at each location in accordance with the FHWA Report FHWA-PD-96-46, "Measurement of Highway Related Noise." A summary of the existing noise level measurements used as part of this analysis are included in Table 2 and copies of the Ambient Noise Measurement Logs are included in Appendix C. Note: Receptor labels 19, 30 and 33 are not listed. They were in the previous noise analysis and are not needed for this update analysis. The table was not renumbered to keep the continuity of the other number labels intact.

Traffic data was simultaneously recorded during the noise measurements and classified into five vehicle types (buses, automobiles, medium trucks (two-axles with six wheels), heavy trucks (three or more axles) and motorcycles) for subsequent entry into the TNM 2.5 noise prediction computer model for validation purposes.

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.

The FHWA TNM estimates vehicle noise emissions based on mean (average) noise emission levels for three classes of vehicles used for this analysis: automobiles, medium trucks, and heavy trucks. The TNM computer model has capabilities for additional vehicular classes but only three were provided as part of the updated traffic analysis for the Refined Preferred Alternative 8. Buses were included in the initial analysis for Alternatives 4 through 8, but they accounted for only 0.3 percent (0.003) of the peak period traffic. The predicted noise levels for the Design Year No-Build and Build alternative condition were based on peak hour volumes and vehicular fleet mixes for the year 2035.

Terrain and other roadway features were input in to TNM. These inputs include roadway widths (including inner and outer shoulders) and elevations, receptor elevations, intervening terrain and ground cover (tree zones). In accordance with INDOT's *Traffic Noise Analysis Procedure* all receptors located within 500 feet of the edge of pavement of all reasonable build alternatives were assessed for traffic noise impacts. Additional receptors located at distances up to 600 feet were included in the model as a conservative measure so that potential impacts would not inadvertently be omitted.

Based on all this input data, TNM uses its acoustic algorithms to predict noise levels at receptor locations by taking into account sound propagation variables such as atmospheric absorption, divergence, intervening ground, barriers, building rows, and 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 shows the traffic inputs that were used for the existing TNM runs. Traffic for the Future No Build condition was provided to Baker by INDOT. Appendix D also shows the traffic inputs that were used in the 2035 Future Build and No Build TNM runs.

The 2035 traffic for the Build alternatives and Future No Build alternative were forecasted for this study by a hierarchy of traffic models. Both the Indiana Statewide Travel Demand Model (ISTDM) Version 6.2, and a more detailed I-69 corridor model were used. For the Refined Preferred Alternative 8, a microsimulation traffic volume analysis was performed to refine the then-preferred Alternative 8 from the DEIS. Appendix D in this technical report shows all the traffic volumes used for all the various Alternative analyses. The modeling included the counties through which the approved corridor for I-69 passes, as well as all or part of other nearby counties.

The 2035 P.M. traffic volumes were used in the noise analysis for Build Alternatives 4 through 8 and the associated abatement analysis. These traffic volumes generally resulted in the higher sound levels. For the Refined Preferred Alternative 8, the microsimulation traffic volume analysis AM volumes were used because the truck percentages (and subsequent absolute truck volumes and overall sound levels) were higher. Test runs performed for both the AM and PM Refined Preferred Alternative 8 traffic volumes and fleet mix indicated that the AM volumes were approximately 1 dBA higher than the PM.

For Build Alternatives 4 through 8, a traffic speed of 65 mph was used for cars, medium trucks, heavy trucks, and buses on the proposed I-69. For the ramps, flow control devices were not applied. Posted speeds were maxed out along the entire length of the ramp. All other local roads were modeled using speeds based on posted limits and field observations. For the Refined Preferred Alternative 8, a traffic speed of 65 mph was used for cars, medium trucks and heavy trucks on the rural section of the proposed I-69 north of Kinser Pike and 55 mph was used south of Kinser Pike. For the ramps, flow control devices were applied. All other local roads were modeled using speeds based on posted limits and field observations.

4.2.2 Alignment

The proposed alignments for the six alternatives were developed by Baker. For alignments 4 through 8, these alignments (I- 69) were converted to 3D-DXF files that were then imported into the TNM with elevations already included. For the Refined Preferred Alternative 8, the coordinates were manually adjusted (from Build Alternative 8) so as not to import an entire 21+ mile set of individual lanes, interchanges, ramps and local roads. All other roadways including state routes and local roads were input manually through available existing GIS elevation data. Google mapping elevations were used to supplement the elevations where necessary to model receptors and intervening terrain.

For Build Alternative 4 through 8, directional traffic was modeled for I-69. 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, the I-69 lanes were separately modeled using single lanes, plus the added and overlapping inner and outer paved shoulders.

For the Refined Preferred Alternative 8, directional traffic was modeled for I-69. Cross-streets at interchanges were also modeled by direction. All other 2-lane 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, the I-69 lanes were separately modeled using single lanes, plus the added and overlapping inner and outer paved shoulders.

4.2.3 Receptors

The project study area was divided into 16 Noise Sensitive Areas (NSA's) based on a combination of land use, traffic volumes and density. In accordance with INDOT's *Traffic Noise Analysis Procedure,* all receptors located within 500 feet of the edge of pavement of all reasonable Build alternatives were assessed for traffic noise impacts. Additional receptors located at distances greater than 500 feet from the edge of pavement for the alternatives were included in the model as a conservative measure so that potential impacts would not inadvertently be omitted. A total of 1,034 sites were modeled to represent 2,327 receptors. The location of all the receptors modeled in TNM can be found on Figure 3 of Appendix A. There are 2,159 single and multifamily dwelling units, 9 places of worship, 2 cemeteries, 2 hospitals, a school band practice facility, 3 apartment pools, 2 tennis courts, a bike park, a movie theater, 6 hotels and 50 non-retail commercial businesses (offices, restaurants, banks, etc.). A default height of 4.9 feet above the base ground elevation was used for all receptors. Specific receptor placement in the model is generally based on exterior areas where normal human occupation is expected to occur on the property. The receptor input data is included on a separate CD to be provided to INDOT upon completion of the project analysis.

4.2.4 Tree Zones and Surface Objects

Tree zones were used to represent areas of dense vegetation. Building rows were modeled where applicable. Tree zones and building rows input into the model were selectively chosen to optimize their effectiveness in the model and to minimize the extensive model run times.

4.2.5 Terrain lines

Terrain lines were used extensively in the model to represent the existing topography and intervening terrain features. Terrain lines input into the model were selectively chosen to optimize their effectiveness in the model and to minimize the extensive model run times.

4.2.6 Barriers

Barriers were used in the noise abatement evaluation. A maximum height of 20 feet was used in this analysis as a baseline limit to avoid inordinately tall barriers.

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 receptor 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 six alternatives. Refined Preferred Alternative 8 is the Preferred Alternative for Section 5. Section 5 begins at just north of the intersection of SR 37 and Victor Pike, south of Bloomington, and continues northward to just south of the existing interchange of SR 37 and SR 39 in Martinsville (refer to Figure 1, Appendix A). This section of the I-69 project is approximately 21 miles in length and extends through Monroe and Morgan Counties, Indiana, along the alignment of existing SR 37, a multi-lane divided principal arterial highway with partial access control. The majority of the corridor is in Monroe County.

Section 5 of the I-69 Evansville to Indianapolis corridor traverses a mixture of urban land use primarily in the southern section and suburban/rural land uses in the middle and northern sections. The project lies within a region characterized by gently sloping or moderately sloping terrain. Figures 4 and 5 show the typical sections for the alternatives (refer to Appendix A).

5.2 Existing Roadways

Existing transportation facilities within the Section 5 corridor include SR 37, the primary route that traverses the corridor. There are no interstate highways within the Section 5 corridor.

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 5 Corridor, SR 37 is functionally classified as an Urban Freeway. SR 37 is a four-lane median divided highway with two 12-foot-wide travel lanes in each direction. There are grade separated interchanges with SR 45 (2nd Street/Bloomfield Road), SR 48 (W. 3rd Street), SR 46 (W. Gurley Pike) and Business SR 37 (N. Walnut Street). The other locally named roads that intersect with the existing SR 37 include the following: That Road, Rockport Road, Fullerton Pike, Tapp Road, Whitehall Crossing Boulevard, Vernal Pike, Acuff Road, Kinser Pike, Bottom Road, Connaught Road, Ellis Road, Griffith Cemetery Road, Wylie Road/Showers Road, Purcell Drive/ Stonebelt Drive, Simpson Chapel Road, Lee Paul Road, Fox Hollow Road, South Crossover Road, North Crossover Road/Chambers Pike, Sylvan Lane/Sparks Road, Burma Road, Bryants Creek Road, Turkey Track Road/Cooksey Lane, Paragon Road/Pine Boulevard, Turkey Track Road/Old SR 37, Old SR 37 S, Liberty Church Road/Godsey Road, Legendary Drive, and Old SR 37 E. Left turn lanes exist on SR 37 at most of the at-grade intersections.

5.3 Proposed Alignments

All of the Build alternatives would upgrade the existing SR 37 to interstate standards, by the closing of access points, providing interchanges and overpasses, and adding access roads adjacent to the interstate. The Build alternatives would all begin at the tie-in to Section 4 at the SR 37 interchange, located south of That Road, and extends approximately 21 miles north to the Section 6 tie-in location, at SR 39 in Martinsville, Indiana. As shown in Figures 4 and 5 (refer to Appendix A), the typical sections are similar for Alternatives 4 and 5, and Alternatives 6, 7, 8 and Refined Preferred Alternative 8. Both a rural and an urban typical section are shown for the alternatives. The rural typical section would apply where there are two travel lanes in each direction, and the urban typical section would be representative of areas with more than two travel lanes in each direction. As shown in the typical sections, Alternatives 4 and 5 would have a larger roadway footprint due to the additional travel lanes and wider shoulders, clear zone widths, and wider access roads. While the alternatives would all widen the roadway, the types/locations of interchanges and overpasses vary. For further design information regarding interchanges, please refer to Chapters 3 and 6 of the FEIS.

5.3.1 Alternatives 4 and 5

Alternatives 4 and 5 would upgrade existing SR 37 to two twelve-foot wide travel lanes in each direction separated by an 84-foot wide median from SR 39 south to the Kinser Pike/Walnut Street area, as depicted in the rural typical section. There would be 12-foot wide shoulders to the outside of the travel lanes, and 30- to 35-foot wide clear zones on the outside of the shoulders. Where access roads are present, they would consist of two 12-foot wide travel lanes, with 8-foot wide shoulders and 20-foot clear zones on each side.

From the Kinser Pike/Walnut Street area south to SR 48/3rd Street (where the urban typical section would apply), there would be three 12-foot wide travel lanes in both directions, with traffic being separated by a 60-foot wide median for Alternative 4. Alternative 5 would have three 12-foot wide travel lanes in the southbound direction, and two travel lanes in the northbound direction. Both Alternatives 4 and 5 would have 12-foot wide shoulders to the inside and outside of the mainline and 30- to 35-foot wide clear zones to the outside of the shoulders.

Both Alternatives 4 and 5 would have four 12-foot wide travel lanes in both direction between SR 48/3rd Street and SR 45/2nd Street. Between SR 45/2nd Street and Fullerton Pike, the mainline would have three travel lanes in each direction, and then from Fullerton Pike south to SR 37 there would be four travel lanes in each direction. The 60-foot wide median would still separate the northbound and southbound traffic, and 12-foot wide shoulders to the inside and outside of the mainline with 30- to 35-foot clear zones on the outside of the mainline.

Alternatives 4 and 5 would have new interchanges or utilize the existing interchanges at Fullerton Pike, SR 46, and Sample Road. Alternative 4 would also have interchanges at SR 45/2nd Street, SR 48/3rd Street, Kinser Pike, Sample Road, and Paragon Road/Pine Boulevard. In addition, Alternative 5 would have new interchanges or use existing interchanges at Tapp Road/SR 45/2nd Street, SR 48/3rd Street, N. Walnut Street, and Liberty Church Road. For further information regarding interchange design, refer to Chapter 3 of the FEIS.

Alternative 4 would have overpasses/underpasses at Rockport Road, Tapp Road, Vernal Pike, Arlington Road, N. Walnut Street, Chambers Pike, and Liberty Church Road. For Alternative 5, there would be overpasses/underpasses at Rockport Road, Vernal Pike, Arlington Road, Kinser Pike, Chambers Pike, and Paragon Road/Pine Boulevard.

5.3.2 Alternatives 6, 7 and 8

In the rural areas, Alternatives 6, 7, and 8 would have two 12-foot wide travel lanes in each direction, with the northbound and southbound traffic being separated by a 60-foot wide median. There would be 12-foot wide shoulders to the inside and outside of the mainline, and a 30-foot clear zone to each side. In areas where access roads are present, there would be no clear zones;

rather, there would be a 12-foot wide shoulder only along the mainline, separated from the access road by a barrier. The access road would have two 11-foot wide travel lanes, with 5-foot wide shoulders on each side of the roadway. To the outside of the access road, there would be a 20-foot wide clear zone.

For the urban areas, there would be three travel lanes in each direction. The mainline would have 12-foot wide shoulders on both the inside and outside of the northbound and southbound travel ways. Instead of a grassed median, there would be a barrier separating the northbound and southbound travel ways, effectively reducing the width of the median to 26.5 feet (i.e. two 12-foot wide shoulders and barrier).

From SR 39 south to the Kinser Pike/N. Walnut Street area, the mainline would be similar to the rural typical section, with two 12-foot wide travel lanes in each direction, 60-foot wide median, 12-foot wide inside and outside shoulders, and 30-foot wide outside clear zones. From Kinser Pike/N. Walnut Street south to the terminus at SR 37, the mainline would have three travel lanes in each direction and be consistent with the urban typical section, with the smaller barrier median.

Alternative 6 would construct or make use of existing interchanges at Fullerton Pike, SR 45/2nd Street (W. Bloomfield Road), SR 48/3rd Street, SR 46, Sample Road, and Liberty Church Road. For detailed interchange design information, please refer to Chapter 3 of the FEIS. There would be overpasses/underpasses located at Rockport Road, Tapp Road, Vernal Pike, Arlington Road, N. Walnut Street, and Chambers Pike.

Alternative 7 would construct or utilize existing interchanges at Fullerton Pike, Tapp Road/SR 45/2nd Street (W. Bloomfield Road), SR 48/3rd Street, SR 46, N. Walnut Street, Sample Road, and Liberty Church Road. In addition, Alternative 7 would have overpasses/underpasses at Rockport Road, Vernal Pike, Arlington Road, Kinser Pike, and Turkey Track Road.

Alternative 8 is a combination of design elements from Alternatives 6 and 7. With Alternative 8, interchanges would be located at Fullerton Pike, Tapp Road/SR 45/2nd Street (W. Bloomfield Road), SR 48/3rd Street, SR 46, N. Walnut Street, Sample Road, and Liberty Church Road.

5.3.3 Refined Preferred Alternative 8

After Alternative 8 was identified as the preferred alternative in the DEIS, modifications were made to Alternative 8, resulting in Refined Preferred Alternative 8. These modifications were made to reduce environmental impacts, reflect decisions made by INDOT based upon additional coordination with local public officials, public organizations, and individuals; improve local access; make minor corrections to the project design; additional engineering and environmental analysis; and, reduce project costs. These refinements were made throughout the project corridor. Refined Preferred Alternative 8 uses features of Alternative 8 and Alternative 7, as well as some new revisions to further reduce impacts. Refined Preferred Alternative 8 has the same mainline typical rural and urban configurations as Alternatives 6, 7, and Alternative 8.

Refined Preferred Alternative 8 is essentially the same as Alternative 8, except with the following general alignment modifications:

- West Fullerton Pike: Modified to taper in this area on the west end of Fullerton Pike to tie into the existing Fullerton Pike alignment. This modification would also straighten the curve on West Fullerton Pike and shift it slightly to the north.
- Access to the Hickory Heights Mobile Home Park: This mobile home park currently has access from Tapp Road. Modified to tie into South Danlyn Road to the west of the mobile home park, to provide easier/shorter access between Tapp Road and the mobile home park.
- 2nd Street Interchange: The existing bridge at 2nd Street will remain in place with some modifications to accommodate bicycle/pedestrian traffic across the bridge. The interchange ramps will be reconfigured to combine with the proposed collector-distributor system between 2nd Street and Tapp Road and the split diamond interchange connecting the two.
- 3rd Street Interchange: The existing interchange layout will remain in place with additional capacity added to the exit ramps. The left turn lanes on 3rd Street to the entrance ramps will be extended and the existing bridge will be widened on each side to provide bicycle/pedestrian facilities.
- N. Walnut Street Interchange Selection: The use of the existing partial interchange was approved by FHWA and will be used at this location, consistent with the DEIS Preferred Alternative 8, Option B.
- Eastern Local Access Road Removal: The eastern local access road connecting Walnut Street to Connaught Road was removed due to the low volumes of traffic on the roadway compared to the environmental impacts and costs associated with constructing the roadway.
- Liberty Church Road Interchange Revision: The interchange at Liberty Church Road was shifted north to minimize impacts to floodplains located in the southwest corner of the interchange.

In addition to these major revisions, minor adjustments/refinements were made to the right-of-way along the alignment to minimize impacts to resources, where possible, as well as to address access changes and roadway design revisions and corrections.

5.4 Receptors

The Section 5 Corridor consists of three primary land uses including urban developed land, agriculture, and forested land. The developed areas include residences, a wide array of commercial operations (both retail and non-retail), cemeteries, churches, and hospitals. These developed areas are scattered throughout the corridor with higher concentrations near the City of Bloomington. Displacements are anticipated with each Build alternative.

Receptors located within 500 feet of the edge of pavement of a Build alternative were assessed for potential noise impacts per the INDOT *Traffic Noise Analysis Procedure*. As a conservative measure, and because of the complex and long model re-run times, this distance was increased to 600 feet to fully capture any impacts that might occur outside the 500-foot cordon line. Receptors were also assessed based upon consideration of roadway and receptors elevations and intervening terrain features. There are 16 NSAs to define the various sound level environments in the project area (see Figure 3 for the locations and limits of the NSAs).

5.5 Planned Development

23 CFR §772.9(b)(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 Analysis Procedure*, 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 5, 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 of 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. Subdivisions often include areas dedicated for public roads and utilities in addition to the platted lots. In Monroe County, subdivisions are regulated by a local subdivision ordinance.

6.0 PREDICTED NOISE LEVELS

6.1 TNM Validation

Receptors representing the 31 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.

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 receptor locations. In general, validation involves comparing actual noise measurements with 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 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. nature sounds, dogs barking, air conditioner condenser units, neighborhood activities, etc.) are the predominant noise component, rather than the visible roadway traffic. A comparison of the existing ambient measured sound levels to the predicted sound level for each site is summarized in Table 3. Based on the results, the TNM noise models constructed for the modeled existing, design year no-build and build alternatives are considered valid.

Based on field observations collected during the existing noise level measurements, SR 37 traffic noise was considered to be the dominant source of noise at most of the noise measurement locations. At 26 of the 31 ambient validation sites, the modeled results were found to be within ±3 dBA of the measurements. Sites M-6, M-28, M-29, M-31 and M-34 had either no dominant traffic noise or the distant SR 37 traffic was not the dominant noise source. The corresponding noise sensitive areas for these measurement sites are shown in Table 3. The existing measured L_{eq} within the project corridor ranged from 42.5 dBA at Site M-34 to 69.6 dBA at Site M-24.

Table 3 TNM Validation Results						
Site No.	Activity Category	NSA	Existing Measured L_{eq} (dBA)	Existing Modeled L_{eq} (dBA)	Measured Minus Modeled L_{eq} (dBA)	Dominant Noise Source at Site
M-1	B	15	59.5	60.4	-0.9	Traffic noise from SR 37
M-2	B	16	59.5	60.8	-1.3	Traffic noise from SR 37
M-3	B	16	64.8	63.1	+1.7	Traffic noise from SR 37
M-4	B	14	61.6	64.2	-2.6	Traffic noise from SR 37
M-5	B	13	60.3	57.8	+2.5	Traffic noise from SR 37
M-6	B	13	51.7	N/A	N/A	Distant traffic noise from SR 37
M-7	B	12	58.9	59.8	-0.9	Traffic noise from SR 37
M-8	B	11	66.7	67.7	-1.0	Traffic noise from SR 37
M-9	B	10	57.3	58.2	-0.9	Traffic noise from SR 37
M-10	B	10	62.1	61.9	+0.2	Traffic noise from SR 37
M-11	B	9	67.0	65.7	+1.3	Traffic noise from SR 37
M-12	B	8	65.5	68.3	-2.8	Traffic noise from SR 37
M-13	B	8	59.2	57.2	+2.0	Traffic noise from SR 37
M-14	B	7	54.3	53.3	+1.0	Traffic noise from SR 37
M-15	B	7	58.5	55.9	+2.6	Traffic noise from SR 37
M-16	B	7	64.6	63.5	+1.1	Traffic noise from SR 37
M-17	B	6	60.2	62.2	+2.0	Traffic noise from SR 37
M-18	B	5	66.9	64.3	+2.6	Traffic noise from SR 37
M-20	B	4	65.1	65.3	-0.2	Traffic noise from SR 37
M-21	B	4	64.6	63.2	+1.4	Traffic noise from SR 37
M-22	B	4	66.9	68.3	-1.4	Traffic noise from SR 37
M-23	B	3	62.0	64.9	+2.9	Traffic noise from SR 37
M-24	B	2	69.6	66.7	+2.9	Traffic noise from SR 37
M-25	B	2	62.9	64.8	-1.9	Traffic noise from SR 37
M-26	B	1	68.1	68.2	-0.1	Traffic noise from SR 37
M-27	B	1	62.3	62.4	-0.1	Traffic noise from SR 37
M-28	B	10	51.7	N/A	N/A	Traffic noise from SR 37
M-29	B	10	55.8	N/A	N/A	Acuff Rd., distant SR 37
M-31	B	14	57.7	N/A	N/A	Traffic noise from SR 37
M-32	B	7	66.3	66.7	-0.4	Traffic noise from SR 37
M-34	B	10	42.5	N/A	N/A	No dominant noise source

Notes:
NSA – Noise Sensitive Area
N/A-Not Applicable. There were no traffic volumes at these locations and/or traffic was not visible at these locations as a result of dense vegetation and/or other intervening structures or terrain.

6.2 Existing Traffic Noise Results

The project study area was divided into 16 NSAs based on a combination of land use, traffic volumes, and density. Base year traffic data from the IDSTM and the I-69 corridor model were used as input into TNM to determine the 2012 existing noise levels for the 1,034 sites that represent 2,327 receptors within the 16 NSAs throughout the Section 5 corridor. Existing L_{eq}(h) levels range from 33 dBA to 70 dBA for those receptors modeled. The results of the noise analysis conducted for the modeled existing condition resulted in 72 receptors that approach or exceed the applicable NAC criteria as defined in the INDOT *Traffic Noise Analysis Procedure.* These locations are comprised of 71 residences (37 single family residences and 34 apartment units) and one cemetery. Appendix E includes the existing sound level results for each modeled site.

6.3 Design Year No Build Alternative Noise Results

The results of the noise analysis conducted for the design year No Build alternative at the existing noise monitoring locations indicate that design year 2035 predicted noise levels would increase by approximately 4 dBA (on average) over the existing condition and would range from 38 dBA to 75 dBA. This increase results from the predicted growth in traffic volumes if the proposed project is not constructed. The predicted number of receptors that approach or exceed the appropriate NAC criteria is 253, an increase of 181 over the existing condition. These locations are comprised of approximately 234 residences, 2 churches, 2 offices, 1 hotel (12 units), 1 business, 1 hospital and 1 cemetery (all exterior impacts). Appendix E includes the Future No Build L_{eq} sound level results for each modeled site.

6.4 Predicted Design Year Build Alternative Noise Results

A noise analysis was performed to determine the predicted design year 2035 noise levels for the receptors located within the modeling limits for the proposed alignments that comprise each of the six alternatives. The predicted noise levels identified for each of the six build alternatives are included in Appendix E.

7.0 PREDICTED YEAR 2035 NOISE RESULTS COMPARATIVE ANALYSIS

7.1 Comparison of Predicted Year 2035 Noise Levels To Existing Year

The generalized results of the noise analysis conducted for Alternatives 4, 5, 6, 7, 8 and Refined Preferred Alternative 8 are relatively the same between the alternatives because they follow the same general location along the existing route (SR 37). The primary differences in the number of impact results from the current predicted number of right-of-way acquisitions, the number of representative sites per receptor, the location of new and/or modified interchanges and the projected traffic volumes between alternatives.

Alternative 4

The results of the noise analysis conducted for Alternative 4 indicate that the year 2035 predicted noise levels for the build condition would range from 40 dBA L_{eq} to 77 dBA L_{eq} for 798 modeled locations representing 1,976 receptors. These predicted noise levels represent a difference from existing noise levels ranging from 0 dBA L_{eq} to 17 dBA L_{eq}, with an average increase of approximately 7 dBA L_{eq}. The changes are a result of increased traffic, closer proximity of new alignment to receptors, traffic changes on the existing ramps and cross-streets, and new interchanges.

Alternative 5

The results of the noise analysis conducted for Alternative 5 indicate that the year 2035 predicted noise levels for the build condition would range from 41 dBA L_{eq} to 77 dBA L_{eq} for 805 modeled locations representing 1,984 receptors. These predicted noise levels represent a difference from existing noise levels ranging from 0 dBA L_{eq} to 17 dBA L_{eq}, with an average increase of approximately 7 dBA L_{eq}. The changes are a result of increased traffic, closer proximity of new alignment to receptors, traffic changes on the existing ramps and cross-streets, and new interchanges.

Alternative 6

The results of the noise analysis conducted for Alternative 6 indicate that the year 2035 predicted noise levels for the build condition would range from 40 dBA L_{eq} to 77 dBA L_{eq} for 896 modeled locations representing 2,090 receptors. These predicted noise levels represent a difference from existing noise levels ranging from 0 dBA L_{eq} to 15 dBA L_{eq}, with an average increase of approximately 7 dBA L_{eq}. The changes are a result of increased traffic, closer proximity of new alignment to receptors, traffic changes on the existing ramps and cross-streets, and new interchanges.

Alternative 7

The results of the noise analysis conducted for Alternative 7 indicate that the year 2035 predicted noise levels for the build condition would range from 41dBA L_{eq} to 78 dBA L_{eq} for 900 modeled locations representing 2,099 receptors. These predicted noise levels represent a difference from existing noise levels ranging from 0 dBA L_{eq} to 16 dBA L_{eq}, with an average increase of approximately 8 dBA L_{eq}. The changes are a result of increased traffic, closer proximity of new alignment to receptors, traffic changes on the existing ramps and cross-streets, and new interchanges.

Alternative 8

The results of the noise analysis conducted for Alternative 8 indicate that the year 2035 predicted noise levels for the build condition would range from 41 dBA L_{eq} to 77 dBA L_{eq} for 876 modeled locations representing 2,072 receptors. These predicted noise levels represent a difference from existing noise levels ranging from 0 dBA L_{eq} to 16 dBA L_{eq}, with an average increase of approximately 8 dBA L_{eq}. The changes are a result of increased traffic, closer proximity of new alignment to receptors, traffic changes on the existing ramps and cross-streets, and new interchanges.

Refined Preferred Alternative 8

The results of the noise analysis conducted for Preferred Alternative 8 indicate that the year 2035 predicted noise levels for the build condition would range from 41 dBA L_{eq} to 77 dBA L_{eq} for 927 modeled locations representing 2,134 receptors. These predicted noise levels represent a difference from existing noise levels ranging from 0 dBA L_{eq} to 21 dBA L_{eq}, with an average increase of approximately 7 dBA L_{eq}. The changes are a result of increased traffic, closer proximity of new alignment to receptors, traffic changes on the existing ramps and cross-streets, and new interchanges.

7.2 Comparison of Predicted Year 2035 Traffic Noise Impacts by Alternative

The following discussions summarize the predicted noise impacts by alternative. Table 4 summarizes the impacted receptors (by type) for each alternative. Table 5 summarizes Table 4 and identifies the number of impacts that are a result of exceeding the NAC, a result of a substantial increase over the existing L_{eq}, or a combination of both.

Table 4
Noise Level Impacts by Land Use - 2035 Build Alternatives

Receptor (or Land Use) Type	2035 Exterior Noise Level Impacts						
		Build Alternatives					
	No Build Alternative	4	5	6	7	8	Refined Preferred Alt 8
Residences	234	285	279	461	435	417	396
Churches	2	2	3	4	4	3	4
Cemeteries	1	2	2	1	2	2	1
Schools	0	0	0	0	0	0	0
Parks	0	0	0	0	0	0	0
Recreation	0	0	0	1	1	1	0
Hotels/Motels*	12	0	12	0	0	0	12
Hospitals	1	1	1	1	1	1	1
Historic Sites/ National Historic Landmarks	0	0	0	0	0	0	0
Commercial (non-retail)	3	6	6	8	9	6	5
Total	**253**	**296**	**303**	**476**	**452**	**430**	**419**

Note:

** Hotels/Motels impacts for the No-build Alternative, Alternative 5, and Refined Preferred Alternative 8 is one hotel with 12 units.*

Table 5
Noise Level Impact Summary

Type of Impact	2035 Exterior Noise Level Impacts					
	Build Alternatives					
	4	5	6	7	8	Refined Preferred Alt 8
NAC Only Impact	293	300	475	451	426	408
Substantial Increase Only Impact (≥15 dBA)	3	3	1	1	4	10
NAC and Substantial Increase Impact	0	0	0	0	0	1
Total	**296**	**303**	**476**	**452**	**430**	**419**

7.2.1 Alternative 4

This alternative will result in 293 NAC impacts and three substantial increase impacts for a total of 296 impacts. These predicted exterior impacts are comprised of 285 residences, two churches, two cemeteries, one hospital and six non-retail commercial buildings (offices, restaurants, etc.). The residential locations include 102 single-family units and 183 multi-family units at four apartment complexes. (Bradford Ridge, Copper Beach, Forest Ridge, and Oakdale Square.)

7.2.2 Alternative 5

This alternative will result in 300 NAC impacts and three substantial increase impacts for a total of 303 impacts. These predicted exterior impacts are comprised of 279 residences, three churches, two cemeteries, one hotel (with 12 units), one hospital and six non-retail commercial buildings (offices, restaurants, etc.). The residential locations include 90 single-family units and 189 multi-family units at four apartment complexes. (Bradford Ridge, Copper Beach, Forest Ridge, and Oakdale Square.)

7.2.3 Alternative 6

This alternative will result in 475 NAC impacts and one substantial increase impact for a total of 476 impacts. These predicted exterior impacts are comprised of 461 residences, four churches, one cemetery, one tennis court (recreation), one hospital and eight non-retail commercial buildings (offices, restaurants, etc.). The residential locations include 148 single-family units and 313 multi-family units at five apartment complexes. (Basswood, Bradford Ridge, Copper Beach, Forest Ridge, and Oakdale Square.)

7.2.4 Alternative 7

This alternative will result in 451 NAC impacts and one substantial increase impact for a total of 452 impacts. These predicted exterior impacts are comprised of 435 residences, four churches, two cemeteries, one tennis court (recreation), one hospital and nine non-retail commercial buildings (offices, restaurants, etc.). The residential locations include 160 single-family units and 275 multi-family units at six apartment complexes. (Basswood, Bradford Ridge, Copper Beach, Forest Ridge Oakdale Square and North Crossover.)

7.2.5 Alternative 8

This alternative will result in 426 NAC impacts and four substantial increase impacts for a total of 430 impacts. These predicted exterior impacts are comprised of 417 residences, three churches, two cemeteries, one tennis court (recreation), one hospital and six non-retail commercial buildings (offices, restaurants, etc.). The residential locations include 146 single-family units and 271 multi-family units at five apartment complexes. (Basswood, Bradford Ridge, Copper Beach, Forest Ridge and Oakdale Square.)

7.2.6 Refined Preferred Alternative 8

This alternative will result in 408 NAC impacts, ten substantial increase impacts, and one impact that meets both criteria for a total of 419 impacts. These predicted exterior impacts are comprised of 396 residences, four churches, one cemetery, one hospital, one hotel (with 12 units), and five non-retail commercial buildings (offices, restaurants, etc.). The residential locations include 145 single-family units and 251 multi-family units at five apartment complexes. (Basswood, Bradford Ridge, Copper Beach, Forest Ridge and Oakdale Square.)

8.0 NOISE ABATEMENT EVALUATION

8.1 INDOT Noise Abatement Policy

Traffic noise abatement measures can be in many forms and may include traffic control measures (TCM), alteration of vertical or horizontal alignment, acquisition of buffering land, noise insulation of public use or non-profit institutional structures, and/or construction of traffic noise barriers. Due to limitations on INDOT's ability to acquire property for mitigation or to mitigate sites off of State Right-of-Way, the most common form of abatement is the construction of noise barriers. Other forms of abatement will be evaluated on a case-by-case basis. INDOT will choose the most feasible and reasonable form of abatement.

8.2 Abatement Measures Evaluation

The following strategies were considered for the predicted highway traffic noise impacts.

Traffic Management Measures: Traffic management measures were not considered reasonable and feasible for abating noise impacts for any receptor. 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 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. However, since Section 5 is primarily on existing alignment, it is not anticipated that substantial horizontal and/or vertical changes will occur that might notably affect sound levels.

Acquisition of Property Rights or Acquisition of Property: 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 displacements), which were determined to outweigh the benefits of land acquisition.

Noise Insulation of Public Use or Nonprofit Institutional Structures: 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 most of the proposed project would be located on an existing highway facility, the potential for local officials and developers to help minimize adverse noise impacts through the use of careful land use planning exists only in the undeveloped areas. 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. Local planning authorities will be provided with information that identifies the limits of where 66 dBA and 71 dBA noise levels are predicted relative to the proposed facility which can be utilized to direct noise compatible land use development outside the 66 dBA and 71 dBA buffer zones along the highway. This information is provided in this report, as part of the FEIS for this project. Copies of this FEIS, which includes this noise report, will be provided to local officials.

Construction of Noise Barriers: The construction of noise barriers between the shoulder and the right-of-way limits is generally one of the most feasible and/or reasonable abatement measures available. 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 the roadway and receptor and the available placement location for a barrier. For those receptors experiencing a noise impact, the feasibility and reasonableness of noise abatement were evaluated using INDOT's feasible and reasonableness assessment criteria.

Possible mitigation measures were considered for sites where noise impacts were predicted to occur. Mitigation was assessed in terms of its feasibility and reasonableness.

Feasibility means that INDOT believes traffic noise impact abatement is prudent based on all of the following:

- <u>Acoustic Feasibility.</u> INDOT requires that noise barriers achieve a 5 dBA reduction at a majority (greater than 50%) of the impacted receptors. If a barrier cannot achieve this acoustic goal, abatement is considered to not be acoustically feasible.
- <u>Engineering Feasibility.</u> INDOT requires noise abatement to be based on sound engineering and evaluated at the optimum location. For instances in which the roadway is located on fill and is at a higher location than nearby receptors, a barrier will be evaluated near the shoulder. For instances in which the roadway is located below the nearby receptors, a barrier will be evaluated near the edge of the right-of-way near the receptors. In addition, noise barriers require long, uninterrupted segments of barrier to be feasible. As such, if there are existing access points and/or driveways, it is not feasible to construct effective noise barriers for the roadway.

  Engineering feasibility also takes into account topography, drainage, safety, barrier height, utilities, and access/maintenance needs (which may include right-of-way considerations). In situations where engineering considerations make noise barriers not feasible, the noise analysis will explicitly state the reasons (topography, drainage, safety, etc.).

Reasonableness means that INDOT believes abatement of traffic noise impacts is prudent based on all of the following factors:

- Cost effectiveness. A barrier is determined to be cost-effective if a five decibel (5 dBA) reduction can be achieved at a cost of no more than $25,000 per benefited receptor if a majority of the nearby receptors in a common noise environment were not constructed prior to the roadway. Using current bid prices, this corresponds to approximately 833 square feet of noise barrier per receptor. The allowed cost is $30,000 per benefited receptor if a majority of the nearby receptors in a common noise environment were constructed prior to the roadway being constructed. This corresponds to approximately 1,000 square feet of noise barrier per receptor using recent bid prices.
    - Note: Placing noise barriers on structures creates additional challenges, since reinforcement of the structure may be necessary to support the increased load. In these situations, other options should be assessed to determine whether cost-effective abatement can be provided without requiring complicated and expensive structural modifications. These could include lighter-weight barriers, shorter barriers, or other considerations. Any variations will be worked out in coordination between the FHWA division office and INDOT's Offices of Structural Services, Environmental Services and Construction Management.

- INDOT Design Goal for Noise Abatement. FHWA requires that traffic noise abatement achieve a substantial noise reduction. INDOT's goal for substantial noise reduction is to provide at least a 7.0 dBA reduction for impacted first row receptors in the design year. However, conflicts with adjacent lands may make it impossible to achieve substantial noise reduction at all impacted first row receptors. Therefore, the noise reduction design goal for Indiana is 7.0 dBA for a majority (greater than 50%) of the impacted first row receptors.

- Consideration and obtaining views of residents and property owners. The viewpoints of the affected property owners and residents are important to FHWA and INDOT. All communication with the public regarding the potential for noise abatement must be coordinated with INDOT's Office of Communication. This public involvement requirement can be handled either through a public hearing or via a mailed survey as outlined in the INDOT *Traffic Noise Analysis Procedure*.

8.3 Noise Barrier Evaluation

Using INDOT's *Highway Traffic Analysis Procedure,* receptors that were categorized as having design year (2035) traffic noise impacts for the six build 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 most current available data was used.

During the NEPA process, there is normally insufficient design information to fully commit to construction of noise abatement. This analysis report identifies locations where noise impacts are predicted to occur, where noise abatement is likely to be feasible and reasonable, and locations with impacts that are likely to have no feasible or reasonable noise abatement alternatives. The information within this report is completed to the extent that design information on the alternatives under study is available at the time the environmental document is completed. Projects may eventually have a narrower scope, updated survey information, or another change that affects the future noise environment. As such, noise abatement recommendations during the NEPA stage do not constitute commitments by INDOT. All Type I projects will undertake a reevaluation of the noise analysis and noise models once design of the roadway project has progressed to a near final stage to determine if noise abatement still meets the feasibility and reasonability standards set forth in this policy. Additional public involvement will be completed as necessary or if the decision is changed.

A final determination on noise abatement for the Preferred Alternative will be made during the final design phase of the project. At that time, additional noise analysis will be performed to more accurately determine barrier performance, barrier characteristics (length and height), and the optimal barrier location for any potential noise barriers that may be recommended for noise abatement. If noise abatement is still determined to be feasible and cost-effective, then potentially affected property owners will be surveyed in accordance with the requirements set forth in the INDOT *Traffic Noise Analysis Procedure* to determine whether they do or do not want noise abatement.

Collectively, noise barrier analyses were conducted at 80 locations for the six alternatives. The areas where the preliminary barrier analyses were deemed to be both feasible and reasonable are depicted on Figure 3 of Appendix A with the TNM modeled receptor sites. Barrier 1 involves impacted receptors along southbound I-69 between Fullerton Pike and Tapp Road. Barrier 3 involves impacted receptors along northbound I-69 between Tapp Road and SR 45 (W. Bloomfield). Barrier 4 involves impacted receptors along northbound I-69 between SR 45 (W. Bloomfield) and SR 48 (W. 3rd Street).

8.3.1 Alternative 4

The results of the barrier analysis for Alternative 4 are shown in Table 7.

Feasibility - There were 9 barriers out of the 35 analyzed for Alternative 4 that did not meet INDOT's criteria for "feasibility" since it was not structurally and acoustically capable of providing a 5 dBA reduction in noise levels at the majority of the impacted receptors. The other barriers assessed for Alternative 4 met the feasibility criteria.

Reasonableness - There were 23 barriers that met the feasibility criteria and met the design goal of 7 dBA noise reduction at the majority of the first row receptors, but did not meet INDOT's cost-effectiveness criteria of $30,000 per benefited receptor, and are therefore not considered "reasonable".

Barriers 1, 3 and 4 meet INDOT's feasibility criteria as well as the design goal and cost effectiveness reasonableness criteria, and were presented to the affected residents and property owners for feedback as part of the public involvement phase.

8.3.2 Alternative 5

The results of the barrier analysis for Alternative 5 are shown in Table 8.

Feasibility **-** There were 11 barriers out of the 40 analyzed for Alternative 5 that did not meet INDOT's criteria for "feasibility" since it was not structurally and acoustically capable of providing a 5 dBA reduction in noise levels at the majority of the impacted receptors.

Reasonableness **-** There were 26 barriers that met the feasibility criteria and met the design goal of 7 dBA noise reduction at the majority of the first row receptors, but did not meet INDOT's cost-effectiveness criteria of $30,000 per benefited receptor, and are therefore not considered "reasonable".

Barriers 1, 3 and 4 meet INDOT's feasibility criteria as well as the design goal and cost effectiveness reasonableness criteria, and were presented to the affected residents and property owners for feedback as part of the public involvement phase.

8.3.3 Alternative 6

The results of the barrier analysis for Alternative 6 are shown in Table 9.

Feasibility **-** There were 12 barriers out of the 46 analyzed for Alternative 6 that did not meet INDOT's criteria for "feasibility" since it was not structurally and acoustically capable of providing a 5 dBA reduction in noise levels at the majority of the impacted receptors.

Reasonableness **-** There were 31 barriers that met the feasibility criteria and met the design goal of 7 dBA noise reduction at the majority of the first row receptors, but did not meet INDOT's cost-effectiveness criteria of $30,000 per benefited receptor, and are therefore not considered "reasonable".

Barriers 1, 3 and 4 meet INDOT's feasibility criteria as well as the design goal and cost effectiveness reasonableness criteria, and were presented to the affected residents and property owners for feedback as part of the public involvement phase.

8.3.4 Alternative 7

The results of the barrier analysis for Alternative 7 are shown in Table 10.

Feasibility **-** There were 13 barriers out of the 50 analyzed for Alternative 7 that did not meet INDOT's criteria for "feasibility" since it was not structurally and acoustically capable of providing a 5 dBA reduction in noise levels at the majority of the impacted receptors.

Reasonableness **-** There were 34 barriers that met the feasibility criteria and met the design goal of 7 dBA noise reduction at the majority of the first row receptors, but did not meet INDOT's cost-effectiveness criteria of $30,000 per benefited receptor and are therefore not considered "reasonable".

Barriers 1, 3 and 4 meet INDOT's feasibility criteria as well as the design goal and cost effectiveness reasonableness criteria, and were presented to the affected residents and property owners for feedback as part of the public involvement phase.

8.3.5 Alternative 8

The results of the barrier analysis for Alternative 8 are shown in Table 11.

Feasibility - There were 14 barriers out of the 50 analyzed for Alternative 8 that did not meet INDOT's criteria for "feasibility" since it was not structurally and acoustically capable of providing a 5 dBA reduction in noise levels at the majority of the impacted receptors.

Reasonableness - There were 33 barriers that met the feasibility criteria and met the design goal of 7 dBA noise reduction at the majority of the first row receptors, but did not meet INDOT's cost-effectiveness criteria for of $30,000 per benefited receptor and are therefore not considered "reasonable".

Barriers 1, 3 and 4 meet INDOT's feasibility criteria as well as the design goal and cost effectiveness reasonableness criteria, and were presented to the affected residents and property owners for feedback as part of the public involvement phase.

8.3.6 Refined Preferred Alternative 8

The results of the barrier analysis for Refined Preferred Alternative 8 are shown in Table 12.

Feasibility - There were 8 barriers out of the 42 analyzed for Alternative 8 that did not meet INDOT's criteria for "feasibility" since it was not structurally and acoustically capable of providing a 5 dBA reduction in noise levels at the majority of the impacted receptors.

Reasonableness - There were 31 barriers that met the feasibility criteria and met the design goal of 7 dBA noise reduction at the majority of the first row receptors, but did not meet INDOT's cost-effectiveness criteria for of $30,000 per benefited receptor and are therefore not considered "reasonable".

Barriers 1, 3 and 4 meet INDOT's feasibility criteria as well as the design goal and cost effectiveness reasonableness criteria, and were presented to the affected residents and property owners for feedback as part of the public involvement phase.

Noise Survey Results

In the first series of 527 surveys sent to potentially benefited residents, there were 24 responses received from the Barrier 1 area (23 in favor, 1 no-commitment), 3 responses from the Barrier 3 area (all in favor) and 16 responses from the Barrier 4 area (13 in favor, 3 opposed).

According to *INDOT Traffic Noise Analysis Procedure*, if the total respondents to the survey do not total a majority (more than 50%) of the benefited receptors and affected property owners for a specific mitigation measure, then a second survey of those that did not respond will be performed. (A third survey will not be performed regardless of the percentage of the responses.)

Consequently, due to the low number of responses (39, 7, and 5 percent for barrier areas 1, 3 and 4, respectively), a second mailing of 402 letters were sent. (Note: the second mailing did not include apartment units that turned out to be vacant.) In the second series, there were only 7 responses received from the Barrier 1 area, 5 responses from the Barrier 3 area and 12 responses from the Barrier 4 area. As a result of the responses that were collected, the majority of the responding residences voted in favor of noise barrier construction. The results of the noise survey are shown in Table 6.

Table 6
Benefited Residents Survey Summary for Refined Preferred Alternative

Barrier Area	Number of Benefited Receptors	Number of Surveys Sent	Number of Surveys Received	Total Percent of Surveys Returned	Percent Favorable of those returned	Percent Not Favorable of those returned
Barrier Area 1	65	70	31	44	96%	0%
Barrier Area 3	50	63	8	13	100%	0%
Barrier Area 4	414	384	28	7	82%	18%

Table 7
Alternative 4 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
1	4851	14	27	80	16	Yes	$2,010,557	$25,132	Yes
2	1923	20	4	25	16	Yes	$1,038,487	$41,540	No
3	1530	20	48	49	14	Yes	$917,996	$18,735	Yes
4	3722	16	135	358	13	Yes	$1,786,415	$4,990	Yes
5	3177	14	8	19	12	Yes	$1,334,354	$70,229	No
6	-	-	2	1	11	No	-	-	-
7	3172	18	6	10	10	Yes	$1,713,062	$171,306	No
10	1625	18	5	5	6	Yes	$877,306	$175,461	No
12	1908	14	8	9	1	Yes	$801,168	$89,019	No
13	400	16	1	1	1	Yes	$192,000	$192,000	No
14	1,600	16	3	3	2	Yes	$768,000	$256,000	No
16	1,200	16	1	1	2	Yes	$576,000	$576,000	No
17	1,200	16	3	3	2	Yes	$576,000	$192,000	No
19	600	16	1	1	3	Yes	$288,000	$288,000	No
23	1,600	16	1	1	4	Yes	$768,000	$768,000	No
24	600	16	1	1	4	Yes	$288,000	$288,000	No
25	1,800	16	4	4	4	Yes	$864,000	$216,000	No
26	1,800	16	4	4	4	Yes	$864,000	$216,000	No
30	600	16	1	1	5	Yes	$288,000	$288,000	No
36	800	16	1	1	7	Yes	$384,000	$384,000	No
41	-	-	1	0	7	No	-	-	-
42	500	16	1	1	7	Yes	$240,000	$240,000	No
43	500	16	1	1	7	Yes	$240,000	$240,000	No
47	1,000	16	1	1	8	Yes	$480,000	$480,000	No
49	600	16	1	1	8	Yes	$288,000	$288,000	No
52	-	-	1	0	9	No	-	-	-
56	-	-	5	0	10	No	-	-	-
57	-	-	2	0	11	No	-	-	-
58	1,500	16	3	3	11	Yes	$720,000	$240,000	No
59	-	-	4	0	13	No	-	-	-
60	-	-	1	0	15	No	-	-	-
61	-	-	1	0	15	No	-	-	-
62	1,200	16	2	2	15	Yes	$576,000	$288,000	No
64	500	16	1	1	15	Yes	$240,000	$240,000	No
65	-	-	1	0	15	No	-	-	-

Table 8
Alternative 5 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
1	4606	14	11	73	16	Yes	$1,934,492	$26,500	Yes
2	2043	18	4	18	16	Yes	$980,446	$54,469	No
3	1492	20	54	55	14	Yes	$894,950	$16,271	Yes
4	3562	16	135	319	13	Yes	$1,709,585	$5,359	Yes
5	3177	14	10	25	12	Yes	$1,344,354	$53,774	No
6	-	-	2	1	11	No	-	-	-
7	3172	18	7	10	10	Yes	$1,713,062	$171,306	No
10	1625	20	5	4	6	Yes	$974,785	$243,696	No
11	-	-	5	0	4	No	-	-	-
12	1908	14	20	24	1	Yes	$801,168	$33,382	No
13	400	16	1	1	1	Yes	$192,000	$192,000	No
14	1,600	16	3	3	2	Yes	$768,000	$256,000	No
15	1,600	16	2	2	2	Yes	$768,000	$384,000	No
16	1,200	16	1	1	2	Yes	$576,000	$576,000	No
17	1,200	16	3	3	2	Yes	$576,000	$192,000	No
18	1,000	16	2	2	3	Yes	$480,000	$240,000	No
19	600	16	1	1	3	Yes	$288,000	$288,000	No
22	1,400	16	3	3	3	Yes	$672,000	$224,000	No
23	1,600	16	1	1	4	Yes	$768,000	$768,000	No
24	600	16	1	1	4	Yes	$288,000	$288,000	No
25	1,800	16	4	4	4	Yes	$864,000	$216,000	No
26	1,800	16	4	4	4	Yes	$864,000	$216,000	No
30	600	16	1	1	5	Yes	$288,000	$288,000	No
36	800	16	1	1	7	Yes	$384,000	$384,000	No
41	-	-	1	0	7	No	-	-	-
42	500	16	1	1	7	Yes	$240,000	$240,000	No
43	500	16	1	1	7	Yes	$240,000	$240,000	No
47	1,000	16	1	1	8	Yes	$480,000	$480,000	No
49	600	16	1	1	8	Yes	$288,000	$288,000	No
52	-	-	1	0	9	No	-	-	-
53	-	-	3	0	9	No	-	-	-
56	-	-	5	0	10	No	-	-	-
57	-	-	2	0	11	No	-	-	-
58	1,500	16	3	3	11	Yes	$720,000	$240,000	No
59	-	-	4	0	13	No	-	-	-
60	-	-	1	0	15	No	-	-	-
61	-	-	1	0	15	No	-	-	-
62	1,200	16	2	2	15	Yes	$576,000	$288,000	No
64	500	16	1	1	15	Yes	$240,000	$240,000	No
65	-	-	1	0	15	No	-	-	-

Table 9
Alternative 6 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
1	4851	14	42	80	16	Yes	$2,010,557	$25,132	Yes
2	1923	20	13	25	16	Yes	$1,038,487	$41,540	No
3	1530	20	88	49	14	Yes	$917,996	$18,735	Yes
4	3722	16	226	358	13	Yes	$1,786,415	$4,990	Yes
5	3177	14	11	12	12	Yes	$1,334,354	$111,196	No
6	-	-	2	1	11	No	-	-	-
7	3172	18	7	10	10	Yes	$1,713,062	$171,306	No
9	2557	14	1	9	8	Yes	$1,074,088	$119,343	No
10	1625	18	5	5	6	Yes	$877,306	$175,461	No
11	-	-	7	0	4	No	-	-	-
12	1908	14	7	9	1	Yes	$801,168	$89,019	No
13	400	16	1	1	1	Yes	$192,000	$192,000	No
14	1,600	16	3	3	2	Yes	$768,000	$256,000	No
17	1,200	16	3	3	2	Yes	$576,000	$192,000	No
18	1,000	16	2	2	3	Yes	$480,000	$240,000	No
19	600	16	1	1	3	Yes	$288,000	$288,000	No
20	1,400	16	3	3	3	Yes	$672,000	$224,000	No
21	1,400	16	3	3	3	Yes	$672,000	$224,000	No
22	1,400	16	3	3	3	Yes	$672,000	$224,000	No
23	1,600	16	1	1	4	Yes	$768,000	$768,000	No
24	600	16	1	1	4	Yes	$288,000	$288,000	No
25	1,800	16	4	4	4	Yes	$864,000	$216,000	No
26	1,800	16	4	4	4	Yes	$864,000	$216,000	No
28	1,800	16	4	4	4	Yes	$864,000	$216,000	No
29	600	16	1	1	5	Yes	$288,000	$288,000	No
30	600	16	1	1	5	Yes	$288,000	$288,000	No
33	800	16	1	1	6	Yes	$384,000	$384,000	No
34	600	16	1	1	7	Yes	$288,000	$288,000	No
35	-	-	1	0	7	No	-	-	-
37	1,000	16	2	2	7	Yes	$480,000	$240,000	No
38	1,100	16	3	3	7	Yes	$528,000	$176,000	No
42	500	16	1	1	7	Yes	$240,000	$240,000	No
48	800	16	1	2	8	Yes	$384,000	$192,000	No
49	600	16	1	1	8	Yes	$288,000	$288,000	No
51	-	-	1	0	9	No	-	-	-
53	-	-	3	0	9	No	-	-	-
54	-	-	2	0	9	No	-	-	-
55	-	-	1	0	10	No	-	-	-
56	-	-	5	0	10	No	-	-	-
57	-	-	2	0	11	No	-	-	-
58	1,500	16	3	3	11	Yes	$720,000	$240,000	No
59	-	-	4	0	13	No	-	-	-
60	-	-	1	0	15	No	-	-	-
62	1,200	16	2	2	15	Yes	$576,000	$288,000	No
64	500	16	1	1	15	Yes	$240,000	$240,000	No
65	-	-	1	0	15	No	-	-	-

Table 10
Alternative 7 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
1	4606	14	40	73	16	Yes	$1,934,492	$26,500	Yes
2	2043	18	15	18	16	Yes	$980,446	$54,469	No
3	1492	20	46	43	14	Yes	$894,950	$20,813	Yes
4	3562	16	226	319	13	Yes	$1,709,585	$5,359	Yes
5	3177	14	12	18	12	Yes	$1,344,354	$74,686	No
6	-	-	2	1	11	No	-	-	-
7	3172	18	8	10	10	Yes	$1,713,062	$171,306	No
8	2279	14	3	6	8	Yes	$957,293	$159,548	No
9	2557	14	2	8	8	Yes	$1,074,088	$134,261	No
10	1625	20	5	4	6	Yes	$974,785	$243,696	No
11	-	-	6	0	4	No	-	-	-
12	1908	14	9	9	1	Yes	$801,168	$89,019	No
13	400	16	1	1	1	Yes	$192,000	$192,000	No
14	1,600	16	3	3	2	Yes	$768,000	$256,000	No
17	1,200	16	3	3	2	Yes	$576,000	$192,000	No
18	1,000	16	2	2	3	Yes	$480,000	$240,000	No
19	600	16	1	1	3	Yes	$288,000	$288,000	No
21	1,400	16	3	3	3	Yes	$672,000	$224,000	No
22	1,400	16	3	3	3	Yes	$672,000	$224,000	No
23	1,600	16	1	1	4	Yes	$768,000	$768,000	No
24	600	16	1	1	4	Yes	$288,000	$288,000	No
26	1,800	16	4	4	4	Yes	$864,000	$216,000	No
28	1,800	16	4	4	4	Yes	$864,000	$216,000	No
29	600	16	1	1	5	Yes	$288,000	$288,000	No
30	600	16	1	1	5	Yes	$288,000	$288,000	No
31	-	-	2	0	6	No	-	-	-
32	800	16	1	1	6	Yes	$384,000	$384,000	No
33	800	16	1	1	6	Yes	$384,000	$384,000	No
35	-	-	1	0	7	No	-	-	-
37	1,000	16	2	2	7	Yes	$480,000	$240,000	No
39	1,000	16	1	1	7	Yes	$480,000	$480,000	No
40	800	16	1	1	7	Yes	$384,000	$384,000	No
41	-	-	1	0	7	No	-	-	-
42	500	16	1	1	7	Yes	$240,000	$240,000	No
44	500	16	1	1	7	Yes	$240,000	$240,000	No
47	1,000	16	1	1	8	Yes	$480,000	$480,000	No
49	600	16	1	1	8	Yes	$288,000	$288,000	No
50	600	16	1	1	8	Yes	$288,000	$288,000	No
51	-	-	1	0	9	No	-	-	-
53	-	-	3	0	9	No	-	-	-
54	-	-	2	0	9	No	-	-	-
55	-	-	1	0	10	No	-	-	-
56	-	-	5	0	10	No			
57	-	-	2	0	11	No	-	-	-
58	1,500	16	3	3	11	Yes	$720,000	$240,000	No
59	-	-	4	0	13	No	-	-	-
62	1,200	16	2	2	15	Yes	$576,000	$288,000	No
63	1,000	16	3	3	15	Yes	$480,000	$160,000	No
64	500	16	1	1	15	Yes	$240,000	$240,000	No
65	-	-	1	0	15	No	-	-	-

Table 11
Alternative 8 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
1	4524	14	32	62	16	Yes	$1,841,718	$29,705	Yes
2	1745	17	14	15	16	Yes	$891,427	$59,428	No
3	1492	20	46	43	14	Yes	$894,950	$20,813	Yes
4	3562	16	226	328	13	Yes	$1,709,585	$5,212	Yes
5	3177	14	8	18	12	Yes	$1,344,354	$74,686	No
6	-	-	2	1	11	No	-	-	-
7	3172	16	8	10	10	Yes	$1,522,722	$152,272	No
9	2554	12	1	3	8	Yes	$919,564	$306,521	No
10	1625	20	5	3	6	Yes	$974,785	$324,928	No
11	-	-	7	0	4	No	-	-	-
12	1908	14	9	9	1	Yes	$801,168	$89,019	No
13	400	16	1	1	1	Yes	$192,000	$192,000	No
14	1,600	16	3	3	2	Yes	$768,000	$256,000	No
17	1,200	16	3	3	2	Yes	$576,000	$192,000	No
18	1,000	16	2	2	3	Yes	$480,000	$240,000	No
19	600	16	1	1	3	Yes	$288,000	$288,000	No
20	1,400	16	3	3	3	Yes	$672,000	$224,000	No
21	1,400	16	3	3	3	Yes	$672,000	$224,000	No
22	1,400	16	3	3	3	Yes	$672,000	$224,000	No
23	1,600	16	1	1	4	Yes	$768,000	$768,000	No
24	600	16	1	1	4	Yes	$288,000	$288,000	No
25	1,800	16	4	4	4	Yes	$864,000	$216,000	No
26	1,800	16	4	4	4	Yes	$864,000	$216,000	No
27	1,800	16	4	4	4	Yes	$864,000	$216,000	No
28	1,800	16	4	4	4	Yes	$864,000	$216,000	No
29	600	16	1	1	5	Yes	$288,000	$288,000	No
30	600	16	1	1	5	Yes	$288,000	$288,000	No
33	800	16	1	1	6	Yes	$384,000	$384,000	No
35	-	-	1	0	7	No	-	-	-
36	800	16	1	1	7	Yes	$384,000	$384,000	No
41	-	-	1	0	7	No	-	-	-
42	500	16	1	1	7	Yes	$240,000	$240,000	No
45	-	-	3	0	8	No	-	-	-
46	1,000	16	1	1	8	Yes	$480,000	$480,000	No
48	800	16	1	2	8	Yes	$384,000	$192,000	No
49	600	16	1	1	8	Yes	$288,000	$288,000	No
50	600	16	1	1	8	Yes	$288,000	$288,000	No
51	-	-	1	0	9	No	-	-	-
53	-	-	3	0	9	No	-	-	-
54	-	-	2	0	9	No	-	-	-
55	-	-	1	0	10	No	-	-	-
56	-	-	5	0	10	No	-	-	-
57	-	-	2	0	11	No	-	-	-
58	1,500	16	3	3	11	Yes	$720,000	$240,000	No
59	-	-	4	0	13	No	-	-	-
60	-	-	1	0	15	No	-	-	-
62	1,200	16	2	2	15	Yes	$576,000	$288,000	No
63	1,000	16	3	3	15	Yes	$480,000	$160,000	No
64	500	16	1	1	15	Yes	$240,000	$240,000	No
65	-	-	1	0	15	No	-	-	-

Table 12
Refined Preferred Alternative 8 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
1	4,818	12	32	65	16	Yes	$1,734,351	$26,682	Yes
2	2,016	14	7	19	16	Yes	$846,636	$44,560	No
3	1,449	18	26	50	14	Yes	$762,634	$15,253	Yes
4	4,235	14	225	414	13	Yes	$1,778,713	$4,296	Yes
5	2,031	14	9	19	12	Yes	$852,861	$44,887	No
7	3,915	14	6	6	10	Yes	$1,644,404	$274,067	No
9	1,964	20	4	3	8	Yes	$1,178,371	$392,790	No
10	3,748	20	3	7	6	Yes	$2,249,064	$321,295	No
12	2022	12	24	18	1	Yes	$727,946	$39,886	No
13	637	10	1	1	1	Yes	$190,987	$190,987	No
13A	358	10	1	1	1	Yes	$107,334	$107,334	No
14	2,262	18	4	4	2	Yes	$786,534	$196,633	No
17	1,203	18	4	4	2	Yes	$649,409	$162,352	No
18A	358	10	1	2	3	Yes	$107,334	$53,667	No
23	1,293	20	1	2	4	Yes	$387,862	$193,931	No
24A	-	-	8	0	4	No	-	-	-
24B	358	10	1	1	4	Yes	$107,334	$107,334	No
24C	2,852	16	4	4	4	Yes	$1,368,780	$456,260	no
29	400	10	1	1	5	Yes	$120,000	$120,000	No
30	400	10	1	1	5	Yes	$120,000	$120,000	No
33A	1,286	18	5	5	6	Yes	$684,713	$136,943	No
36	400	10	1	1	7	Yes	$120,000	$120,000	No
36A	7136	14	7	8	7	Yes	$2,997,182	$374,648	No
42	400	10	1	1	7	Yes	$120,000	$120,000	No
42A	2,354	18	1	4	7	Yes	$1,271,272	$317,818	No
45	-	-	2	0	8	No	-	-	-
45A	-	-	2	0	8	No	-	-	-
46	800	10	1	1	8	Yes	$240,000	$240,000	No
48	2,438	12	3	4	8	Yes	$877,775	$219,444	No
49	400	10	1	1	8	Yes	$120,000	$120,000	No
49A	400	10	1	1	8	Yes	$120,000	$120,000	No
50	1000	10	1	2	8	Yes	$300,000	$150,000	No
50A	400	10	1	1	8	Yes	$120,000	$120,000	No
51A	400	10	1	1	9	Yes	$120,000	$120,000	No
54	-	-	2	0	9	No	-	-	-
55B	-	-	4	0	10	No	-	-	-
57A	2,031	20	2	3	11	Yes	$1,218,837	$406,279	No
57B	400	10	1	1	11	Yes	$120,000	$120,000	No
58	-	-	5	0	10	No	-	-	-
60	-	-	1	0	15	No	-	-	-
64	400	10	1	1	15	Yes	$120,000	$120,000	No
65	-	-	1	0	15	No	-	-	-

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

While there is no NAC set up for undeveloped lands (Category G,) as described in Table 1, INDOT *Traffic Noise Analysis Procedure* requires noise contours to be developed for undeveloped lands to aid with future land use planning. As part of the requirements of the INDOT *Traffic Noise Analysis Procedure*, estimated future noise levels associated with the Proposed Build scenario for undeveloped lands that are not planned, designed, and programmed will be provided to local governments by INDOT so that the appropriate land-use planning can be performed.

Since most of the proposed project would be constructed on an existing highway facility, the potential for local officials and developers to help minimize adverse noise impacts through the use of careful land use planning exists only in the undeveloped areas. With regard to currently undeveloped land, the creation of a "buffer zone" or the location of noise sensitive developments a reasonable distance away from the project would help minimize future noise impacts. Local planning authorities will be provided with information that identifies the limits of where the 71 dBA (non-retail commercial business) and 66 dBA (residences, schools, churches, hospitals, parks) noise levels are predicted relative to the proposed facility and can be utilized to direct noise compatible land uses outside the 71 and 66 dBA buffer zones along the highway. At this time, the estimated distance from the edge of the nearest I-69 travel lane for such buffers are approximately 145 feet for the 71 dBA contour and 300 feet for the 66 dBA contour.

Please note that this distance is for planning purposes only and does not include the effects of local terrain variables, site-specific shielding features or other noise generating sources.

This information is only intended to be used as a guide to assist the local government agencies. Any future land use planning should take into account developments so that they are planned, designed, and constructed in such a way that noise impacts are minimized for the areas developed.

11.0 SUMMARY

A Noise Analysis was performed for Section 5 Alternatives 4, 5, 6, 7, 8 and Refined Preferred Alternative 8 to determine the predicted traffic noise impacts.

Thirty-one existing ambient measurements were recorded. Seven of the ambient levels approached or exceeded the NAC criteria. A total of 1,034 location sites representing 2,327 receptors were modeled for the existing, design year Build and No Build alternatives. There were 72 receptors that approached or exceeded the NAC criteria in the existing condition. An evaluation of the design year No Build scenario resulted in the identification of 253 receptors that approached or exceeded the NAC criteria. The following is a summary of the predicted impacts for each design year build alternative.

Alternative 4

This alternative will result in 293 NAC impacts and three substantial increase impacts for a total of 296 impacts.

There were 9 barriers out of the 35 analyzed for Alternative 4 that did not meet INDOT's criteria for "feasibility".

There were 23 barriers that met the feasibility criteria and INDOT's design goal criteria, but did not meet the cost effectiveness criteria of $30,000 per benefited receptor.

Barriers 1, 3 and 4 meet INDOT's feasible criteria as well as the design goal and cost effectiveness reasonableness criteria.

Alternative 5

This alternative will result in 300 NAC impacts three substantial increase impacts for a total of 303 impacts.

There were 11 barriers out of the 40 analyzed for Alternative 5 that did not meet INDOT's criteria for "feasibility".

There were 26 barriers that met the feasibility criteria and INDOT's design goal criteria, but did not meet the cost effectiveness criteria of $30,000 per benefited receptor.

Barriers 1, 3 and 4 meet INDOT's feasible criteria as well as the design goal and cost effectiveness reasonableness criteria.

Alternative 6

This alternative will result in 475 NAC impacts and one substantial increase impact for a total of 476 impacts.

There were 12 barriers out of the 46 analyzed for Alternative 6 that did not meet INDOT's criteria for "feasibility".

There were 31 barriers that met the feasibility criteria and INDOT's design goal criteria, but did not meet the cost effectiveness criteria of $30,000 per benefited receptor.

Barriers 1, 3 and 4 met INDOT's feasible criteria, as well as the design goal and cost effectiveness reasonableness criteria.

Alternative 7

This alternative will result in 451 NAC impacts and one substantial increase impact for a total of 452 impacts.

There were 13 barriers out of the 50 analyzed for Alternative 7 that did not meet INDOT's criteria for "feasibility".

There were 34 barriers that met the feasibility criteria and INDOT's design goal criteria, but did not meet the cost effectiveness criteria of $30,000 per benefited receptor.

Barriers 1, 3 and 4 met INDOT's feasible criteria, as well as the design goal and cost effectiveness reasonableness criteria.

Alternative 8

This alternative will result in 426 NAC impacts and four substantial increase impacts for a total of 430 impacts.

There were 14 barriers out of the 50 analyzed for Alternative 8 that did not meet INDOT's criteria for "feasibility".

There were 33 barriers that met the feasibility criteria and INDOT's design goal criteria, but did not meet the cost effectiveness criteria of $30,000 per benefited receptor.

Barriers 1, 3 and 4 met INDOT's feasible criteria, as well as the design goal and cost effectiveness reasonableness criteria.

Refined Preferred Alternative 8

This alternative will result in 408 NAC impacts, ten substantial increase impacts, and one impact that meets both the NAC impact and substantial increase impact criteria, for a total of 419 impacts.

There were 8 barriers out of the 42 analyzed for Refined Preferred Alternative 8 that did not meet INDOT's criteria for "feasibility" since it was not structurally and acoustically capable of providing a 5 dBA reduction in noise levels at the majority of the first row receptors.

There were 31 barriers that met the feasibility criteria and met the design goal of 7 dBA noise reduction at the majority of the first row receptors, but did not meet INDOT's cost-effectiveness criteria of $30,000 per benefited receptor and are therefore not considered "reasonable".

Barriers 1, 3 and 4 meet INDOT's feasibility criteria as well as the design goal and cost effectiveness reasonableness criteria.

Noise Survey Results

As a result of the responses that were collected, the majority of the responding residents voted in favor of noise barrier construction for Barrier areas 1, 3 and 4.

A final determination on noise abatement for the Preferred Alternative will be made during the final design phase of the project. At such time, additional noise analysis will be performed to more accurately determine barrier performance, barrier characteristics (length and height), and the optimal barrier location for any potential noise barriers that may be recommended for noise abatement.

Statement of Likelihood

This Statement of Likelihood is applicable to all Build alternatives as the same preliminary barrier area locations are deemed to be feasible and reasonable. This is because the six Build alternatives generally follow the same alignment of existing SR 37 and affect the same relative receptors plus/minus the receptors that may be acquired through right-of-way purchase as a result of the proposed action. The number of impacted receptors and barrier costs reflect the range of the six Build alternatives.

A reevaluation of the noise analysis will occur during final design. If during final design it has been determined that conditions have changed such that noise abatement is not feasible and reasonable, the abatement measures might not be provided. The final decision on the installation of any abatement measure(s) will be made upon the completion of the project's final design and the public involvement processes.

The viewpoints of the impacted residents and property owners have been sought and considered in determining the reasonableness of highway traffic noise abatement measures for proposed highway construction projects. As a result of the responses that were collected, the majority of the responding residents voted in favor of noise barrier construction for Barrier areas 1, 3 and 4. INDOT will incorporate highway traffic noise consideration in on-going activities for public involvement in the highway program.

Barrier 1: Based on the studies completed to date, the State of Indiana has identified 27 to 42 impacted receptors (32 receptors for Refined Preferred Alternative 8) and has determined that noise abatement is likely, but not guaranteed, between Fullerton Pike and Tapp Road. Noise abatement at these locations is based upon preliminary design costs and design criteria. Noise abatement in these locations at this time has been estimated to cost $1.73 million to $2.01 million ($1.73 million for Refined Preferred Alternative 8), and will reduce the noise level by a minimum of 7 dBA at a majority of the identified impacted receptors. A reevaluation of the noise analysis will occur during final design. If during final design it has been determined that conditions have changed such that noise abatement is not feasible and reasonable, the abatement measures might not be provided. The final decision on the installation of any abatement measure(s) will be made upon the completion of the project's final design and the public involvement processes.

Barrier 3: Based on the studies completed to date, the State of Indiana has identified 26 to 88 impacted receptors (26 receptors for Refined Preferred Alternative 8) and has determined that noise abatement is likely, but not guaranteed south of SR 45 at the Oakdale apartments. Noise abatement at these locations is based upon preliminary design costs and design criteria. Noise abatement in these locations at this time has been estimated to cost $0.76 million to $0.91 million ($0.76 million for Refined Preferred Alternative 8), and will reduce the noise level by a minimum of 7 dBA at a majority of the identified impacted receptors. A reevaluation of the noise analysis will occur during final design. If during final design it has been determined that conditions have changed such that noise abatement is not feasible and reasonable, the abatement measures might not be provided. The final decision on the installation of any abatement measure(s) will be made upon the completion of the project's final design and the public involvement processes.

Barrier 4: Based on the studies completed to date, the State of Indiana has identified 135 to 226 impacted receptors (225 receptors for Refined Preferred Alternative 8) and has determined that noise abatement is likely, but not guaranteed at the Basswood, Bradford Ridge, Cooper Beach, Forest Ridge and Canterbury apartments north of Bloomfield Road. Noise abatement at these locations is based upon preliminary design costs and design criteria. Noise abatement in these locations at this time has been estimated to cost $1.71 million to $1.79 million ($1.78 million for Refined Preferred Alternative 8) and will reduce the noise level by a minimum of 7 dBA at a majority of the identified impacted receptors.

12.0 REFERENCES

23 CFR Part 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, July, 2010.

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.

FHWA *Highway Traffic Noise Analysis and Abatement Guidance,* August, 2010.

Indiana Department of *Transportation Traffic Noise Analysis Procedure,* July, 2011.

Lee, Cynthia S.Y., Gregg G. Fleming. "Measurement of Highway-Related Noise", U.S. Department of Transportation Federal Highway Administration Office of Environment and Planning, May, 1996.