

DATE: February 16, 2012

TO: Ben Lawrence, Manager, Environmental Policy Section, INDOT

FROM: Chad Costa, Senior Environmental Planner, RW Armstrong

RE: Noise Re-Evaluation of Barriers 13, 14 and 15 for the US 31 Plymouth to South Bend Project, Des. No. 0710783

1.0 FEIS Overview

The US 31 Improvement Project from Plymouth to South Bend in Marshall and St. Joseph Counties, Indiana consists of a corridor which is approximately 20 miles in length, beginning from the southern terminus at US 30, near Plymouth, to the northern terminus at the south junction with US 20, near South Bend. The project involves upgrading US 31 to meet three (3) overall goals:

- Reduce congestion and construction on US 31 by providing the capacity to meet the forecasted travel demand for 2030.
- Improve safety on US 31 between US 30 and US 20.
- Consistency with statewide (INDOT) and regional (MACOG) transportation plans.

In accordance with the public notification requirements of the National Environmental Policy Act of 1969 (NEPA), INDOT initiated the Environmental Impact Statement (EIS) with the publication of a Notice of Intent (NOI) on the Federal Register on March 26, 2002.

The Draft Environmental Impact Statement (DEIS) prepared evaluated a wide range of alternatives for addressing existing and future transportation needs in the vicinity of US 31 in Marshall and St. Joseph Counties. The Federal Highway Administration (FHWA) and INDOT approved the DEIS and it was made available for public review and comment on February 27, 2004 with the No-Build Alternative and Freeway Alternatives Cs, Es, and G-C still under consideration. A Public Hearing to discuss the findings of the DEIS was held on March 18, 2004. In response to the public comments, a hybrid alternative, Alternative G-E, was developed that consisted of a combination of the southern portion of Alternative G-C and the northern portion of Alternative Es.

On September 23, 2004, INDOT announced that Alternative G-Es (a modified version of Alternative G-E) had been identified as the Preferred Alternative for the proposed improvements

to US 31 and would be advanced to the Final Environmental Impact Statement (FEIS). The FEIS was signed by FHWA and INDOT on April 3, 2006 and the Notice of Availability was published in the Federal Register on April 21, 2006.

The Preferred Alternative satisfies the project's Purpose and Need performance measures and was among the best traffic performers of all alternatives under consideration. It utilizes more of the existing US 31 and provides free-flowing traffic movements. With the Preferred Alternative, US 31 will be upgraded and realigned from US 30 near Plymouth to the US 20 bypass in South Bend. Approximately 15 miles of the 20 mile corridor will be built on new terrain east of the existing route.

A Record of Decision (ROD) was published for the proposed project on June 26, 2006 which approved the Preferred Alternative as described in the FEIS. Three Additional Information (AI) Reports outlining additional right-of-way needs, impacts, and changes in the proposed improvements within various areas were approved on November 9, 2007, December 2, 2010 and January 3, 2012.

2.0 Intent of the Re-Evaluation

The intent of this re-evaluation is to amend the barrier analysis finding that was completed as part of the FEIS due to extenuating factors. The factors necessitating the re-evaluation follow, but are discussed in more detail below:

- Modifications to the Design Plans / Project Right-of-Way
- Changes in INDOT's Traffic Noise Policy

In addition, this re-evaluation is intended to serve as INDOT's final decision on the installation of noise abatement measures. The FEIS indicated in *Chapter 6 – Mitigation* that “*If during final design these conditions substantially change, the abatement measures might not be provided. A final decision on the installation of abatement measure(s) will be made upon completion of the project design and the public involvement process.*”

Modifications to the Design Plans / Project Right-of-Way

This re-evaluation took into consideration the most current design information available for Alternative G-E's when assessing the feasibility and reasonableness of Barriers 13, 14 and 15. Advancement of Alternative G-E's through the normal design process has resulted in the expansion of right-of-way at some locations, due to changes in the vertical and horizontal profiles. As such, these changes in profile are reflected in the noise model prepared for the preferred alternative using FHWA's *Traffic Noise Model, Version 2.5 (TNM)*.

Changes in the State's Traffic Noise Policy

At the time the FEIS and ROD were completed, April 3, 2006 and June 26, 2006, respectively, a noise policy was in place that has since been superseded by INDOT's current Traffic Noise Analysis Procedure (2011). Table 1 below illustrates the differences in the policy that was in place at the time the FEIS was prepared and the current policy.

TABLE 1 – SUMMARY OF CHANGES IN INDOT TRAFFIC NOISE POLICY SINCE THE FEIS		
Criteria	Policy In Place During the FEIS	Current Policy
Feasibility	Structurally and acoustically reduce noise at receptors by 5 dBA	Attained if satisfies Engineering and Acoustic criteria
1) Engineering	Not Defined	A particular form of abatement can actually have an effect on the traffic noise levels at a receptor. These considerations include topography, drainage, safety, access control, and right-of-way.
2) Acoustic	Not Defined	A majority of the impacted receptors are benefited, that is, they receive an insertion loss of at least 5 dBA in the design year.
Reasonableness		
1) Design Criteria	Not Defined	A majority of the first row benefited receptors experience at least a 7 dBA reduction in the design year.
2) Cost Effectiveness (per benefited receptor)	\$20,000 - \$30,000	≤ \$25,000 (≤ \$30,000 if majority of receptors present prior to construction of highway)
Barrier Cost (per sq. ft.)	\$20	\$30
3) Views of Impacted / Benefited Receptors	If determined cost effective, a majority of the impacted or benefited receptors must affirm support for the prescribed mitigation.	If determined cost effective, a majority of the impacted or benefited receptors must affirm support for the prescribed mitigation.

In addition, in June 2010 the FHWA released its updated *Highway Traffic Noise: Analysis and Abatement Guidance* (revised January 2011). This guidance made several changes to the

process in which each state evaluates noise impacts associated with highway projects. Some of the changes included the steps that should be taken to determine whether a barrier is feasible and reasonable, and refining the list of land use activity categories and Noise Abatement Criteria (NAC) thresholds.

This re-evaluation of the barriers that were identified in the FEIS as potentially feasible and reasonable forms of abatement intends to utilize the current INDOT criteria identified in Table 1, above. In so doing, it will be ascertained whether the barriers remain a feasible and reasonable form of mitigation.

3.0 FEIS Summary of Barrier Results

The FEIS identified two common noise environments along Alternative G-E's where barriers were found to be likely feasible and reasonable (Appendix B). The barriers associated with these two locations were referred to as Barrier 13 and Barrier 14. Additionally, the FEIS identified two other locations as not meeting INDOT's criteria of feasibility and reasonableness, but acknowledged further consideration should be given during the design phase. The barriers associated with these two locations were referred to as Barrier 15 and Barrier 18. Barrier 18, which was located on the north side of US 20 east of US 31, was not considered in this re-evaluation. The reason for not including Barrier 18 is due to the Project Team's decision to remove the reconfiguration of the US 31 / US 20 interchange from the project, thus terminating the project south of US 20.

What follows is a summary of the noise analysis results documented in the FEIS for Barriers 13, 14 and 15. It should be noted that the noise models developed during the FEIS assumed the worst-case scenario by not including vertical elevations. This is often the case in projects where design information is limited. As a result, noise levels are typically elevated due to the unobstructed path between the receptor and the noise source. The incorporation of elevations, ground types (i.e., water, grass or pavement) and terrains has the potential to change the path or characteristics of sound as it propagates from the source. The results presented in Section 5 are based on the inclusion of these factors into the noise model given the current design detail that is now available.

3.1 Barrier 13

The FEIS evaluated a barrier along the east side of US 31 between Gilmer Road and Johnson Road. The barrier varied in height from 12 to 15 ft. and extended approximately 1,856 ft. This barrier was determined to benefit 22 of 26 receptors evaluated at an estimated cost of \$493,433 (using a cost of \$20 per square foot). The cost per benefited receptor was \$22,428. As the barrier benefited a sufficient number of receptors at a cost that was within INDOT's cost effectiveness threshold, Barrier 13 was determined to be likely feasible and reasonable.

3.2 Barrier 14

The FEIS evaluated a barrier along the west side of US 31 between Johnson Road and Jackson Road. The barrier varied in height from 14 ft. to 19 ft. and extended approximately 800 ft. This barrier was determined to benefit 10 of the 19 receptors evaluated at an estimated cost of \$267,792 (using a cost of \$20 per square foot), providing a cost per benefited receptor of \$26,779. As the barrier benefited a sufficient number of receptors at a cost that was within INDOTs cost effectiveness threshold, Barrier 14 was determined to be likely feasible and reasonable.

3.3 Barrier 15

The FEIS evaluated a barrier along the east side of US 31 between Johnson Road and Jackson Road. The barrier varied in height from 8 ft. to 16 ft. and extended approximately 1,400 ft., benefitting 11 receptors at a cost of \$375,990 (using a cost of \$20 per square foot), or \$34,180 per benefited receptor. However, since the cost effectiveness of the barrier was shown to exceed the previous noise policy by \$4,180 per benefited receptor, it was not recommended as a feasible and reasonable abatement measure. Although dismissed, the FEIS recommended the barrier be given further consideration during the design phase due to the number of residences that could benefit from its inclusion.

4.0 Receptor Identification / Modification

In accordance with the *Indiana Department of Transportation Traffic Noise Analysis Procedures (2011)*, potential receptors within the vicinity of Barriers 13, 14 and 15 were included in the re-evaluation if they occurred within 500 ft. of the proposed edge of pavement. It should be noted that there were no impacted receptors identified at 500 ft., so an adjustment of the analysis area was unnecessary.

Whether predicted noise levels approached or exceeded the Noise Abatement Criteria (NAC) at an identified receptor is determined by the NAC land use category in which it is classified. The *Indiana Department of Transportation Traffic Noise Analysis Procedures (2011)*, developed from Title 23, CFR 772, identifies four exclusively exterior NAC land use categories, A, B, C, and E, one exclusively interior land use category, D, and two categories with no established NAC, F and G. A description of each NAC category is listed in Table 2 below.

TABLE 2 - FHWA NAC LAND USES			
Activity Category	Activity Criteria Leq(h)	Evaluation Location	Activity Description
A	57 dBA	Exterior	Land uses on which serenity and quiet are of extraordinary significance and serve an important public need. The preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 dBA	Exterior	Residential
C	67 dBA	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 dBA	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 dBA	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

Receptors in the vicinity of Barriers 13, 14 and 15 that were included in the FEIS analysis were field verified in February 2011 to determine if they should remain active receptors. In other words, each receptor was evaluated to ascertain whether there was still a structure with some sort of exterior activity associated with it. Also, if determined to be active, the receptor was evaluated for the applicable activity category based on the current guidance from the state and Federal policy (see Table 2). The area was also examined for additional receptors located within the 500 ft. from edge of pavement analysis limits. This process resulted in the addition of 21 new receptors to the re-evaluation. As illustrated in Table 3 below, the majority of these receptors, 17, were Category B land use activities, but also included one receptor that qualified as a Category C activity. Additionally, Category F receptors, which includes those receptors with no identified exterior activity were noted in field observations and included in the analysis, but were not factored into the actual barrier evaluation. That is, they were neither considered to be

impacted or benefited due to the lack of an exterior activity. There were three Category F receptors identified as part of this re-evaluation.

TABLE 3 - RECEPTORS ADDED TO BARRIER RE-EVALUATION			
Receptor ID	Description	NAC Category	Affected Barrier
A	Residence at 19774 Ruth Avenue	B	15
B	Residence at 19789 Ruth Avenue	B	15
C	Residence at 60143 St. Joseph Street	B	15
D	Residence at 60171 St. Joseph Street	B	15
E	Residence at 19852 Johnson Street (Vacant)	B	13
F	Residence at 19842 Johnson Street	B	13
G	Residence at 19809 Hildebrand Street	B	13
H	Residence at 19808 Hildebrand Street	B	13
I	Residence at 19813 Yoder Street	B	13
J	Residence at 19822 Yoder Street	B	13
K	Residence at 60129 St. Joseph Street	B	15
L	Residence at 19831 Dice Street	B	13
M	Residence at 19826 Dice Street	B	13
N	Playground of the Southlawn Academy Preschool / Southern United Methodist Church	C	13
O	Residence at 19845 Pulling Street	B	13
P	Residence at 60305 Main Street	B	14
Q	Residence at 160 Ritter Street	B	14
R	Residence at 20023 Ritter Street	B	
S	Commercial – Communication Company of South Bend	F	14
T	Commercial – Farm Credit Services	F	14
U	Commercial - AAA Federal Credit Union	F	13

As illustrated in Table 3 above, the majority of the receptors that were added to the re-evaluation were associated with Barrier 13. However, it should be noted that in all instances, with the exception of the three Category F and one Category C receptors, the added receptors represented third or fourth row residences. The results of the re-evaluation to determine the feasibility and reasonableness of Barriers 13, 14 and 15 follow in Section 5.

The re-evaluation was completed using the FHWA's approved model for predicting noise levels associated with highway projects, *Traffic Noise Model, Version 2.5* (TNM). TNM generated noise emission levels for the proposed project, which are reported in decibels (dBA), and compared against the NAC thresholds identified in Table 2 to determine whether a receptor is impacted. As defined in the *Indiana Department of Transportation Traffic Noise Analysis Procedures (2011)*, a traffic noise impact occurred if one of the following criteria is found to be true:

- Predicted dBA levels approach (within 1 dBA) or exceed the NAC identified in Table 2, or

- Predicted dBA levels substantially exceed the existing ambient levels (at least 15 dBA above the existing conditions).

A more detailed discussion on the receptors impacted by the project is discussed below. The location of each receptor in relation to the project is also identified on the illustrations included in Appendix A.

5.0 Re-Evaluation Results

Consideration of measures to mitigate or abate traffic noise impacts must be afforded if impacted receptors have been identified in the analysis area. In order for abatement to be seriously considered and implemented into the project it must undergo scrutiny to determine if it is both feasible and reasonable to construct. The definition of feasible and reasonable is identified in the *Indiana Department of Transportation Traffic Noise Analysis Procedures (2011)*, but is summarized below.

Noise abatement is **feasible** if it meets all of the following conditions:

Engineering Feasibility:

- Engineering considerations to determine if a particular form of abatement can actually have an effect on the traffic noise levels at a receptor. These considerations include topography, drainage, barrier height, utilities, safety and access / maintenance needs control.

Acoustic Feasibility:

- A majority (greater than 50%) of the impacted receptors achieve a 5 dBA reduction in noise.

The **reasonableness** of noise abatement is based on a measured design goal for noise abatement, cost effectiveness and views of impacted receptors:

Design Goal:

- A majority of the impacted first row receptors achieve at least a 7 dBA reduction in noise.

Cost Effectiveness:

- The estimated cost of constructing a noise barrier does not exceed \$25,000 per benefited receptor. In those cases where a majority of the development (more than 50%) was in place prior to construction of the highway, a barrier is considered cost-effective if the estimated cost does not exceed \$30,000 per benefited receptor.

Views of the Impacted and/or Benefited Receptors:

- A majority (more than 50%) of the impacted or benefited receptors must affirm support for the prescribed mitigation.

The results of the re-evaluation of Barriers 13, 14 and 15 are discussed in the following sections. However, the locations of the evaluated receptors and barriers are illustrated on the “Re-Evaluation of Noise Impacts and Barrier Abatement” map contained in Appendix A.

5.1 Barrier 13:

A total of 31 receptors were included in the analysis of Barrier 13, including 10 additional residences and one business (Category F receptor) that were not evaluated in the FEIS (see Table 4). The FEIS identified 9 receptors in this common noise environment that were impacted by the project in that predicted levels approached or exceeded the NAC. By including the current design data in this re-evaluation, which added vertical elevations to the roadway, receptors and barriers, the number of impacted receptors reduced to three.

TABLE 4 – SUMMARY OF BARRIER 13 RE-EVALUATION

Receptor ID	NAC Land Use Cat.	NAC Leq(h)	Design Year Prediction (dBA)	With Barrier		Impacted ⁽¹⁾	Benefited ⁽²⁾
				Calculated Leq(h)	Reduction (dBA)		
659	B	67	62	57	5	No	Yes
660	B	67	61	56	5	No	Yes
661 ^(†)	F	--	N/A	N/A	N/A	N/A	N/A*
664	B	67	60	54	6	No	Yes
665 ^(†)	C	67	62	55	7	No	Yes*
669	B	67	61	54	7	No	Yes*
673 ^(†)	B	67	61	54	7	No	Yes*
674	B	67	59	52	7	No	Yes*
680 ^(†)	F	--	N/A	N/A	N/A	N/A	N/A*
682	B	67	61	54	7	No	Yes*
684	B	67	63	57	6	No	Yes*
685	B	67	62	54	8	No	Yes*
687	B	67	63	55	8	No	Yes*
688	B	67	65	56	9	No*	Yes*
689 ^(†)	B	67	69	58	11	Yes*	Yes*
691 ^(†)	B	67	66	58	8	Yes*	Yes*
692	B	67	64	56	8	No	Yes*
693	B	67	63	56	7	No	Yes*
699	B	67	63	57	6	No	Yes*
704 ^(†)	B	67	66	59	7	Yes*	Yes*
E	B	67	61	59	2	No	No
F	B	67	60	58	2	No	No
G	B	67	62	58	4	No	No
H	B	67	61	56	5	No	Yes
I	B	67	62	56	6	No	Yes
J	B	67	61	54	7	No	Yes
L	B	67	60	53	7	No	Yes
M	B	67	58	52	6	No	Yes
N ^(†)	C	67	62	55	7	No	Yes
O	B	67	59	53	6	No	Yes
U ^(†)	F	--	69	--	--	--	--
Re-Evaluation Total (Count "Yes")						3	25

1 – Receptors under this heading with an "*" were identified in the FEIS as being impacted by the Project.

2 – Receptors under this heading with an "*" were identified in the FEIS as receiving a benefit (reduction of 5 dBA or more) from the insertion of the barrier.

† – Designates a first row receptor.

Several barrier configurations were considered as part of the re-evaluation in an attempt to determine whether it was still a feasible and reasonable form of abatement to the receptors it was originally found to benefit. The variation of Barrier 13 that provided a benefit to the most receptors was approximately 2,179 ft. and varied in height from 6 ft. to 20 ft. At an estimated cost of \$1,075,045 (using a conservative estimate of \$30 per square foot), this barrier benefited

25 receptors for a cost/benefit of \$43,002 per benefited receptor. The results of the analysis of this barrier are shown in Table 4 above, while the details of the barrier are included in Appendix C.1.

Feasibility:

The receptors associated with Barrier 13 are adjacent to a highway that will be limited access. Aside from the nearest interchanges at Kern Road and US 20, the US 31 route will be devoid of local access points, such as commercial and residential drives and at-grade intersections with US 31. The topography in the area of Barrier 13 is level and there is no known unique drainage, barrier height, utility or safety issues that would preclude consideration of a barrier at this location. Additionally, as illustrated in Table 4 above, all three of the impacted receptors identified in this common noise environment were found to benefit from the insertion of Barrier 13. That is, a majority of the impacted receptors evaluated along with Barrier 13 were found to have at least a 5 dBA reduction in their predicted noise levels. Therefore, Barrier 13 satisfied the criteria for engineering and acoustic feasibility. It should be noted that, although not impacted, Barrier 13 provided a benefit to an additional 22 receptors.

Reasonableness:

In terms of achieving the reasonableness design goal, there are nine first row receptors associated with this common noise environment, three of which were determined to be impacted by the project. All three of the impacted first row receptors would receive at least a 7 dBA reduction in noise levels from the insertion of Barrier 13. As a majority of the first row impacted receptors would receive at least a 7 dBA reduction in noise, the design goal for reasonableness was met. However, as discussed above, the cost to construct this barrier was estimated at \$1,075,045 and provided a benefit to 25 receptors at \$43,002 per benefited receptor. This cost ratio exceeds the cost effectiveness criteria established by *Indiana Department of Transportation Traffic Noise Analysis Procedures (2011)*. Therefore, Barrier 13 was not determined to be a reasonable form of mitigation and will not be given further consideration.

5.2 Barrier 14:

A total of 20 receptors were included in the analysis of Barrier 14, including three additional residences and two businesses (Category F receptors) that were not evaluated in the FEIS (see Table 5). The FEIS identified five receptors in this common noise environment that were impacted by the project in that predicted levels approached or exceeded the NAC. By including the current design data in this re-evaluation, which added vertical elevations to the roadway, receptors and barriers, the number of impacted receptors reduced to three.

TABLE 5 – SUMMARY OF BARRIER 14 RE-EVALUATION

Receptor ID	NAC Land Use Cat.	NAC Leq(h)	Design Year Prediction (dBA)	With Barrier		Impacted ⁽¹⁾	Benefited ⁽²⁾
				Calculated Leq(h)	Reduction (dBA)		
713 ^(†)	B	67	64	64	0	No*	No
728 ^(†)	B	67	67	60	7	Yes*	Yes*
729	B	67	63	58	5	No	Yes*
731 ^(†)	B	67	64	58	6	No	Yes*
734 ^(†)	B	67	64	58	6	No	Yes*
737 ^(†)	B	67	66	59	7	Yes*	Yes*
742 ^(†)	B	67	64	58	6	No	Yes*
743 ^(†)	B	67	64	59	5	No	Yes*
749 ^(†)	B	67	64	59	5	No	Yes*
1295	B	67	59	58	1	No	No
1296	B	67	59	58	1	No	No
1297	B	67	59	58	1	No	No
1298	B	67	60	58	2	No	No
1299	B	67	59	55	4	No	No
1302	B	67	57	55	2	No	No
P	B	67	60	60	0	No	No
Q ^(†)	B	67	66	66	0	Yes	No
R	B	67	58	58	0	No	No
S	F	--	72	--	--	--	--
T	F	--	71	--	--	--	--
Re-Evaluation Total (Count "Yes")						3	8

1 – Receptors under this heading with an "*" were identified in the FEIS as being impacted by the Project.

2 – Receptors under this heading with an "*" were identified in the FEIS as receiving a benefit (reduction of 5 dBA or more) from the insertion of the barrier.

† – Designates a first row receptor.

Several barrier configurations were considered as part of the re-evaluation in an attempt to determine whether it was still a feasible and reasonable form of abatement to the receptors it was originally found to benefit. The variation of Barrier 14 that provided the best shielding for the insertion cost was approximately 896 ft. and varied in height from 6 ft. to 20 ft. At an estimated cost of \$472,232 (using a conservative estimate of \$30 per square foot), this barrier benefited eight receptors for a cost/benefit of \$59,029 per benefited receptor. The results of the analysis of this barrier are shown in Table 5 above, while the details of the barrier are included in Appendix C.2.

Feasibility:

The receptors associated with Barrier 14 are adjacent to a highway that will be limited access. Aside from the nearest interchanges at Kern Road and US 20, the US 31 route will be devoid of local access points, such as commercial and residential drives and at-grade intersections with US 31. The topography in the area of Barrier 14 is level and there is no known unique drainage, barrier height, utility or safety issues that would preclude consideration of a barrier at this

location. Additionally, as illustrated in Table 5 above, two of the three impacted receptors identified in this common noise environment were found to benefit from the insertion of Barrier 14. That is, a majority of the impacted receptors evaluated along with Barrier 14 were found to have at least a 5 dBA reduction in their predicted noise levels. Therefore, Barrier 14 satisfied the criteria for engineering and acoustic feasibility. It should be noted that, although not impacted, Barrier 14 provided a benefit to an additional six receptors.

Reasonableness:

In terms of achieving the reasonableness design goal, there are nine first row receptors associated with this common noise environment, three of which were determined to be impacted by the project. Two of the three impacted first row receptors would receive at least a 7 dBA reduction in noise levels from the insertion of Barrier 14. As this constitutes a majority of the first row impacted receptors receiving at least a 7 dBA reduction in noise, the design goal for reasonableness was met. However, as discussed above, the cost to construct this barrier was estimated at \$472,232 and provided a benefit to eight receptors at \$59,029 per benefited receptor. This cost ratio exceeds the cost effectiveness criteria established by *Indiana Department of Transportation Traffic Noise Analysis Procedures (2011)*. Therefore, Barrier 14 was not determined to be a reasonable form of mitigation and will not be given further consideration.

5.3 Barrier 15:

A total of 17 receptors were included in the analysis of Barrier 15, including five additional residences that were not evaluated in the FEIS (see Table 6). The FEIS identified six receptors in this common noise environment that were impacted by the project in that predicted levels approached or exceeded the NAC. By including the current design data in this re-evaluation, which added vertical elevations to the roadway, receptors and barriers, the number of impacted receptors reduced to two.

TABLE 6 – SUMMARY OF BARRIER 15 RE-EVALUATION

Receptor ID	NAC Land Use Cat.	NAC Leq(h)	Design Year Prediction (dBA)	With Barrier		Impacted ⁽¹⁾	Benefited ⁽²⁾
				Calculated Leq(h)	Reduction (dBA)		
712 ^(†)	B	67	68	63	5	Yes*	Yes
718	B	67	60	54	6	No	Yes*
719	B	67	63	56	7	No	Yes*
720 ^(†)	B	67	65	57	8	No*	Yes*
723	B	67	61	57	4	No	No*
724	B	67	62	57	5	No	Yes*
725 ^(†)	B	67	64	57	7	No*	Yes*
738 ^(†)	B	67	65	58	7	No*	Yes*
739	B	67	61	57	4	No	No*
740	B	67	64	58	6	No*	Yes*
746 ^(†)	B	67	66	60	6	Yes*	Yes*
747	B	67	62	58	4	No	No*
A	B	67	59	55	4	No	No
B	B	67	59	55	4	No	No
C	B	67	59	55	4	No	No
D	B	67	59	53	6	No	Yes
K	B	67	58	54	4	No	No
Re-Evaluation Total (Count "Yes")						2	10

1 – Receptors under this heading with an "*" were identified in the FEIS as being impacted by the Project.

2 – Receptors under this heading with an "*" were identified in the FEIS as receiving a benefit (reduction of 5 dBA or more) from the insertion of the barrier.

† – Designates a first row receptor.

Only one configuration of Barrier 15 was considered as part of this re-evaluation. This variation of Barrier 15 was approximately 1,741 ft. and varied in height from 8 ft. to 18 ft. At an estimated cost of \$751,970 (using a conservative estimate of \$30 per square foot), this barrier benefited 10 receptors for a cost/benefit of \$75,197 per benefited receptor. The results of the analysis of this barrier are shown in Table 6 above, while the details of the barrier are included in Appendix C.3.

Feasibility:

The receptors associated with Barrier 15 are adjacent to a highway that will be limited access. Aside from the nearest interchanges at Kern Road and US 20, the US 31 route will be a devoid of local access points, such as commercial and residential drives and at-grade intersections with US 31. The topography in the area of Barrier 15 is level and there is no known unique drainage, barrier height, utility or safety issues that would preclude consideration of a barrier at this location. Additionally, as illustrated in Table 6 above, both impacted receptors identified in this common noise environment were found to benefit from the insertion of Barrier 15. That is, a majority of the impacted receptors evaluated along with Barrier 15 were found to have at least a 5 dBA reduction in their predicted noise levels. Therefore, Barrier 15 satisfied the criteria for

engineering and acoustic feasibility. It should be noted that, although not impacted, Barrier 15 provided a benefit to an additional eight receptors.

Reasonableness:

In terms of achieving the reasonableness design goal, there are five first row receptors associated with this common noise environment, two of which were determined to be impacted by the project. Only one of the two impacted first row receptors would receive at least a 7 dBA reduction in noise levels from the insertion of Barrier 15. As a majority of the first row impacted receptors did not receive at least a 7 dBA reduction in noise, the design goal for reasonableness was not met. Therefore, Barrier 15 was not determined to be a reasonable form of mitigation and will not be given further consideration. However, even if the design goal were achieved the cost to construct this barrier was estimated at \$751,970 and provided a benefit to 10 receptors at \$75,197 per benefited receptor. This cost ratio exceeds the cost effectiveness criteria established by *Indiana Department of Transportation Traffic Noise Analysis Procedures (2011)* and would have also excluded Barrier 15 from further consideration.

6.0 Public Involvement

A public open house was held at the Jackson Intermediate Center on May 17, 2011. A table was made available to attendees where the results of the re-evaluation of Barriers 13, 14 and 15 were presented. Approximately 350 people attended the open house. Several attendees that reside within the area of Barrier 13, 14 or 15 visited the noise station and inquired about the possibility including noise walls. The barrier analysis process was explained to these individuals, as well as the reasons for which the barriers were not being given further consideration. A few people also inquired as to whether provisions could be made to improve the insulating characteristics of their home as a form of interior noise abatement. The people making this inquiry were informed that interior noise abatement is not commonly considered for residential properties, but rather for other types land use activities (such as churches). No comments on the noise re-evaluation were received following the open house. The materials and handouts that were made available to the public at this information meeting are included in Appendix D.

7.0 Statement of Likelihood

Based on the studies thus far accomplished, the INDOT has not identified any locations where noise abatement is likely. Noise abatement at these locations is based upon preliminary design costs and design criteria. Noise abatement has been found to be feasible, but is not reasonable as the allowable cost per benefited receptor of \$25,000 is exceeded for Barriers 13 and 14. Likewise, Barrier 15, while determined feasible, is not a reasonable form of abatement as it did not satisfy the reasonableness design criteria of providing at least a 7 dBA reduction to a majority of the first row receptors. A reevaluation of the noise analysis will occur during final design if it has been determined that elements of the preferred alternative, i.e. the horizontal or

vertical alignment, have substantially changed. If during final design it has been determined that conditions have changed such that noise abatement is feasible and reasonable, abatement measures might 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.