



5.8 Highway Noise

The evaluation of highway noise impacts anticipated for each of the alternatives was conducted in accordance with the FHWA’s “Highway Traffic Noise Analysis and Abatement: Policy and Guidance” and INDOT’s Noise Policy using TNM 2.5 software.

Predicted Noise Impacts

No-Build Alternative

Under the No-Build scenario, the increased traffic volumes along the existing US 31 would continue to impact all front row receivers within 200 to 300 feet of the centerline depending upon location. No-Build traffic volumes and speed data for the year 2030 are included in Appendix J-1. The TNM 2.5 analysis using 2030 traffic forecasts indicates L_{eq} noise levels along US 31 would range from 55.7 to 79.1 dBA, and that approximately 535 of the 771 modeled sites would experience L_{eq} noise levels approaching or exceeding the 67 dBA Category B NAC (Appendix J-2). This represents an additional 69 sites to those currently estimated as impacted along existing US 31. Again, the majority of such impacts occur from Lakeville north up to US 20 at South Bend; however, local concentrations of residences which would continue to experience increased highway noise levels along US 31 also occur between Michigan Street and Lakeville at LaPaz and several crossroad intersections. Figure 5.8.15 illustrates the number of sensitive receivers with predicted L_{eq} levels of 66 dBA or above for the design year 2030 relative to the base year 2002.

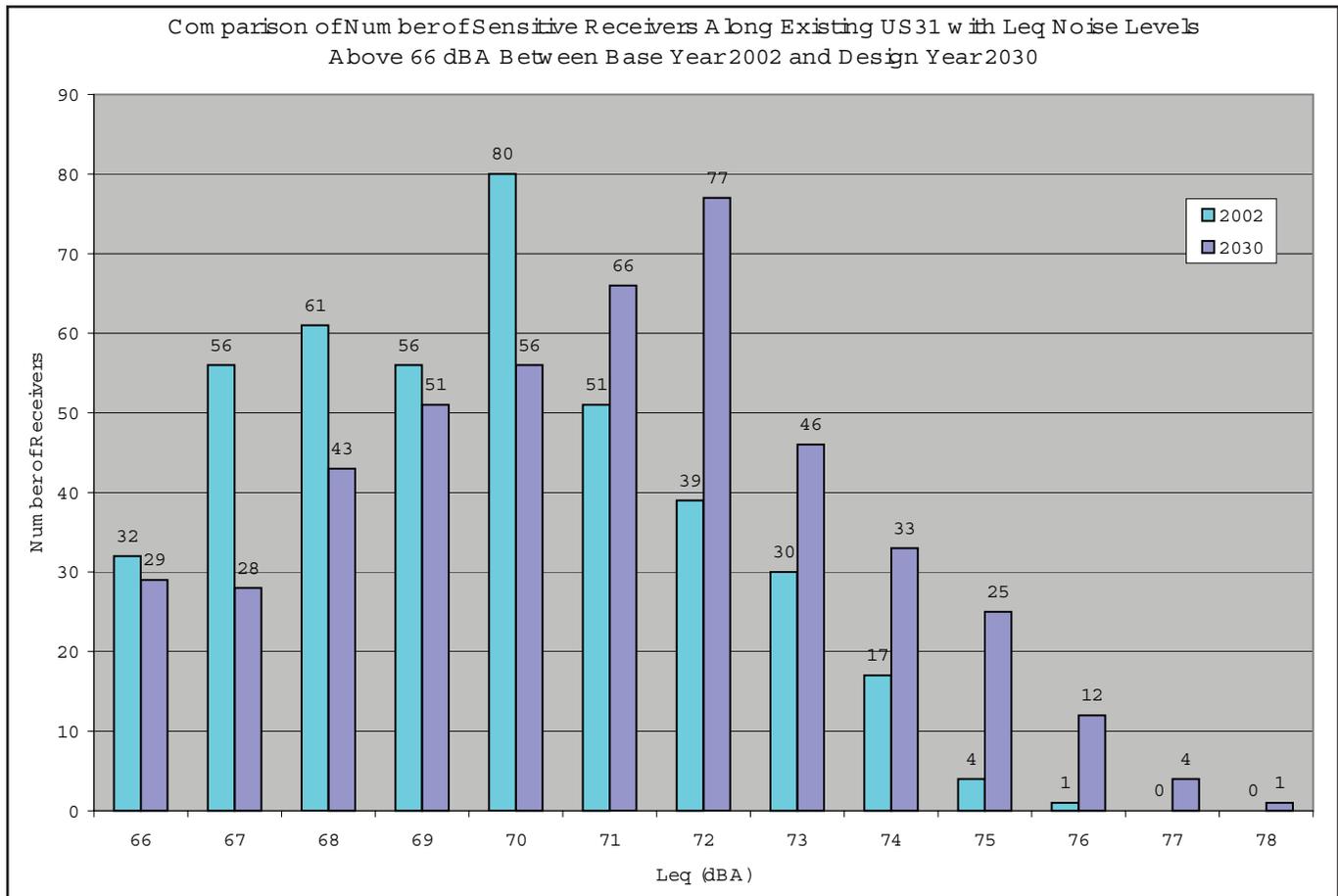


Figure 5.8.15 Comparison of Number of Sensitive Receivers Along Existing US31 with L_{eq} Noise Levels Above 66 dBA Between Base Year 2002 and Design Year 2030



Build Alternatives

This section highlights those areas along each proposed build alternative where highway noise impacts are anticipated. In accordance with INDOT Traffic Noise Policy, a noise impact occurs when one or both of the following criteria are met.

- 1) The predicted design year hourly L_{eq} approaches or exceeds the appropriate noise abatement criteria (NAC) indicated in Table 5.8.25. Approach means that the future levels are higher than 1 dBA $L_{eq}(h)$ below the appropriate NAC.
- 2) The predicted design year hourly L_{eq} substantially exceeds existing noise levels. Substantially exceeds means that predicted levels are 15 dBA or more above existing levels.

Appendix J-1 includes traffic volumes and speed data used in the TNM 2.5 modeling for each alternative. Figure 5.8.16 illustrates the number of residential sensitive noise receiver impacts predicted for each of the study alternatives based on the Category B 67 dBA NAC and the substantial increase (>15 dBA) criteria. Table 5.8.25 summarizes the number and location where highway traffic noise impacts are predicted for each of the alternatives for the year 2030.



Figure 5.8.16 Comparison of Build Alternative Predicted Noise Impacts for 2030



Table 5.8.25. Summary of Predicted Highway Noise Impacts for US 31 Build Alternatives

Location	Alt. Cs	Alt. Es	Alt. G-Cs	Preferred Alt. G-Es
Maple Road, 2A Road, 2C Road	6 residences	6 residences	6 residences	6 residences
1B Road	1 residence	1 residence		1 residence
Tyler Road			1 residence	1 residence
Lilac Road	1 residence	1 residence		
Old US31 at Lakeville	1 residence	1 residence		
Osborne Road	1 residence	1 residence	1 residence	1 residence
US31		1 residence	12 residences	9 residences
Southern Acres subdivision		3 residences		
Sun Communities MHP	30 residences			
Roosevelt Road and vicinity	1 business	7 residences	13 residences	7 residences
Johnson Road to Kern Road (includes Sycamore Hills and Whispering Hills subdivisions)	17 residences		9 residences	
Kern Road		2 residences		2 residences
Gilmer Street		1 residence		1 residence
West of Alternative Es and GEs from Gilmer Street to Jackson Road		8 residences		8 residences
West of US31 from Jewell Avenue to Jackson Road	6 residences		6 residences	
East of Alternatives Es and GEs from Dice Street to Southeast Little League and Jackson Fields		15 residences 2 businesses		13 residences 1 business
East of US31 from Jewell Avenue to Jackson Road	3 residences		3 residences	
Baneberry subdivision	5 residences		6 residences	
Southeast Little League and Jackson Fields	2 baseball fields 2 soccer fields	2 baseball fields 2 soccer fields	2 baseball fields 2 soccer fields	2 baseball fields 2 soccer fields
Reasor Road	7 residences	4 residences	7 residences	4 residences
Business US31 south of Ireland Road		1 business		1 business
Residential Total	78 residences	51 residences	64 residences	53 residences
Business Total	1 business	3 businesses	none	2 businesses
Recreation Total	2 baseball fields 2 soccer fields			



Alternative Cs

Predicted L_{eq} noise levels for 373 sites modeled along Alternative Cs range from 55.5 to 69.8 dBA (Appendix J-3). The Alternative Cs analysis included sites along the US 31/US 20 bypass between Ireland Road to the west and Miami Road to the east. The 2030 design year analysis concluded that noise levels would approach or exceed the 67 dBA NAC, or result in a substantial increase (>15 dBA) at 78 single-family residences throughout the project area for this alternative. Seven of the residential impacts occur in rural Marshall County, six of which occur along Maple Road, 3A Road and 2C Road where predicted values were >15 dBA over existing L_{eq} noise levels. The majority of the remaining 71 impacted receivers are located in St. Joseph County, primarily in five localized areas. Alternative Cs passes immediately east of Sun Communities mobile home park along Locust Road. An ambient measurement of 46 dBA along the eastern edge of this community indicates that a substantial increase of >15 dBA would occur when noise levels begin to exceed 61 dBA. Based on this analysis, 61 dBA levels would be experienced up to 390 feet from the centerline and encompass 30 residential units within the mobile home park. Further north, a second grouping of 17 impacted receivers occurs between Johnson Road and Kern Road where the alignment passes through the western portion of the Whispering Hills subdivision and the eastern portion of Sycamore Hills subdivision. Ambient measurements of 44 to 48 dBA indicate that a substantial increase would be experienced at 59 to 63 dBA. Within the Baneberry Hills subdivision south of US 20/US 31 and west of Linden Road, predicted noise levels at five residences at the ends of cul-de-sacs would be between 66 and 70 dBA. Base year modeling indicates that three of these currently meet the Category B NAC. Because Alternative Cs proposes alignment and configuration changes for the existing interchange between US 31 and US20, noise sensitive receivers between Ireland Road and Jewel Road, and east along US 20 as far as Miami Road were also assessed for impact. With predicted L_{eq} levels of 67 to 68 dBA, the seven residences on Reasor Road north of US 20 will continue to experience noise levels at or above the Category B 67 dBA NAC. In addition, six first row receivers along the west side of US 31 and three along the east side of US 31 between Jackson and Jewel are expected to experience decreases of 3 to 4 dBA, yet would still experience predicted levels of 67 to 70 dBA, equal to or above the Category B NAC. One rural business site on Roosevelt Road would experience L_{eq} levels of 62.0 dBA, representing a substantial increase.

In addition to residences and the one business identified, portions of the Southeast Little League and Jackson Fields nearest to US 20 east of Fellows Street are predicted to continue experiencing highway noise levels in excess of the 67 dBA NAC. Design year results predict levels up to 69 dBA for the baseball fields and as much as 74 dBA at the soccer fields.

By substantially removing the through traffic currently on US 31 between 4A Road in Marshall County and Jewel Road in southern South Bend, the residual local traffic expected to use existing US 31 would be reduced to the point where highway noise impacts are only anticipated at very few locations. Of the 702 noise receivers modeled along US 31 between 4A Road and Jewel Road, only four are still predicted to meet the NAC of 67 dBA for residences or 72 dBA for businesses. Noise reductions along this portion of US 31 are predicted to range from just 2 dBA to as much as 16 dBA with a mean and median of 10.2 and 10.1 dBA respectively.

Alternative Es

Predicted L_{eq} noise levels for 280 sites modeled along Alternative Es range from 53.7 to 74.9 dBA (Appendix J-3). At the northern terminus, the Alternative Es analysis included sites along the US 20 bypass from the US 31 interchange east to Miami Road. The 2030 design year analysis for this alignment predicted L_{eq} noise level impacts (>67 dBA or substantial) at 51 single-family residences. For Marshall County, the residential noise impacts are the same as those described for Alternative Cs, including the six residences in the vicinity of the Maple Road and 3A Road intersection. In St. Joseph County, this alignment avoids impacts to the Sun Communities mobile home park off of Locust Road, the Whispering Hills and Sycamore Hills subdivisions between Johnson Road and Kern Road, and the



Baneberry Hills subdivision south of US 20 and west of Linden Road described for Alternatives Cs and G-Cs. The Alternative Es alignment does however pass through the western end of the Southern Acres subdivision north of Madison Road resulting in several displacements. Three of the remaining westernmost residences of this neighborhood are predicted to experience L_{eq} levels between 63 and 67 dBA representing a substantial increase and/or levels approaching or equaling the Category B NAC. Further north at Roosevelt Road, seven residences (four to the west and three to the east of the proposed alignment) are expected to experience a substantial increase in highway noise based on an existing ambient measurement of 45 dBA. North of the proposed Kern Road interchange Alternative Es converges back onto the existing US 31 alignment. Additional right-of-way anticipated for the reconstruction of this segment of US 31 will displace several of the existing first row receivers and establish other residences as new first row receivers. On the east side of Alternative Es north of Dice Street, including the area southeast of the US 31/US 20 interchange up to the Southeast Little League fields, there are 15 residential receivers predicted to meet the 67 dBA NAC. To the west of Alternative Es between Gilmer Street and Jewel Street, eight residences are also predicted to meet the 67 dBA NAC. The extension of Fellows Street over US 20 to provide local access is currently expected to require the displacement of three residences along Reasor Street north of US20. The four remaining residences to the east of the proposed overpass are predicted to experience L_{eq} levels between 68 and 69 dBA, above the Category B NAC. Additional single or paired residential impacts (67 dBA criteria and/or substantial increase) are predicted on Lilac Road, Old US 31 at Lakeville, Osborne Road, US 31, Kern Road and Gilmer Street. Three businesses along US 31, two to the south of US20 and one to the north would also be impacted based on the Category C NAC of 72 dBA.

As indicated for Alternative Cs, portions of the Southeast Little League and Jackson Fields nearest to US 20 east of Fellows Street are predicted to continue experiencing highway noise levels in excess of the 67 dBA NAC. Design year results predict levels up to 69 dBA for the baseball fields and as much as 74 dBA at the soccer fields.

The diversion of traffic off of existing US 31 onto Alternative Es between 4A Road in Marshall County and Kern Road in St. Joseph County will result in greatly reduced highway noise levels along the existing facility. The residual local traffic expected to use existing US31 is expected to result in L_{eq} levels between 43 and 68 dBA for the 600 receiver sites modeled within 800 feet of the centerline. Of these, only four residences along US 31 south of Roosevelt Road are predicted to experience L_{eq} levels of 66 dBA or greater. Noise reductions along this portion of US31 are predicted to range from 0 dBA to as much as 15 dBA with a mean and median of 9.8 and 10.0 dBA respectively.

Alternative G-Cs

Predicted L_{eq} noise levels for 371 sites modeled along Alternative G-Cs range from 55.1 to 67.6 dBA (Appendix J-3). The Alternative G-Cs analysis included sites along the US 31/US 20 bypass between Ireland Road to the west and Miami Road to the east. The 2030 design year analysis concluded that noise levels would approach or exceed the 67 dBA NAC, or result in a substantial increase (>15 dBA) at 64 single-family residences along this alternative. Six of the residential impacts occur in rural Marshall County, all of which along Maple Road, 3A Road and 2C Road where predicted values were >15 dBA over existing L_{eq} noise levels. The majority of the remaining 59 residential sites predicted to experience highway noise impacts occur at six localized areas in St. Joseph County. Alternative G-Cs crosses existing US 31 just south of Roosevelt Road resulting in predicted impacts to six residences along the east side of US 31 and six along the west side of US 31. The 66 to 71 dBA L_{eq} noise levels predicted at these sites include noise emanating from residual traffic on existing US31 as well as from the new alignment. Progressing north, an estimated 13 residences along or in the vicinity of the Roosevelt Road crossing would experience levels that equal or exceed the 67 dBA criteria or represent a substantial increase over existing levels. Within the Whispering Hills subdivision, an estimated eight residential sites are predicted to experience L_{eq} levels between 61 and 72 dBA resulting in substantial increases over existing and/or exceeding the 67 dBA NAC. A ninth residential site west of the



alignment between Johnson Road and Kern Road is also predicted to experience a substantial increase. Within the Baneberry Hills subdivision south of US 20/US 31 and west of Linden Road, predicted noise levels for six residences at the ends of cul-de-sacs are between 66 and 70 dBA. Base year modeling indicates that three of these currently meet the Category B NAC. As with Alternative Cs, Alternative G-Cs proposes alignment and configuration changes for the existing interchange between US 31 and US 20, therefore noise sensitive receivers between Ireland Road and Jewel Road, and east along US 20 as far as Miami Road were also assessed for impact. Anticipated highway noise impacts for this alignment are the same as those described for Alternative Cs: the seven residences on Reasor Road north of US 20 will continue to experience noise levels at or above the Category B 67 dBA NAC with predicted L_{eq} levels of 67 to 68 dBA, six first row receivers along the west side of US 31 and three along the east side of US 31 between Jackson and Jewel are expected to experience decreases of 3 to 4 dBA, yet would still experience predicted levels of 68 to 71 dBA, in excess of the Category B NAC. No business site impacts are predicted for this alternative.

The Southeast Little League and Jackson Fields nearest to US20 east of Fellows Street are predicted to continue experiencing highway noise levels in excess of the 67 dBA NAC. Design year results for Alternative G-Cs scenario predict levels up to 69 dBA for the baseball fields and as much as 73 dBA at the soccer fields.

The diversion of traffic off of existing US31 onto Alternative G-Cs between 4A Road in Marshall County and Jewel Road in southern South Bend, will result in greatly reduced highway noise levels along the existing facility. Of the 678 noise receivers modeled along US31 between 4A Road and Jewel Road, 33 residences were still predicted to meet the NAC of 67 dBA NAC. Noise reductions along this portion of US 31 are predicted to range from 0 dBA to as much as 15 dBA with a mean and median of 8.2 and 8.5 dBA respectively.

Preferred Alternative G-Es

Predicted L_{eq} noise levels for 310 sites modeled along Alternative G-Es range from 51.0 to 74.8 dBA (Appendix J-3). Maps in Appendix J show the location of all modeled sites (impacted and non-impacted) for the Alternative G-Es analysis. At the northern terminus, the Alternative G-Es analysis included sites along the US 20 bypass from the US 31 interchange east to Miami Road. The 2030 design year analysis concluded that noise levels would approach or exceed the 67 dBA NAC, or result in a substantial increase (>15 dBA) at 53 single-family residences along this alternative. Seven of the residential impacts occur in rural Marshall County, six of which are along Maple Road, 3A Road and 2C Road where predicted values were >15 dBA over existing L_{eq} noise levels. In St. Joseph County, this alignment avoids impacts to the Sun Communities mobile home park off of Locust Road, the Whispering Hills and Sycamore Hills subdivisions between Johnson Road and Kern Road, and the Baneberry Hills subdivision south of US20 and west of Linden Road described for Alternatives Cs and G-Cs, as well as the western end of the Southern Acres subdivision described for Alternative Es. The majority of the 47 residential sites predicted to experience highway noise impacts in St. Joseph County occur at five localized areas. Alternative G-Es crosses existing US 31 just south of Roosevelt Road resulting in predicted impacts to five residences along the east side of US 31 and four along the west side of US 31. The 67 to 71 dBA L_{eq} noise levels predicted at these sites include noise emanating from residual traffic on existing US 31 as well as from the new alignment. Progressing north, an estimated seven residences (four to the east and three to the west of the proposed alignment) along or in the vicinity of the Roosevelt Road crossing would experience levels that equal or exceed the 67 dBA criteria or represent a substantial increase over existing levels. North of the proposed Kern Road interchange Alternative G-Es converges back onto the existing US 31 alignment and results in the same highway noise impacts as Alternative G-Es. Additional right-of-way anticipated for the reconstruction of this segment of US 31 will displace several of the existing first row receivers and establish other residences as new first row receivers. On the east side of Alternative G-Es north of Dice Street, including the area southeast of the US 31/US 20 interchange up to the Southeast Little League fields, there are 13 residential receivers predicted to meet the 67 dBA NAC. To the west of Alternative G-Es between Gilmer Street and Jewel Street, eight residences are also predicted to meet the 67 dBA NAC. The extension of Fellows Street over US 20 to provide local access is currently expected to require the displacement of three residences along Reasor Street



north of US 20. The four remaining residences to the east of the proposed overpass are predicted to experience L_{eq} levels between 68 and 69 dBA, above the Category B NAC. Additional single or paired residential impacts (67 dBA criteria and/or substantial increase) are predicted on 1B Road, Tyler Road, off US31, Kern Road, and Gilmer Street. Two businesses along US 31, one to the south of US 20 and one to the north, would also be impacted based on the Category C NAC of 72 dBA.

The Southeast Little League and Jackson Fields nearest to US 20 east of Fellows Street are predicted to continue experiencing highway noise levels in excess of the 67 dBA NAC. Design year results for Alternative G-Es scenario predict levels up to 69 dBA for the baseball fields and as much as 73 dBA at the soccer fields.

The diversion of traffic off of existing US 31 onto Alternative G-Es between 4A Road in Marshall County and Kern Road in St. Joseph County will result in greatly reduced highway noise levels along the existing facility. The residual local traffic expected to use existing US 31 is expected to result in L_{eq} levels between 43 and 67 dBA for the 580 receiver sites modeled within 800 feet of the centerline. Of these, only seven residences along US 31 south of Kern Road are predicted to experience L_{eq} levels of 66 dBA or greater. Noise reductions along this portion of US 31 are predicted to range from 0 dBA to as much as 16 dBA with a mean and median of 10.2 and 10.7 dBA respectively.

Preferred Alternative Abatement Consideration

INDOT Policy considers the following measures for the abatement of highway noise where an impact has been identified:

- Traffic control measures (TCM) – Includes reduced speed limits, prohibiting heavy truck traffic, etc.
- Alteration of vertical and horizontal alignment – Includes raising or lowering a roadway profile to alter the acoustic setting between roadway and receiver, and/or shifting the alignment away from receiver(s) to increase the distance over which highway noise must travel.
- Acquisition of buffering land – Involves the purchase of land along a highway facility, thus precluding future development into an area where noise impacts would occur.
- Noise insulation of impacted receivers – Generally reserved as an option for public offices or facilities (e.g. libraries)
- Construction of traffic noise barriers – The use of earthen berms or structural walls to alter the pathway of sound between roadway and receiver, thus reducing its energy at the receiver. This is the most common means of noise abatement employed in Indiana.

Given the purpose and need of the project and the functional classification of the proposed facility, the use of traffic control measures is not considered prudent for Preferred Alternative G-Es. Although a horizontal shift of the alignment may locally reduce noise levels at specific receivers below the NAC, such shifts generally only result in additional noise impacts elsewhere by moving the alignment closer to other receivers. At this time the vertical alignment of the roadway relative to impacted receivers is not known. However, due to the relatively flat terrain of the project area, changing the vertical alignment is only expected to result in minor reductions. This would need to be explored in greater detail during the design phase of the project. The acquisition of buffering land is not justified for this project, nor is the need for noise insulation. The remainder of this section addresses the “feasibility” and “reasonableness” of abatement using traffic noise barrier walls at various locations along Preferred Alternative G-Es where predicted 2030 impacts have been identified.



An analysis of noise barrier performance was performed at 18 sites using TNM 2.5. Barriers were comprised of 200 feet long segments with a maximum height of 20 feet. Total cost was based on \$20.00 per square foot. The feasibility of the barrier was based on whether it is structurally and acoustically possible to attenuate traffic noise occurring at a receiver by at least 5 dBA $L_{eq}(h)$. Since at this stage of the design process sufficient detail is lacking to completely address the structural feasibility of any proposed barrier, it is assumed that it would be possible to construct all barriers evaluated. According to INDOT policy, “reasonable” means that abatement of traffic noise impacts is prudent based on consideration of all the following factors:

1. The number of benefited receivers, those for whom the mitigation will benefit by at least 5 dBA $L_{eq}(h)$ at the noisiest hour conditions. This number is not necessarily the number of receivers impacts.
2. The cost of abatement on a benefited receiver basis and on a project level basis. The INDOT has set the acceptable cost per benefited receiver range as \$20,000 - \$30,000. This cost should be arrived at by applying a square footage cost basis on the square footage of the noise barrier.
3. The severity of existing and future traffic noise level. The absolute level and the increase of the future noise are two aspects with which to assess the severity of the noise impacts.
4. The timing of development near the project. The state considers it appropriate to give more consideration for development that occurs before initial highway construction.
5. The views of noise impacted residents. Potential negative impacts of noise barriers include unsightliness, shortened daylight, poor air circulation, degradation by weather, reduced safety, vandalism, and restriction of access for emergency vehicles.

Table 5.8.26 summarizes the results of the analysis for the 18 barrier sites along Preferred Alternative G-Es. The length, height, cost, number of benefited receivers and cost per benefited receiver are based on an optimal barrier solution that provides a minimum of 5 dBA abatement to the greatest number of residences possible, but at the lowest cost per benefited receiver possible. The severity of impact at each barrier site was determined based on the difference between the predicted noise level and the existing noise level compared to the difference between the predicted noise level and the appropriate noise abatement criteria (Appendix J).

Each of the 18 barrier analysis sites are evaluated in terms of the “reasonableness” criteria as follows:

Site 1 (Maple Road south of 3A Road) – Two of the five residences along Maple Road are predicted to experience L_{eq} levels greater than 15 dBA over existing levels, resulting in a severity of impact rating of “severe”. The remaining three residences fall into the “moderate” class. All five of the residences were constructed before the US 31 EIS was initiated. An optimal barrier 1200 feet long ranging from 11 to 15 feet in height is predicted to provide ≥ 5 dBA noise reduction at only one residence, thus resulting in a cost per benefited receiver of \$344,043. It is assumed that impacted and benefited receivers at this location would be favorable to highway noise mitigation in the form of a barrier wall. Although a barrier is likely feasible, such a barrier is capable of only achieving the goal of 5 dBA reduction at one receiver, and is therefore not considered to be likely reasonable.

Site 2 (3A Road) - One of the two residences along 3A Road are predicted to experience L_{eq} levels greater than 15 dBA over existing levels, resulting in a severity of impact rating of “severe”. The remaining residence is classified as “moderate”. Both residences were constructed before the US 31 EIS was initiated. A short barrier 400 feet long and 17 feet tall is predicted to provide ≥ 5 dBA noise reduction for only one residence with a cost per benefited receiver of \$136,022. It is assumed that impacted and benefited receivers at this location would be favorable to highway noise mitigation in the form of a barrier wall. Although a barrier is likely feasible, such a barrier is capable of only achieving the goal of 5 dBA reduction at one receiver and at a cost of 4.5 times the INDOT criteria. Therefore, such a barrier is not considered to be likely reasonable.



Table 5.8.26. Summary of Barrier Performance Assessment for Preferred Alternative G-Es

ID	Location	NAC	No. Impacted	No. Analyzed	No. Benefited	Benefit Range (dBA)	Length	Height	Cost	Cost Per Benefited Receiver	Severity of Impact	Feasible	Reasonable
1	East side of Alt G-Es along Maple Road	67	2	5	1	5	1200	11-15	\$344,043	\$344,043	Severe = 2 Moderate = 3	Yes	No
2	West side of Alt G-Es along 2A Road	67	1	2	1	5	400	17	\$136,022	\$136,022	Severe = 1 Moderate = 1	Yes	No
3	West side of Alt G-Es along Maple Road and 2C Road	67	3	3	3	5	2000	10-15	\$560,046	\$186,682	Severe = 3	Yes	No
4	East side of Alt G-Es along 1B Road	67	1	3	3	5 - 8	800	17	\$271,951	\$90,650	Severe = 1 Moderate = 2	Yes	No
5	West side of Alt G-Es along Tyler Road	67	1	1	1	5	200	8	\$32,008	\$32,008	Severe = 1	Yes	No
6	West side of Alt G-Es along Osborne Road	67	1	3	1	5	400	8	\$64,005	\$64,005	Moderate = 1 No Impact = 2	Yes	No
7	West side of Alt G-Es along existing US 31	67	5	13	0	No Barrier Solution					Minor = 2 No Impact = 11	No	No
8	East side of Alt G-Es along existing US 31	67	5	8	2	5	800	8-10	\$144,031	\$72,015	Minor = 1 No Impact = 7	Yes	No
9	West side of Alt G-Es along Roosevelt Road	67	3	4	3	5 - 9	1200	8-19	\$344,008	\$144,669	Severe = 3 Moderate = 1	Yes	No
10	East side of Alt G-Es along Roosevelt Road and west end of Weller Heights subdivision	67	4	44	11	5 - 12	2400	18-20	\$888,031	\$80,730	Severe = 4 Moderate = 16 Minor = 4 No Impact = 20	Yes	No
11	West side of Alt G-Es off of Gilmer Street	67	1	1	1	5	800	10-11	\$172,010	\$172,010	Severe = 1	Yes	No
12	West side of Alt G-Es from Gilmer Street to Johnson Road	67	3	18	12	5 - 10	2212	8-12	\$769,654	\$64,137	Minor = 4 No Impact = 14	Yes	No
13	East side of Alt G-Es from Gilmer Street to Johnson Road	67	7	26	22	5 - 12	1856	12-15	\$493,433	\$22,428	Minor = 3 No Impact = 23	Yes	Yes
14	West side of Alt G-Es from Johnson Road to Jackson Road	67	5	19	10	5 - 10	800	14-19	\$267,792	\$26,779	Minor = 1 No Impact = 18	Yes	Yes
15	East side of Alt G-Es from Johnson Road to Jackson Road	67	5	15	11	5 - 11	1400	8-16	\$364,005	\$33,180	Minor = 4 No Impact = 11	Yes	Yes
16	East side of Alt G-Es/US 20 interchange from Jackson Road to Southeast Little League baseball fields	67	2	13	7	5 - 10	1280	16-17	\$427,063	\$61,009	Minor = 2 No Impact = 11	Yes	No
17	Southeast Little League and Jackson Fields	67	See Discussion Below								Moderate = 4 Minor = 2 No Impact = 7	Yes	No
18	Northeast side of Alt G-Es/US 20 interchange along Reasor Street	67	4	4	4	5 - 6	800	9-10	\$151,998	\$36,999	No Impact = 4	Yes	No

Red shaded cells indicate locations where optimized barrier does not meet \$30,000 reasonableness criteria.

Yellow shaded cells indicate locations where optimized barrier is slightly above the \$30,000 reasonableness criteria.

Green shaded cells indicate locations where optimized barrier is within the \$30,000 reasonableness criteria.

Site 3 (Maple Road and 2C Road) – All three of the residences at this location are predicted to experience L_{eq} levels greater than 15 dBA over existing levels, resulting in a severity of impact rating of “severe”. Each were constructed before the US 31 EIS was initiated. An optimal barrier 2000 feet long ranging from 10 to 15 feet tall is predicted to provide ≥ 5 dBA noise reduction for all three residences at a cost per benefited receiver of \$186,682. It is assumed that impacted and benefited receivers at this location would be favorable to highway noise mitigation in the form of a barrier wall. Although a barrier is likely feasible, and would potentially benefit all three receivers, the cost per benefited receiver is six times the \$30,000 INDOT criteria, and is therefore not considered to be likely reasonable.



Site 4 (1B Road) – One of the three residences at this location are predicted to experience L_{eq} levels greater than 15 dBA over existing levels, resulting in a severity of impact rating of “severe”. The remaining two are classified as “moderate”. All three residences were constructed before the US 31 EIS was initiated. An optimal barrier 800 feet long and 17 feet tall is predicted to provide ≥ 5 dBA noise reduction for all three residences at a cost per benefited receiver of \$90,650. It is assumed that impacted and benefited receivers at this location would be favorable to highway noise mitigation in the form of a barrier wall. Although a barrier is likely feasible, and would potentially benefit all three receivers, the cost per benefited receiver is three times the \$30,000 INDOT criteria, and is therefore not considered to be likely reasonable.

Site 5 (Tyler Road) – The single impacted residences at this location is predicted to experience L_{eq} levels greater than 15 dBA over existing levels, resulting in a severity of impact rating of “severe”. This residence was constructed before the US 31 EIS was initiated. A short 200 foot long and 8 feet tall barrier is predicted to provide ≥ 5 dBA noise reduction for this residence at a cost per benefited receiver of \$32,008. It is assumed that this resident(s) would be favorable to highway noise mitigation in the form of a barrier wall. Such a barrier is likely feasible, and has a cost per benefited receiver only slightly above the \$30,000 INDOT criteria; however, it is not currently considered to be likely reasonable as abatement for a single receiver.

Site 6 (Osborne Road) - One of the three residences west of Alternative G-Es along Osborne Road are predicted to experience L_{eq} levels greater than 66 dBA, resulting in a severity of impact rating of “moderate”. The remaining two residences are classified as “no impact”. All three residences were constructed before the U S31 EIS was initiated. A short barrier 400 feet long and 8 feet tall is predicted to provide ≥ 5 dBA noise reduction only for the single impacted residence at a cost per benefited receiver of \$64,005. It is assumed that the resident(s) at this location would be favorable to highway noise mitigation in the form of a barrier wall. Although a barrier is likely feasible, such a barrier is capable of only achieving the goal of 5 dBA reduction at only one receiver and at a cost per benefited receiver twice that of the INDOT criteria. Therefore, barrier wall abatement is not considered to be likely reasonable.

Site 7 (West side of Alternative G-Es along US31 and Whitmer Road) – Five of the 13 residences west of Alternative G-Es along US 31 are predicted to experience L_{eq} levels greater than 66 dBA. Two have a severity of impact rating of “minor” with the remainder classed as “no impact”. All thirteen residences were constructed before the US 31 EIS was initiated. An assessment of barrier performance along the west side of Alternative G-Es did not yield a barrier solution with a height less than or equal to 20 feet in which a ≥ 5 dBA noise reduction was predicted for any of the residences included in the analysis. This inability to abate traffic noise by 5 dBA at this site is attributed in part to the effect of the residual traffic anticipated along existing US31. Based on this TNM 2.5 analysis, abatement is not currently considered to be likely feasible since a 5 dBA reduction would not be achievable; therefore, reasonableness criteria for cost per benefited receiver was not applied.

Site 8 (East side of Alternative G-Es along US31) – Five of the eight residences at this location are predicted to experience L_{eq} levels greater than 66 dBA, resulting in a severity of impact rating of “minor” for one residence and “no impact” for the remaining seven. All eight residences were constructed before the US 31 EIS was initiated. An optimal barrier 800 feet long ranging in height between 8 and 10 feet is predicted to provide ≥ 5 dBA noise reduction for only two residences at a cost per benefited receiver of \$72,015. It is assumed that impacted and benefited receivers at this location would be favorable to highway noise mitigation in the form of a barrier wall. Although a barrier is likely feasible, such a barrier is predicted to only benefit two residences and at a cost of 2.4 times the \$30,000 INDOT criteria. Therefore, barrier wall abatement is not considered to be likely reasonable.

Site 9 (West side of Alternative G-Es along Roosevelt Road) – Three of the four residences at this location are predicted to experience L_{eq} levels greater than 66 dBA and/or L_{eq} levels greater than 15 dBA over existing levels, resulting in a severity of impact rating of “severe”. The fourth residence is classified as “moderate”. All eight residences were constructed before the US 31 EIS was initiated. An optimal barrier 1200 feet long ranging in height



between 8 and 19 feet is predicted to provide ≥ 5 dBA noise reduction for all three residences at a cost per benefited receiver of \$144,669. It is assumed that impacted and benefited receivers at this location would be favorable to highway noise mitigation in the form of a barrier wall. Although a barrier is likely feasible, and would potentially benefit all three impacted receivers, the cost per benefited receiver is 4.8 times the \$30,000 INDOT criteria, and is therefore not considered to be likely reasonable.

Site 10 (East side of Alternative G-Es along Roosevelt Road and west end of Weller Heights subdivision) – Four of the 44 residences at this location (i.e. within 800 feet of the proposed centerline) are predicted to experience L_{eq} levels greater than 66 dBA and/or L_{eq} levels greater than 15 dBA over existing levels, resulting in a severity of impact rating of “severe”. The remaining 40 residences have severity of impact ratings of “moderate” (16 homes), “minor” (4 homes) or “no impact” (20 homes). All 44 residences were constructed before the US 31 EIS was initiated. An optimal barrier 2400 feet long ranging in height between 8 and 20 feet is predicted to provide ≥ 5 dBA noise reduction for eleven residences at a cost per benefited receiver of \$80,730. It is assumed that impacted and benefited receivers at this location would be favorable to highway noise mitigation in the form of a barrier wall. Although a barrier is likely feasible, and would potentially benefit eleven first row receivers, the cost per benefited receiver is 2.7 times the \$30,000 INDOT criteria, and is therefore not considered to be likely reasonable.

Site 11 (West side of Alternative G-Es off of Gilmer Street) – A single residence accessed off of Gilmer Street is predicted to experience L_{eq} levels greater than 15 dBA over existing levels, resulting in a severity of impact rating of “severe”. This residence was constructed before the US 31 EIS was initiated. An optimal barrier 800 feet long ranging in height between 10 and 11 feet is predicted to provide ≥ 5 dBA noise reduction for eleven residences at a cost per benefited receiver of \$172,010. It is assumed that impacted and benefited receiver at this location would be favorable to highway noise mitigation in the form of a barrier wall. Although a barrier is likely feasible, such a barrier is capable of only achieving the goal of 5 dBA reduction at only one receiver and at a cost per benefited receiver 5.7 times that of the INDOT criteria. Therefore, the use of a barrier for abatement is not considered to be likely reasonable.

Site 12 (West side of Alternative G-Es from Gilmer Street to Johnson Road) – Three out of 18 residences at this location are predicted to experience L_{eq} levels equal to or greater than 66 dBA. Four residences have a severity impact rating of “minor” with the remaining 14 classed as “no impact”. All residences were constructed before the US 31 EIS was initiated. An optimal barrier 2212 feet long ranging in height between 8 and 12 feet is predicted to provide ≥ 5 dBA noise reduction for 12 residences at a cost per benefited receiver of \$64,137. It is assumed that impacted and benefited receiver at this location would be favorable to highway noise mitigation in the form of a barrier wall. Although such a barrier is likely feasible, and is capable of achieving the goal of 5 dBA reduction at 12 receivers, the cost per benefited receiver is still twice that of the INDOT criteria. Therefore, the use of a barrier for abatement is not considered to be likely reasonable.

Site 13 (East side of Alternative G-Es from Gilmer Street to Johnson Road) – Six out of 20 residences and Southlawn Church are predicted to experience L_{eq} levels equal to or greater than 66 dBA, and one out of 5 businesses in this area are expected to experience L_{eq} levels equal to or greater than 71 dBA. Three residences have a severity impact rating of “minor” with the remaining 23 classed as “no impact”. All residences, businesses and Southlawn Church were constructed before the US 31 EIS was initiated. An optimal barrier 1856 feet long ranging in height between 12 and 15 feet is predicted to provide ≥ 5 dBA noise reduction for 16 residences and six businesses between Gilmer Street and Johnson Road at a cost per benefited receiver of \$22,428. It is assumed that the 16 impacted and/or benefited residential receivers and Southlawn Church at this location would be favorable to highway noise mitigation in the form of a barrier wall; however, the businesses may view the structure as an impairment to visibility from the highway. Such a barrier is likely feasible, and although the severity of impact is generally low for the area, a barrier is capable of achieving the goal of 5 dBA reduction at several residential receivers and at a cost per benefited receiver below the INDOT criteria. Based on the preliminary results of this analysis, the use of a barrier for abatement is also considered to be likely reasonable.



Site 14 (West side of Alternative G-Es from Johnson Street to Jackson Road) – Five out of 19 residences are predicted to experience L_{eq} levels equal to or greater than 66 dBA, resulting in a severity of impact rating of “minor” for one residence and “no impact” for the remaining 18. All residences were constructed before the US 31 EIS was initiated. An optimal barrier 800 feet long ranging in height between 14 and 19 feet is predicted to provide ≥ 5 dBA noise reduction for 10 residences between Jewel Avenue and Johnson Road at a cost per benefited receiver of \$26,779. It is assumed that the 10 impacted and/or benefited residential receivers at this location would be favorable to highway noise mitigation in the form of a barrier wall. Such a barrier is likely feasible, and although the severity of impact is generally low for the area, a barrier is capable of achieving the goal of 5 dBA reduction at several residential receivers and at a cost per benefited receiver below the INDOT criteria. Based on the preliminary results of this analysis, the use of a barrier for abatement is also considered to be likely reasonable.

Site 15 (East side of Alternative G-Es from Johnson Street to Jackson Road) – Five out of 15 residences are predicted to experience L_{eq} levels equal to or greater than 66 dBA, resulting in a severity of impact rating of “minor” for four residences and “no impact” for the remaining eleven. All residences were constructed before the US 31 EIS was initiated. An optimal barrier 1400 feet long ranging in height between 8 and 16 feet is predicted to provide ≥ 5 dBA noise reduction for 11 residences between Jewel Avenue and Johnson Road at a cost per benefited receiver of \$33,090. It is assumed that the 11 impacted and/or benefited residential receivers at this location would be favorable to highway noise mitigation in the form of a barrier wall. Such a barrier is likely feasible, and although the severity of impact is generally low for the area and the cost per benefited receiver is slightly above the INDOT criteria, such a barrier is capable of achieving the goal of 5 dBA reduction at several residential receivers in this area. Based on the preliminary results of this analysis, the use of a barrier for abatement is therefore considered to be likely reasonable.

Site 16 (East side of Alternative G-Es/US20 Interchange from Jackson Road to Southeast Little League baseball fields) – Two out of 13 residences are predicted to experience L_{eq} levels equal to or greater than 66 dBA, resulting in a severity of impact rating of “minor”. The remaining eleven residences are classed as “no impact”. All residences were constructed before the US 31 EIS was initiated. An optimal barrier 1280 feet long ranging in height between 16 and 17 feet is predicted to provide ≥ 5 dBA noise reduction for seven residences at a cost per benefited receiver of \$61,009. It is assumed that the seven impacted and/or benefited residential receivers at this location would be favorable to highway noise mitigation in the form of a barrier wall. Although a barrier is likely feasible, and would potentially benefit seven residences, the overall severity of impact is low and the cost per benefited receiver is twice the INDOT criteria; therefore it is not considered to be likely reasonable.

Site 17 (Southeast Little League and Jackson Fields) - In addition to consideration of abatement at residences and businesses along Preferred Alternative G-Es alignment, a noise barrier analysis was also conducted for the Southeast Little League and Jackson Fields south of US 20 between the proposed Fellows Street extension and Miami Road. Noise receivers were modeled at the bleachers, dugouts and home plate for the two baseball fields closest to US 20, as well as along the northern sidelines of the two soccer fields to the east. Receiver points at a third baseball field between the aforementioned baseball fields and soccer fields were not modeled since only the outfield is closest to US 20. The analysis demonstrated that reductions of 5 to 12 dBA would be possible at these points through the use of two barrier walls of 8 to 10 feet high totaling 1,534 feet in length. This discontinuous wall configuration (one section for the baseball fields to the west and one for the soccer fields to the east) has an estimated cost of \$261,000. A continuous barrier wall with no gap between the two baseball fields and two soccer fields would be 2,124 feet in length and cost approximately \$360,000. Owing to the fact that these fields are only used for limited periods of time on a seasonal basis and the fact that a relatively quiet environment is not critical to the continued functional use of the facility, the construction of barrier walls to provide abatement for these recreational land uses does not appear to be reasonable, and is therefore not currently recommended.



Site 18 (Northeast side of Alternative G-Es/US20 interchange along Reasor Street) – All four residences east of the proposed Fellows Street overpass are predicted to experience L_{eq} levels equal to or greater than 66 dBA, but have a severity of impact rating of “no impact”. All residences were constructed before the US 31 EIS was initiated. A short optimal barrier 800 feet long ranging in height between 9 and 10 feet is predicted to provide ≥ 5 dBA noise reduction for all four residences along Reasor Street at a cost per benefited receiver of \$36,999. It is assumed that all four impacted and/or benefited residential receivers at this location would be favorable to highway noise mitigation in the form of a barrier wall. Although a barrier is likely feasible, such abatement would potentially benefit a small number of residences, the overall severity of impact is low and the cost per benefited receiver is approximately \$7,000 above the INDOT criteria. Based on the preliminary results of this analysis, the use of a barrier for abatement is therefore currently not considered to be likely reasonable, but should be given further consideration during the design phase.

The specific characteristics of the proposed barriers (i.e., placement, length, height) at Sites 13, 14, and 15 will be refined during the final design. If during final design conditions substantially change, the abatement measures might be proved to no longer be feasible and/or reasonable, in which case barrier wall(s) may 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.