4.8 Highway Noise

As Indiana's transportation system expands with new roadways and the traffic capacity of existing roadways increase, the communities through which these facilities run continue to be subjected to higher levels of highway related noise. Such intrusions have become a growing environmental concern, especially in high density urban settings and outlying urban/suburban areas where large numbers of residential properties along high volume Interstates and highways are routinely affected.

The FHWA requires that all states have an approved policy to identify and address highway traffic noise impacts. INDOT's noise policy (INDOT, 1997) was developed to implement the requirements of 23 CFR 772 and the noise-related requirements of the National Environmental Policy Act of 1969 and received FHWA approval on October 15, 1997. The structure of the policy is based on FHWA's "Highway Traffic Noise Analysis and Abatement: Policy and Guidance" (USDOT, 1995) and focuses on seven principal elements briefly explained below.

A. Identification Levels

B. Identification of Traffic Noise Impacts

C. Identification and Consideration of Noise-Sensitive Land Uses

D. Determination of Existing Noise Levels

E. Prediction of Future Noise of Abatement

F. Consideration of Construction Noise

G. Coordination with Local Government Officials

Typically a highway noise study is designed to quantitatively analyze specific areas for noise impacts along one or more proposed Alternatives, each of which possess a clearly defined alignment with known horizontal and vertical geometry as well as a complete picture of the individual human occupied areas adjacent to the proposed roadway. The process begins by first identifying any and all locations where the proposed roadway would constitute an encroachment adjacent to developed and planned development areas involving human occupation.

The unit of measurement used in sound measurement is the decibel (dB). For traffic noise assessment the unit of measurement used is the A-weighted decibel scale (dBA), which most closely represents the response of the human ear to sound. The measurement most commonly used and adopted in Indiana is the Hourly Equivalent Sound Level, designated as $L_{eq}(h)$. This descriptor quantifies a noise-sensitive receiver's cumulative exposure from all noise-producing events over a one hour period.

Five Activity Categories described in Table 4.8.10 have been established by the FHWA to classify land use for the purposes of assessing impact and for the consideration of traffic noise abatement. The most common potential noise receiver anticipated for the US 31 project is the single family residence. However, schools, churches, public meeting centers, offices, and other types of properties frequented by people are also regarded as potential receiver sites in the US 31 study area. Although commercial businesses (typically assessed under Activity Category C) occur all along US 31 and achieve higher densities in southern South Bend, Lakeville, and LaPaz; these areas also have residential properties interspersed within the commercial operations. For this reason, the Category B criteria were used for the entire study area.

Table 4.8.10: Federal Highway Administration (FHWA) Noise Abatement Criteria (NAC)		
Activity Category	NAC, LAeq (h)	**Description of Activity Category**
A	57 dBA (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 dBA (exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches libraries, and hospitals.
C	72 dBA (exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	no NAC designated	Undeveloped lands.
E	52 dBA (interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums

The assessment of potential highway traffic related noise impacts is accomplished by comparing the predicted future noise levels to the appropriate Noise Abatement Criteria (NAC) and existing noise levels. According to FHWA and INDOT policy, a highway traffic noise impact occurs when either of the following conditions is experienced at a sensitive receiver:

- The future predicted L_{eq}(h) noise level approaches or exceeds the appropriate NAC indicated in Table 4.8.10. INDOT has defined "approach" as meaning within 1 dBA of the NAC.

- The future predicted L_{eq}(h) noise level substantially exceeds the existing ambient Leq(h) noise level. INDOT defines substantial as 15 dBA or greater. Traffic-generated noise level increases of 15 dBA or more are typically associated with roadway improvements involving new alignment in rural areas.

Prediction of future noise levels at sensitive receivers along proposed alternatives was conducted using the FHWA Traffic Noise Model (TNM 2.5) computer program. The model spatially simulates the 3-D geometry of the proposed roadway and receiver location relative to the roadway, and accepts variable input concerning traffic volume, vehicle speed, vehicle composition (cars, trucks, etc.), terrain and surrounding landscape cover. Noise levels were predicted for the outdoor living areas at each sensitive receiver using the worst traffic conditions likely to occur on a regular basis for the design year (2030).

Future traffic-generated noise levels were predicted for the Alternatives No-Build, Cs, Es, G-Cs and the Preferred Alternative G-Es. Since the proposed alternatives would be fully controlled access facilities, the traffic volume from one interchange to the next is fixed. Therefore the proposed interchanges were used to define the beginning and end of discrete traffic volume segments throughout each of the alternatives. Predicted hourly car and truck volumes for the year 2030 used in the analysis can be found in Appendix J Tables 1 through 5.

The roadways in TNM 2.5 were constructed using a typical divided 4-lane section with two 12 foot lanes in each direction and a 60 foot median. In conducting this analysis the following data input variables and conditions had to be assumed or set to the TNM 2.5 default:

- for the existing conditions and the No-Build Alternative, US 31 is the sole source of highway noise traffic (no crossroads or potential frontage roads were included)

- no shielding from building rows or tree zones

- default ground type = lawn
- relative humidity = 50%
- temperature = 68o F

To establish typical baseline ambient sound levels within the study area, 46 field measurements were taken throughout the US 31 study area between US 30 and US 20. Residential properties randomly scattered along the existing US 31 facility, as well as representative residences within 800 feet of the three study alternatives, were sampled using a Larson·Davis DSP82 Type 1L sound level meter (serial no. 0152) according to procedures set forth in "Measurement of Highway-Related Noise" (Lee & Fleming, 1996). Table 4.8.11 shows the recorded data for existing conditions. Sound sources such as chirping birds, distant barking dogs, farm equipment in the background, and the occasional car or truck passing along the rural road were not excluded from the sampling since these sources are considered a part of the ambient noise environment.

Table 4.8.11: Ambient Field Noise Measurements for US 31 Study Area

	Sample Site Location	US31	Alt. Cs	Alt. Es	Alt. G-Cs	Alt. G-Es (Preferred)	Leq(h)
1	US 31 @ Plymouth Goshen Trail	X	X	X	X	X	69.1
2	US 31 N. of Third Road	X					71.0
3	US 31 in LaPaz	X					72.3
4	US 31 S. of Riley Road	X					70.1
5	US 31 near Pleasant Lake in Lakeville	X	X	X			69.6
6	US 31 @ Monroe St. in Lakeville	X					69.1
7	US 31 @ Cabot St. in Colburn	X					71.3
8	US 31 S. of New Road	X					70.5
9	US 31 S. of Miller Road	X					69.8
10	US 31 N. of Roycroft Drive	X					74.7
11	US 31 S. of Roosevelt Road	X			X	X	69.6
12	US 31 @ Weller Avenue	X					71.4
13	US 31 @ Detroit Avenue in South Bend	X		X		X	73.9
14	Main St. & Pulling St. in South Bend	X		X		X	59.5
15	Jewell St. E. of US 31 in South Bend	X		X		X	63.1
16	Main St. north of Jackson Rd. in South Bend	X	X	X	X	X	56.0
17	Jackson Ave. @ Clara Ave. in South Bend	X	X	X	X	X	60.2
18	Ruth Ave. E. of US 31 in South Bend	X		X		X	64.3
19	Hush Breeze Ct. in Whispering Hills Subdiv.		X		X		48.4
20	Dunwoody Ct. in Whispering Hills Subdiv.		X		X		44.4
21	Clover Hill Ct. N. of Kern Rd.		X		X		44.6
22	Old Spanish Tr. S. of Kern Rd.		X		X		49.0
23	Barber MHP on Locust Rd.		X				53.2
24	Roosevelt Rd. W. of US 31			X	X	X	45.3
25	Sun Communities MHP on Locust Rd.		X	X			46.3

Table 4.8.11: Ambient Field Noise Measurements for US 31 Study Area (Continued)

	Sample Site Location	US31	Alt. Cs	Alt. Es	Alt. G-Cs	Alt. G-Es (Preferred)	Leq(h)
26	Madison Rd. W. of US 31		X	X			48.4
27	Miller Rd. E. of US 31				X	X	51.9
28	Kenilworth Rd. N. of Osborne Rd.				X	X	56.3
29	Osborne Rd. E. of Kenilworth Rd.				X	X	53.8
30	Osborne Rd. W. of US 31 in Colburn		X	X			52.1
31	SR 4 W. of Mangus Rd.		X	X			62.8
32	SR 4 E. of Kenilworth Rd.				X	X	56.9
33	Quinn Rd. E. of Kenilworth Rd.				X	X	54.3
34	Lake Tr. E. of Kenilworth Rd.				X	X	51.4
35	Lilac Rd. S. of Leeper Rd.		X	X			48.9
36	Lilac Rd. @ Rankert Rd.		X	X			49.2
37	Tyler Rd. W. of Lilac Rd.		X	X	X	X	50.5
38	Tyler Rd. E. of Lilac. Rd.				X	X	54.5
39	Kenilworth Rd. @ Rockstroh Rd.				X	X	55.0
40	First Rd. W. of Lilac Rd.		X	X	X	X	62.1
41	1B Rd. W. of Lilac Rd.		X	X	X	X	49.6
42	SR 6 W. of Lilac Rd.		X	X	X	X	60.2
43	Maple Rd. @ 3A Rd.		X	X	X	X	43.4
44	Southeast Little League baseball fields south of US20		X	X	X	X	68.1
45	Reasor Street N. of US20		X	X	X	X	70.8
46	Widner Lane N. of US20		X	X	X	X	65.6

Measurements taken at 15 properties along US 31 and US 20 ranged from 68.1 to 74.7 dBA, and therefore all exceeded the 67 dBA NAC under current conditions. Sampling of six residences near, but not along US 31 or US 20 in South Bend ranged from 56.0 to 65.6 dBA. Each of these, excluding the residence north of US 20 (#46), are not considered "first row" receivers (i.e., residences closest to the primary highway noise source), but have the potential to become "first row" receivers based on anticipated land acquisition and displacements to accommodate the proposed right-of-way through this portion of South Bend. The 25 suburban and rural measurements taken at residences that would be located adjacent to or near one or more of the proposed alternative alignments ranged from 43.4 to 62.8 dBA. The mean ambient sound level for the rural sites was 51.7 dBA, with a median level of 51.4 dBA.

Using TNM 2.5, L_{eq} noise levels at 835 receiver sites were modeled with base year 2002 traffic data. Under base year conditions, it is estimated that 488 of these sites (58%) currently experience traffic noise levels from US 31 that approach, equal, or exceed the Category B NAC of 67 dBA. These sites are generally scattered all along existing US 31 with the greatest concentrations occurring within and around LaPaz, Lakeville, the south side of South Bend and the several small high density communities at US 31 crossroads. The number of receiver sites within the 66 to 78 dBA range is illustrated in Figure 4.8.32.

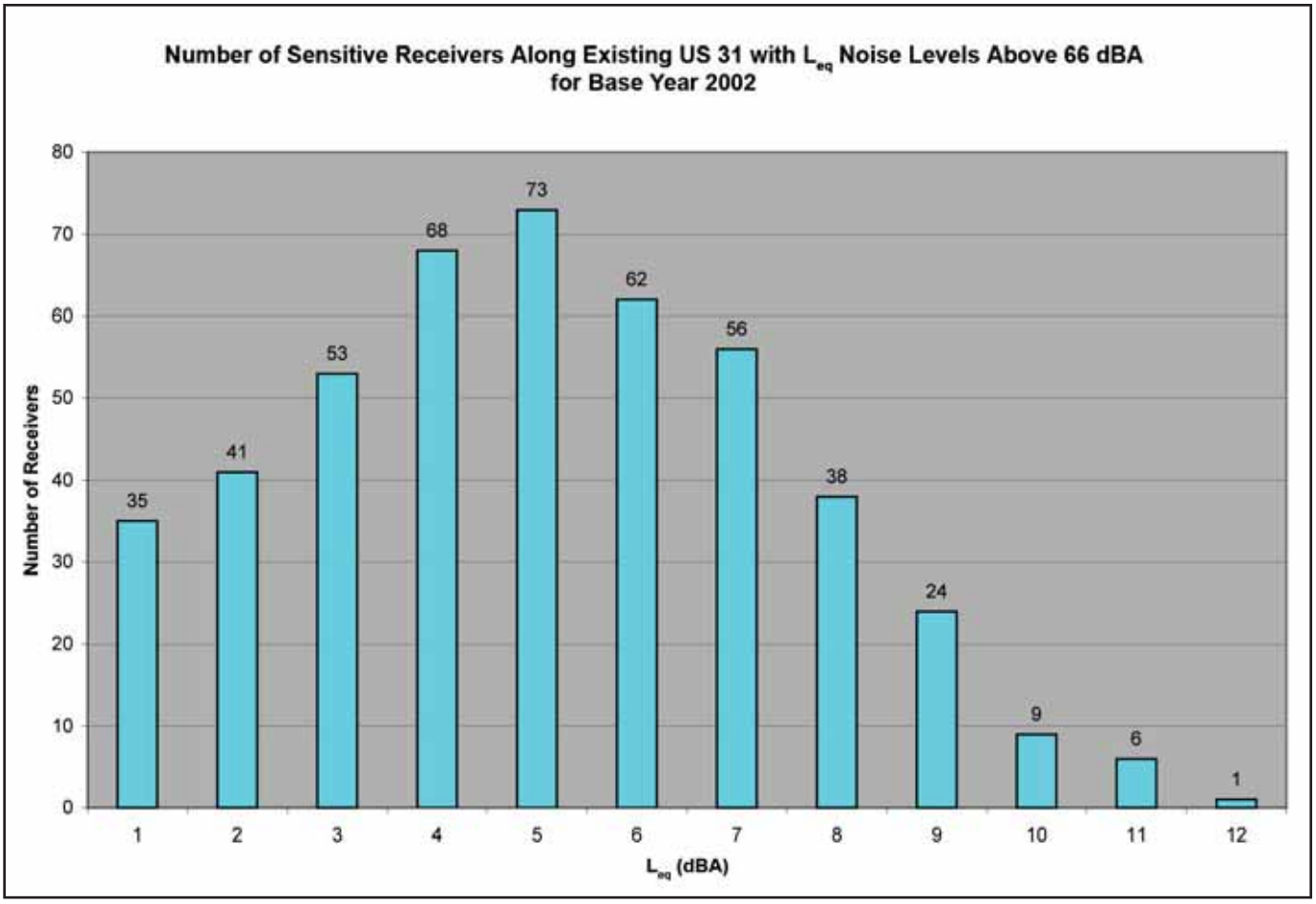

Figure 4.8.32: Number of Sensitive Receivers with L_{eq} Noise Levels Above 66 dBA for Base Year 2002

4.9 Natural Resources

4.9.1 Physiographic Regions

Physiographic regions are areas that have similar elevation, relief and related types of topographic features present. These regions provide a general view of the terrain of an area, and what resources are present. The entire US 31 Plymouth to South Bend Project study area is within the Northern Moraine and Lake Region. This region covers about the northern quarter of Indiana. The majority of the state's natural lakes are within this region. Most of these lakes are small, occurring at terminal moraines. A moraine is an accumulation of earth and stones carried forward and deposited by a glacier. There are numerous outwash and lacustrine (associated with lakes or ponds) plains, which are often characterized by wide marshes (many now drained), intersected by low sand ridges or knolls. Large, rugged moraines are common in this region (Mumford and Whitaker, 1982). Bogs and fens also occur in this portion of the state.

4.9.2 Natural Regions

A natural region is "a major, generalized unit of the landscape where a distinctive assemblage of natural features is present. It is part of a classification system that integrates several natural features, including climate, soils, glacial history, topography, exposed bedrock, pre-settlement vegetation, species composition, physiography, and plant and animal distribution to identify a natural region" (Homoya, et al, 1985). Natural regions are similar to physiographic regions, but whereas physiographic regions may give information on predominant topography and land use, natural regions give more information about the native plant and animal species of an area.

The majority of the study area is within the Northern Lakes Natural Region. A small portion of the northwest corner of the study area is within the Grand Prairie Natural Region. There are no alternatives that go through the Grand Prairie Natural Region, and for this reason, it will not be discussed in detail in this Section. Figure 4.9.33 shows the study area and the natural regions in this portion of the state.

The following natural region descriptions are from "The Natural Regions of Indiana," by Homoya et al. (1985).

> "There are numerous natural community types within the Northern Lakes Natural Region. They include: bogs, fens, marshes, prairie, sedge meadows, swamps, seep springs, lakes and various deciduous forest types. Oak and hickory species, especially red oak, white oak, black oak, shagbark hickory, and pignut hickory, dominate the dry and dry-mesic upland forests. Mesic sites characteristically have beech, sugar maple, black maple, and tulip tree as dominants. Floodplain forests typically include sycamore, American elm, red elm, green ash, silver maple, red maple, cottonwood, hackberry and honey locust. Swamp communities commonly border lake and bog sites where red maple, silver maple, green ash, American elm, black ash, and locally, yellow birch, are typical. Swamps dominated by black ash typically are associated with seep springs."

The Northern Lakes Natural Region is characterized by numerous freshwater lakes of glacial origin. Marsh communities are often associated with these lakes. Typical marsh species include swamp loosestrife, cattails, bulrush, marsh fern, marsh cinquefoil and sedges, notably *Carex stricta* and *C. lasiocarpa*. In deeper water, distinctive species such as spatterdock, watershield, fragrant water-lily, pickerelweed, hornwort, wild celery, pondweeds, Virginia arrow-arum and sedge occur. Figure 4.9.34 shows a wetland associated with Catfish Lake.

Bogs are more numerous in this natural region than any other. Bogs commonly consist of a floating mat of *Sphagnum* moss occupying a glacial depression. Characteristic bog plants include leatherleaf, cranberry, bog