Appendix 3: Noise Assessment Report

Noise Assessment Report

for

US 70: Beginning 6.4 miles East of SH 3 in Broken Bow and Extending East to the Oklahoma/Arkansas State Line

McCurtain County, Oklahoma

Prepared for:

Oklahoma Department of Transportation
200 N. E. 21st Street
Oklahoma City, OK 73105

Prepared by:

Carter-Burgess

July 2008

I. Introduction

This Noise Assessment Report investigates the noise impacts that could result from the proposed improvements to the US 70 corridor from 6.4 miles east of the junction of SH 3 in Broken Bow to the east of the Oklahoma/Arkansas state line in McCurtain County, Oklahoma. The proposed improvements include the expansion of the existing two-lane roadway facility to a four-lane roadway facility as described in the Environmental Assessment (EA) as Alternative No. 1.

The purpose of this document is to determine the noise impacts and the possible mitigation of any impacts. This will be achieved by using computer modeling to predict future noise levels using traffic projections for the design year. The report relies on design traffic data as provided to Oklahoma Department of Transportation (ODOT) Planning & Research Division and Traffic Engineering Consultants, Inc. The noise analysis was performed using TNMLook-Up Tables, a computer program based on the Federal Highway Administration's (FHWA) Transportation Traffic Noise Model 2.5, and compiles with the ODOT Policy Directive (*Highway Noise Abatement*).

II. Terminology

This noise analysis will discuss noise levels as L_{eq} (h). L_{eq} is defined as the steady state sound level that, in a stated period of time, contains the same acoustic energy as the time-varying sound level during the same period. Leq(h) is the hourly value of Leq. Leq(h) is based on the more commonly known decibel (dB) and the "A-weighted" decibel unit (dBA). Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore, an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. It is commonly measured in decibels and is expressed as "dB." This adjustment is called A-weighting and is expressed as "dBA."

Decibels are logarithmic units as opposed to the more common linear units. For example, temperature units of Fahrenheit and Celsius are linear. A two-degree increase is twice as much as a one-degree increase. However, in decibels, a three decibel increase from a noise source results in a doubling of sound energy, but not in the human perception of sound. Research indicates that, to an average listener, a 10 dBA increase is perceived as twice as loud. One dBA is the smallest change in sound level an average person can detect under ideal conditions. Usually, an observer cannot detect an increase in noise of three to four decibels if the increase takes place over several years.

III. Methodology

Traffic noise analysis consists of a comparison of physically measured or computer modeled noise levels for existing conditions with computer modeled noise levels for future conditions. FHWA's TNM software is used to model noise levels based on traffic data, roadway geometry, and receptor site locations. A receptor is a location usually representing a dwelling unit, where exterior human activity occurs, and modeled for noise levels and evaluated for noise impacts.

The FHWA has five noise activity categories based on land use and sound levels, each of which has its own Noise Abatement Criteria (NAC) as shown in **Table 1**. If a project would result in higher Leq(h) values than the NAC values for a given location, then noise abatement or mitigation measures must be evaluated. For locations where there is no outside human activity

(i.e., churches), interior noise levels can be determined using adjustment factors and compared to NAC for determining impacts. An impact occurs when, at a given receptor, future noise levels approach by one dBA, meet or exceed the FHWA NAC for its activity category, or when the future noise levels exceed existing noise levels by 15 dBA at a given receptor. Once an impact is identified, then noise abatement is considered for the impacted area. Only those areas for which mitigation is determined to be feasible and reasonable as defined by ODOT Policy Directive "Highway Noise Abatement" will be recommended.

Table 1. Federal Highway Administration Noise Abatement Criteria

Activity Category	L_{eq} Noise Level	Description Activity Category
A	57 (Exterior)	Tracts of land in which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of these qualities is essential if the area is to continue to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of parks, open spaces, or historic districts which are dedicated or recognized by appropriate local officials for activities requiring some requiring special qualities of serenity and quiet.
B	67 (Exterior)	Picnics areas, recreation areas, playgrounds, active sport areas, and parks which are not included in Category A and residences, motels, hotels, public meeting rooms, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties or activities not included in Categories A or B above.
D	--	Undeveloped lands.
E	52 (Exterior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: Federal Highway Administration

IV. Traffic Data

The unit of measurement for traffic on a highway is the average daily traffic (ADT), which is defined as the total volume of vehicles during a given time period (typically greater than one year), divided by the number of days in that time period. The design year ADT is the volume of traffic that is anticipated for the specified year. Design hourly volume (DHV) is the traffic count (vehicles per hour) and is used to model noise levels. The design year ADT for the US 70 project corridor is 2030. Project traffic volumes DHV are shown in Table 2. Locations are mapped in Figure 1.

Table 2. Projected 2030 Traffic Volumes

LOCATION	LOCATION DESCRIPTION	2030 ADT	2030 DHV	2030 DHV Factor	2030 (%) DHV Cars	2030 (%) DHV MT	2030 (%) DHV HT
1	¼ mile west of Mountain Fork River	7450	745	10%	(80%) 596	(7%) 52	(13%) 97
2	1 mile east of Mountain Fork River	7500	750	10%	(70%) 525	(21%) 158	(9%) 67
3	½ mile east of Eagletown Road	6400	640	10%	(75%) 480	(11%) 70	(14%) 90
4	½ mile west of Oklahoma/Arkansas state line	6000	600	10%	(70%) 420	(15%) 90	(15%) 90

Source: ODOT/Traffic Engineering Consultants

Noise analysis models the "worst hour for noise" which occurs when the highest volume (DHV) for an hour is combined with the highest speeds. The highest hourly traffic predicted to travel at the design speed of 65 mph is observed at Location 2, which illustrated vehicles per hour (vph) of 750. This volume of traffic will be used to model the "worst hour of the day" or peak hour traffic noise levels. To accurately model traffic, a breakdown of traffic vehicles and their speeds in modeled traffic is required and are also shown in Table 2. Worse case traffic conditions of peak hour traffic were used.

V. Identification of Receivers

Recent aerial photographs and field investigations were used to help identify possible noise sensitive receivers. Surrounding properties along the US 70 project corridor are characterized as mostly undeveloped (pastureland and woody vegetation) with sparsely scattered residences (single-family), small businesses (automotive, service stations, convenience stores, canoe rental facilities), and a wildlife refuge located along the project corridor boundaries. Approximately five rural communities were noted along the boundaries consisting of mixed-use [a combination of single-family homes (no more than three) and small businesses (no more than two)] within the same locality. Individual receivers (residence or business) were noted otherwise throughout the project corridor. Residential receivers located within the project vicinity are classified NAC Category B. The commercially developed land is classified as NAC Category C.

VI. Existing Noise Levels

Existing noise readings were determined using field measurements; seven measurements were taken near existing roadways at the existing right of way line. Existing noise readings were taken in April 2004. The exterior noise levels ranged between 66 to 71 dBA. There were no other sources that contribute to substantial background noise. Therefore, it is assumed for this analysis that noise levels for the design year is due to highway traffic. Measurements taken at the seven sensitive receivers and their locations are shown in Table 3. Measurement locations are illustrated in Figure 2.

Table 3. US 70 Project Corridor 2004 Existing Noise Levels

Measurement Number	Site Description	Existing Noise Level (dB)
1 (R1)	Eastbound roadway/Entrance for the Riverside Canoe Rental and Shuttle (just East of Mountain Fork Bridge)	69
2 (R2)	Eastbound roadway/Entrance for residential and commercial (Curtis Bryer Hydraulics Shop) just west of overflow structure	67
3 (R3)	Eastbound roadway/Approximately 11 miles east of Broken Bow, in front of single-family residences (commercial – Fina Station/K&K Country Store located just east of residences)	69
4	Eastbound roadway/Undeveloped Forested Area	71
5 (R4)	Westbound roadway/Convenience Store located just west of Oklahoma/Arkansas state line	70
6	Westbound roadway/Entrance of Three River Wildlife Management Area	68
7 (R5)	Westbound roadway/Entrance of Post Office	66

VII. Future Noise Levels

Future noise levels were modeled using the traffic data in Table 2. The "worst hour of noise" was observed at Location 2. Vehicle type at Location 2 was observed as 70 percent of the vehicles were cars, 21 percent were medium trucks, and nine percent were heavy trucks. Table 4 shows the predicted noise levels in 2030. The hourly equivalent sound level without a noise barrier ranges between 70 dBA and 76 dBA. Receiver locations are illustrated in Figure 3.

Table 4. US 70 Project Corridor 2030 Predicted Noise Levels

Receiver Location	Distance from Existing US 70 Centerline	NAC Category	NAC Level	2030 Predicted Noise Level (dB)	Increase +/- dBA	Noise Impact?	Comments
R1-Residential/EB, just east of Mountain Fork Bridge*	145	B	67	69.9	0.9	Yes	Exceed s NAC
R2-Commercial/EB, just west of overflow structure	110	C	72	71.1	4.1	Yes	Exceeds NAC
R3-Residence/EB approximately 11 miles east of Broken Bow*	140	B	67	70.1	1.1	Yes	Exceeds NAC
R4-Business/WB, just west of Oklahoma/Arkansas state line	71	C	72	73.0	3.0	Yes	Exceeds NAC
R5-Business/WB, Post Office	253	C	72	67.3	1.3	No	---

*Representative receiver located in a rural community consisting of mixed-use (single-family home/business) within one locality.

Predicted noise levels for the proposed project exceeded the NAC at four receiver locations. As indicated in Table 4, the proposed project would result in a traffic noise impact.

VIII. Noise Mitigation Options and Criteria

If a noise impact is anticipated, noise abatement must be considered. As indicated in Table 4, the proposed project will result in traffic noise impacts. Therefore, noise abatement measures were considered for the project. Four abatement measures were considered:

- Physical alteration of vertical and or horizontal alignment of the roadway
- Noise buffer zones by acquisition of undeveloped property
- Traffic Management
- Noise walls

Alteration of Horizontal and/or Vertical Alignments: Any alteration of the existing alignment would displace existing businesses and residences, require additional right-of-way and not be cost effective/reasonable.

Buffer Zone: The acquisition of sufficient undeveloped land adjacent to the highway project to preclude future development that could be impacted by highway traffic noise would not be cost effective/reasonable.

Traffic Management: Control devices could be used to reduce the speed of the traffic; however, the minor benefit of one dBA per five mph reduction in speed does not outweigh the associated increase in congestion and air pollution. Other measures such as time or use restrictions for certain vehicles are prohibited on state highways.

Noise Walls: This is the most commonly used noise abatement measure. However, for this project, a noise wall would severely restrict access to adjacent activity areas. Numerous gaps in the noise barrier for driveways and streets would satisfy access requirements but render the barrier ineffective (infeasible). Also, noise barriers could have a detrimental impact on nearby businesses by restricting views and access by potential customers. Finally, a noise barrier would not be cost effective for an individual receiver. Before any abatement measure can be incorporated into the project, it must be both feasible and reasonable. If a noise impact is anticipated, noise abatement must be considered. In order to be feasible, the measure should substantial reduce noise levels by at least seven dBA at impacted first row receivers; and to be reasonable it should not exceed $30,000 for each benefited receiver. A benefited receiver is a residential receptor that receives at least a five decibel reduction when compared to no mitigation and includes all residential receptors (not only first row receptors).

IX. Noise Abatement

Predicted noise levels for the proposed project exceeded the NAC at four receiver locations; therefore, noise barriers were analyzed for the project to determine if noise abatement was reasonable and feasible. For this project, a noise barrier would severely restrict access to a majority of the adjacent activity areas. Numerous gaps in the noise barrier would satisfy access requirements but would render the barrier ineffective (unfeasible). Also, noise barriers could have a detrimental impact on nearby businesses by restricting views and access by potential customers. Finally, a noise barrier would not be cost effective for an individual receiver. For these reasons as described, noise barriers would not be feasible or reasonable for R1 through R4. In addition, noise barriers would not be feasible or reasonable for representative receivers (represented by R1 and R3) located within the five identified communities along the project corridor consisting of mixed-use within one locality. No noise abatement measures are recommended for this project.

X. Information for Local Officials

Undeveloped land and natural lands are adjacent to the project. No known development is currently planned, designed or programmed in these areas. There is no NAC for undeveloped land; however, to avoid noise impacts that may result from future development of properties adjacent to the project, local officials responsible for land use control programs should ensure, to the maximum extent possible, no new activities are planned or constructed along or within the predicted (2030) noise impact contours shown in Table 5.

Table 5. 2025 Noise Contour Lines

Location	66 dB (Category B)	71 dB (Category C)
US 70 project corridor	325 feet from centerline*	110 feet from centerline*

* Distance calculated from the centerline of the eastbound and westbound roadways.

On the date of approval of the EA document (Date of Public Knowledge), which includes this noise assessment, FHWA and ODOT are no longer responsible for providing noise abatement for new development adjacent to the project.A copy of this traffic noise analysis will be provided to local officials to ensure, to the maximum extent possible, future developments are planned, designed and programmed in a manner that will avoid traffic noise impacts.

XI. Construction Noise

The ODOT "Highway Noise Abatement" Policy Directive states that any special noise sensitive land uses or activities will be identified which maybe affected by construction noise from the proposed project, and any special measures, which are feasible and reasonable will be added to the project plans and specifications.

Noise associated with the construction of the project is difficult to predict. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are more tolerable. None of the receivers is expected to be exposed to construction noise for a long duration; therefore, any extended disruption of normal activities is not expected.

XII. Conclusions

Traffic noise impacts have been examined for the proposed reconstruction of US-70 east of Broken Bow to the Oklahoma/Arkansas State Line in McCurtain County. Under current conditions, two residential receivers exceed the 67 dBA Leq(h) for the Noise Abatement Criteria, Category B (NAC-B). Based on the new four-lane facility and with projected traffic growth, the same two residential receivers will exceed the NAC-B. The noise levels for these receivers are expected to increase approximately 1.0 decibel in the design year (2030) over current conditions. In considering noise mitigation, it was found that noise abatement for the impacted receivers would require blocking driveway access to US 70. Maintaining this access would render a noise abatement wall ineffective. Mitigation is not feasible for the identified receivers, and therefore, noise abatement is not recommended for this project. In planning noise compatible land use planning, the future 66 dBA impact zone was determined to be 325 feet from the center of the new divided four-lane facility. This noise assessment report will be provided to the local officials to aid in noise compatible land use planning.