October 8, 2003

Elvin Pinckney
Ohio Department of Transportation
Office of Environmental Services
1980 West Broad Street
Columbus, OH 43223

Subject: Portsmouth Bypass
Draft Noise Report
SCI-823-0.00 (PID 19415)

Dear Elvin:

Enclosed is a draft copy of the Noise Analysis Report for the Portsmouth Bypass. This report is a draft because it could not address every area for each Feasible Alternative. Because of on-going engineering analysis at the project termini (interchanges at US-23 and US-52), these areas were not available in time for inclusion. These areas will be incorporated into the final.

There are two (2) Feasible Alternatives addressed in this report – The Hill Alternative and the Valley Alternative. These have been developed through an extensive environmental/ engineering evaluation and public involvement process.

The enclosed report concludes that, based on the current data, noise walls are reasonable in two (2) locations – one for each Feasible Alternative. On the Hill Alternative, barrier H9-2 was found to be reasonable. Barrier H9-2 is 2,404 feet long and located just south of the Little Scioto River. It provides noise reduction to the community known as Highland Bend. On the Valley Alternative, barrier V1a-4 was found to be reasonable. Barrier V1a-4 is 6,490 feet long and located in Lucasville. It provides noise reduction to the Tomlison Addition, on the opposite side of SR-728 from the Southern Ohio Correctional Facility.

Thank you for your assistance with this task. Please don't hesitate to contact me at (614) 734-7144, ext. 20 if you have any questions or comments.

Sincerely,

CH2M HILL

Rob Miller
Project Manager

Cc: Susan Swartz, TranSystems (2 copies)

DRAFT

Noise Analysis Report
SCI-823-0.00
PID No. 19415

Prepared for

Ohio Department of Transportation

October 2003

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Acronyms

ANSI	American National Standards Institute
ODOT	Ohio Department of Transportation
CFR	*Code of Federal Regulations*
dB	decibel
dBA	A-weighted decibel
DD	doubling of the distance
FHWA	Federal Highway Administration
IEC	International Electrotechnical Commission
Hz	hertz
km/h	kilometers per hour
L_{10}	sound level exceeded 10 percent of the time
L_{eq}	hourly equivalent sound level
mph	miles per hour
NAC	noise abatement criteria
SPL	sound pressure levels
T_{24}	percent of trucks during the 24-hour period
TCE	Temporary Construction Easement
µPa	micro Pascals
$\mu N/m^2$	micro Newtons per square meter

Noise Analysis Report

A. Introduction

This report discusses the noise impacts related to the Feasible Alternatives associated with the Ohio Department of Transportation's (ODOT) Portsmouth Bypass Project (SCI-823-0.00, PID 19415). This noise evaluation is intended to provide the project team with information on potential impacts in order to assist the team in the decision-making associated with selecting a Preferred Alternative. **Figure 1** depicts the general vicinity of the project.

This Draft Noise Analysis report evaluates the project's feasible alternatives, for the areas where data is available. The termini interchange locations are excluded from this draft. These are sections 1, 8 and 9 of the Valley Alternative, and sections 1 and 10 of the Hill Alternative. These sections are shown in ***Figure 2****. When available, the data pertaining to those sections will be used to update the analysis, and presented in the Final Report.*

This report will comply with the five-step process established by the Federal Highway Administration (FHWA) for evaluating traffic-related noise. As specified in 23 CFR 772, this report will:

- Identify Existing Activities (Sensitive Receptors)
- Determine Existing Noise Levels
- Predict Future Noise Levels
- Determine Impacts, and,
- Evaluate Abatement Measures

Specifically, the purpose of this noise analysis is to assess the potential noise impact that the Feasible Alternatives would have on nearby noise sensitive receivers. The analysis uses the project's latest engineering/design information and the Federal Highway Administration's (FHWA) Traffic Noise Model (TNM) to evaluate the existing and projected future (2028) traffic noise exposure at noise-sensitive locations within the project vicinity, assess potential traffic and construction noise impacts due to the proposed project, identify the level of noise abatement required, analyze the effects of noise barriers to be considered for traffic noise abatement, and determine whether any noise barriers would be feasible and reasonable to construct in accordance with ODOT requirements.

Figure 1: Project Location

B. Project Description

The concept of a highway bypass around the City of Portsmouth (Scioto County, Ohio) has been in existence since the creation of the Appalachian Development Highway System in 1964. The goal is to alleviate deficiencies with the existing roadway system. The approved/signed north-south route between northern Kentucky and southern Ohio is along the Ohio River via US Route 52 to US Route 23 in the city of Portsmouth. To avoid this bottleneck, travelers utilize a number of alternate routes. These alternate routes are ill-equipped to handle the traffic volumes and types of vehicles avoiding the approved route.

The Portsmouth Bypass was developed utilizing the ODOT Project Development Process (PDP). The project team has been developing and evaluating alternatives, ultimately arriving at the two (2) Feasible Alternatives shown on **Figure 2**. The details of the various studies associated with the PDP are available in the Environmental Impact Statement prepared for this project.

The Valley Alternative traverses the relatively level ground, associated with the Little Scioto River Valley, to go north from US Route 52 (along the Ohio River) to the Village of Minford. From this point, the Valley Alternative turns westward toward its connection with US Route 23. It follows a course between the steeply sloped ridges in this area (approximately along the route of existing State Route 728).

The Hill Alternative utilizes the lesser populated and more steeply-sloped ridgelines to make the same trip from the US Route 52 to Minford to US Route 23. The two alternatives share a small section in the vicinity of Minford.

Because of the size of the study area, each Feasible Alternative has been segmented into parts (10 for the Hill Alternative and 9 for the Valley Alternative), for ease of analysis, as follows below in **Table 1.**

TABLE 1
Section Descriptions

Segment	Hill Alternative	Valley Alternative
Section 1	** Between US-23 and Thomas Hollow*	**Interchange at US-23 in Lucasville*
Section 1a	-	Between interchange and near Candy Run
Section 2	Between Rose Hill and Moris Lane	Between Schuler Hollow and Clarktown
Section 3	North of Lucasville-Minford Rd.	Between Clarktown and Swauger Valley Rd.
Section 4	Between SR-139 and Minford	Between Minford and Blake Hollow
Section 5	Between Rase Farm and near Minford	Crossing SR-335 and diverging from Hill Alternative
Section 6	Between Minford and Blake Hollow	Between Little Scioto River and Fair Oaks
Section 7	West of SR-335 crossing Power Lines	Between Slocum and SR-140
Section 8	Stout Hollow area	**Between SR-140 and Sciotodale*
Section 9	Between Little Scioto River and Railroad	**Between Sciotodale and US-52*
Section 10	**Between Sciotodale and US-52*	-

* Italicized entries are those sections, which were not modeled in TNM due to a lack of complete data.

Figure 2: Hill and Valley Alternatives with Modeled Sections

C. Fundamentals of Traffic Noise

Sound pressure can be measured in units of micro Newtons per square meter (μN/m2) called micro Pascals (μPa). One μPa is approximately one-hundred-billionth of the normal atmospheric pressure. The pressure of a very loud sound may be 200,000,000 μPa, or 10,000,000 times the pressure of the weakest audible sound (20 μPa). Expressing sound levels in terms of μPa would be very cumbersome, however, because of this wide range. For this reason, sound pressure levels (SPL) are described in logarithmic units of ratios of actual sound pressures to a reference pressure squared. These units are called bels, named after Alexander G. Bell. In order to provide a finer resolution, a bel is subdivided into decibels (deci or tenth of a bel), abbreviated dB.

Appendix A provides a description of the acoustical terminology used in this report. Unless otherwise stated, all sound levels reported are in A-weighted decibels (dBA). A-weighted sound level is defined as the level, in decibels, measured with a sound level meter having the metering characteristics and a frequency weighting specified in the American National Standards Institute Specification for Sound Level Meters, ANSI S 1.4 – 1983. The A-weighting de-emphasizes lower frequency sounds below 1000 hertz (1 kHz) and higher frequency sounds above 4 kHz. It emphasizes sounds between 1 kHz and 4 kHz. A-weighting is the measure most used for traffic and environmental noise throughout the world. Most community noise standards utilize A-weighting, as it provides a high degree of correlation with human annoyance and health effects.

The actual impact of noise is not a function of loudness alone. The time of day during which noise occurs and the duration of the noise are also important. In addition, most noise that lasts for more than a few seconds is variable in its intensity. Consequently, a variety of noise descriptors have been used such as L_{10}, L_{50}, and L_{dn}. The noise descriptor used for this study is the L_{eq}.

The L_{eq} is the equivalent steady state sound level which in a stated period of time would contain the same acoustical energy as the time-varying sound level during the same period. The L_{eq} (h) is the energy-average of the A-weighted sound levels occurring during a one hour period, in decibels, i.e., a one hour L_{eq}.

From the source to the receiver, noise changes both in level and frequency spectrum. The most obvious is the decrease in noise as the distance from the source increases. The manner in which noise reduces with distance depends on the following important factors:

- Geometric spreading from point and line sources
- Ground absorption
- Atmospheric effects and refraction
- Shielding by natural and manmade features, noise barriers, diffraction, and reflection

Sounds from a small localized source (approximating a “point” source) radiates uniformly outwards as it travels away from the source in a spherical pattern. The sound level decreases or drops-off at a rate of 6 dBA for each doubling of the distance (6 dBA/DD).

However, highway traffic noise is not a single, stationary point source of sound. The movement of the vehicles makes the source of the sound appear to emanate from a line (line source) rather than a point when viewed over some time interval.

Two site types are currently used in traffic noise models:

HARD SITES – These are sites with a reflective surface between the source and the receiver such as parking lots or smooth bodies of water. No excess ground attenuation is assumed for these sites and the changes in noise levels with distance (drop-off rate) is simply the geometric spreading of the line source or 3 dBA/DD (6dBA/DD for a point source).

SOFT SITES – These sites have an absorptive ground surface such as soft dirt, grass or scattered brushes and tress. An excess ground attenuation value of 1.5 dBA/DD is normally assumed. When added to the geometric spreading, this results in an overall drop-off rate of 4.5 dBA/DD for a line source (7.5 dBA/DD for a point source).

Research has shown that atmospheric conditions can have a profound effect on noise levels within 60 meters (200 feet) from a highway. Wind has shown to be the single most important meteorological factor within approximately 150 meters (500 feet), while vertical air temperature gradients are more important over longer distances. Other factors such as air temperature and humidity, and turbulence, also have significant effects.

Changes in noise levels are perceived as follows:

- A 3 dBA change is barely perceptible
- A 5 dBA change is readily perceptible
- A 10 dBA change is perceived as a doubling or halving of noise

D. Federal and State Policies and Procedures

The criteria for evaluating noise impacts that are used in this report are contained in Title 23 of the *Code of Federal Regulations* (CFR), Part 772 – *Procedures for Abatement of Highway Traffic Noise and Construction Noise* (23 CFR 772, 1992) and ODOT Policy Number 21-001 (P), *Analysis and Abatement of Highway Traffic Noise,* dated September 2001. The Category B land use activity criterion in these documents applies to residences, churches, schools, recreation areas, and similar uses and is an hourly sound level that approaches or exceeds 67 dBA hourly equivalent sound level (L_{eq}) or 70 dBA L_{10}. Other developed lands, properties, or activities not described in Categories A or B are included in Category C, for which an hourly sound level criterion that approaches or exceeds 72 dBA L_{eq} or 75 dBA L_{10} has been established. ODOT policy does not provide noise abatement for activity Category C unless it is determined that subject land uses within this category include exterior areas that accommodate frequent outdoor human activities. There are no criteria for undeveloped lands which are not planned or programmed at the time of the environmental documentation. The above-described noise abatement criteria (NAC) are determined at the exterior of structures during peak-hour noise conditions. In this analysis, criterion levels in terms of L_{eq}, rather than hourly L_{10} values, have been used to evaluate noise impacts caused by the proposed project.

Table 2 shows the Federal Highway Administration (FHWA) Noise Abatement Criteria (NAC) used for determining the noise standard for specific land uses (e.g., residential and commercial). FHWA and ODOT consider a traffic noise impact to occur if predicted peak-hour traffic noise levels approach or exceed the NAC. ODOT defines "approach" as noise levels within 1 dBA of the NAC, or 66 dBA for activity Category B.

TABLE 2
FHWA Noise Abatement Criteria

Activity Category	Design Noise Levels Hourly L_{eq} (dBA)	Description of Land Use Activity Category
A	57 (Exterior)	Tracts of land for which serenity and quiet are of extraordinary significance and which serve an important public need. The preservation of serenity and quiet is essential if this land is to continue to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of parks, open spaces, or historic districts that are dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports 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 and B above.
D	--	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: Code of Federal Regulations. Title 23 CFR Part 772 – Procedures for Abatement of Highway Traffic Noise and Construction Noise. Federal Highway Administration, April 1992.

In addition to the above-described sound level criterion , FHWA and ODOT consider a traffic noise impact to occur if predicted sound levels "substantially" exceed existing noise levels. ODOT policy states that a substantial increase occurs when future noise levels exceed existing noise levels by 10 dBA or more.

Based on the above discussion, noise abatement features must be considered for the proposed project if predicted design-year noise levels increase by 10 dBA, or more over existing noise levels or the design-year noise level equals or exceeds 66 dBA, L_{eq}.

E. Study Methods and Procedures

In this noise analysis report, the existing and projected future (2028) traffic noise levels are evaluated using onsite traffic noise level measurements and the FHWA Traffic Noise Model (TNM) Version 2.1. TNM is the most recent analytical method for traffic noise evaluation. The program is based upon reference energy emission levels for automobiles, medium trucks (2 axles), heavy trucks (3 or more axles), buses and motorcycles with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site. TNM was developed to predict noise levels for both constant-flow and interrupted-flow traffic conditions. The model enables the user to account for the effects of different pavement types, graded roadways, and attenuation over/through rows of buildings and dense vegetation. TNM enables the user to input terrain elevation lines to account for shielding effects of natural terrain. The model also allows the user to specify various intervening ground types with different sound absorption qualities. The ground types available for use include soft and hard soil, snow-covered ground, water, and pavement. In this analysis, FHWA rules and restrictions regarding the use of weather, ground type, pavement type, and vegetation parameters were strictly adhered to.

In this study, for noise receivers located near existing high-volume roadways, traffic noise levels calculated by TNM are validated using onsite traffic noise level measurement data and concurrent traffic counts. At other receivers located far from existing roadways, background noise levels were measured and used to represent existing noise levels in the area(s) represented by the monitoring locations. At all locations, future peak-hour noise levels predicted by TNM were compared to the NAC and to existing noise levels to determine noise impacts. To model the roadways, receiver and barrier locations and intervening topography within the project area, terrain information and roadway geometry data were utilized. In all cases, actual site conditions during the measurements were taken into account in order to draw a realistic comparison of the model.

For the purpose of performing this noise analysis, certain assumptions about traffic data had to be developed to facilitate the study, as follows:

- Truck percentages were developed based on Design traffic and Route 23 and Route 52 traffic counts conducted in the field during the existing noise monitoring effort. According to onsite traffic counts, it would be reasonable to use the T24 estimate of 14 percent for overall trucks, with a breakdown of 4 percent medium trucks and 10 percent heavy trucks. Since the T24 forecast is higher than the design hour forecast (8 percent), the assumed truck percentages result in a conservative assessment of future traffic noise levels.
- On main highway travel lanes, assumed vehicle speed for automobiles, medium trucks, and heavy trucks is 113 kilometers per hour (km/h) (70 miles per hour [mph]).
- Assumed travel speed on freeway ramps is 72 km/h (45 mph) for all vehicle types.

Finally, TNM was utilized to determine locations and heights of noise barriers required to significantly reduce future traffic noise levels, and to assess the feasibility and reasonableness of constructing such barriers.

F. Existing Noise Environment

The dominant sources of noise in the study areas are primarily non-traffic sources. Environmental noise sources contributing to the existing ambient noise environment include typical neighborhood activities, traffic on surface streets, barking dogs, muffler-less vehicles, loud neighbors, and occasional light aircraft flight operations from the nearby Greater Portsmouth Regional Airport. At locations near the two project termini, at US Route 52 and US Route 23, and locations near existing major arterial roadways, vehicular traffic is the dominant source of environmental noise.

1. Existing Land Use

Recent (1999) aerial photography of the area shows mainly forest, agricultural and residential land uses throughout the majority of the study area. Most of the steep slopes that dominate the study area are forested or used for cattle grazing. Residential, commercial and institutional land uses are concentrated in the flatter portions of the study area along the main roadways. The most expansive developed lands occur in and east of Lucasville, in and around Minford, and in Wheelersburg. The Southern Ohio Correctional Facility is located along the south side of Lucasville-Minford Pike approximately 1.6 miles east of US 23. Railroads pass north and south through the study area adjacent to US 23 near Lucasville and parallel to SR 335. High-tension electric lines also pass north to south through the center of the study area, and east to west through the southern part of the study area. The extreme northwestern corner of the study area includes a portion of the Scioto County Fairgrounds, the Lucasville library, and the Scioto County Engineer's facility.

2. Existing Noise Levels

Short-term ambient noise level measurements (15 minutes in duration) were conducted within the project area by CH2M Hill staff, with an ODOT observer, on December 19th and 20th, 2002. CH2M Hill Staff conducted subsequent short-term and ambient noise level measurements on January 8th and 9th, and May 1st, 2003 in order to determine the existing traffic and ambient noise levels throughout the project area. Measurement equipment consisted of a Bruel & Kjaer (B&K) 2236 precision sound level meter equipped with a B&K Type 4188 half-inch condenser microphone. The instrumentation was calibrated in the field, prior to each measurement, using a B&K 4130 acoustical calibrator to ensure the accuracy of the measured noise levels. All instrumentation complies with the requirements of the American National Standards Institute (ANSI) and International Electrotechnical Commission (IEC) for Type I (precision) sound-level equipment.

Short-term ambient noise level measurements were conducted at a total of 60 locations along the two Feasible Alternatives. The monitoring locations are representative of the closest homes to the proposed roadway and were selected to provide full coverage and representation of homes within the noise study areas. The noise monitoring locations are shown on **Figure 3. Appendix B** shows a summary of the field data and **Table 3** summarizes the results of the measured existing noise levels and compares them to the NAC.

Figure 3.

TABLE 3
Measured Existing Noise Levels (Leq, dBA)

Noise Receiver Location	Section/Feasible Alternative	Measured Existing Noise Level (Leq)	Approach/Exceed NAC?
1	Section1/Hill	61	NO
H1	Section1/Hill	44	NO
3	Section1/Hill	46	NO
H2	Section2/Hill	47	NO
H3	Section2/Hill	44	NO
N6	Section2/Hill	43	NO
N7	Section2/Hill	52	NO
N8	Section2/Hill	59	NO
H5	Section3/Hill	55	NO
N11	Section3/Hill	56	NO
16	Section3/Hill	45	NO
N12	Section4/Hill	40	NO
N13	Section7/Hill	41	NO
H6	Section7/Hill	64	NO
44	Section8/Hill	50	NO
41	Section9/Hill	54	NO
42	Section9/Hill	52	NO
43	Section9/Hill	50	NO
H8	Section9/Hill	54	NO
H9	Section10/Hill	47	NO
2	Section1a/Valley	58	NO
3	Section1a/Valley	46	NO
4	Section1a/Valley	53	NO
5	Section1a/Valley	51	NO
6	Section1a/Valley	63	NO
7	Section1a/Valley	59	NO
7a	Section1a/Valley	57	NO
8a	Section1a/Valley	52	NO
V2	Section1a/Valley	46	NO
9	Section2/Valley	62	NO
10	Section2/Valley	62	NO
11	Section2/Valley	61	NO
12	Section2/Valley	53	NO

TABLE 3
Measured Existing Noise Levels (Leq, dBA)

Noise Receiver Location	Section/Feasible Alternative	Measured Existing Noise Level (Leq)	Approach/Exceed NAC?
12a	Section2/Valley	53	NO
13	Section2/Valley	62	NO
V3	Section3/Valley	46	NO
V4	Section3/Valley	47	NO
V5	Section3/Valley	44	NO
18	Section3/Valley	49	NO
20	Section4/Hill + 3/Valley	62	NO
21	Section4/Hill + 3/Valley	56	NO
22	Section5/Hill + 3/Valley	51	NO
23	Section6/Hill + 4/Valley	48	NO
24	Section6/Hill + 4/Valley	48	NO
24a	Section6/Hill + 4/Valley	58	NO
26	Section5/Valley	56	NO
27	Section5/Valley	58	NO
29	Section6/Valley	43	NO
30	Section6/Valley	56	NO
31	Section6/Valley	56	NO
32	Section6/Valley	52	NO
33	Section7/Valley	56	NO
34	Section7/Valley	56	NO
35	Section7/Valley	48	NO
35a	Section7/Valley	43	NO
V6	Section8/Valley	43	NO
37	Section8/Valley	48	NO
38	Section8/Valley	45	NO
39	Section10/Hill + 9/Valley	53	NO
45	Section9/Valley	72	YES

From data presented in **Table 3**, it is apparent that existing noise levels throughout the project corridor are generally well below the NAC. The only locations where existing noise levels exceed the NAC are the receivers at the south end of the corridor, where the proposed Portsmouth Bypass would meet US-52 (represented by receiver location 45).

In order to assess existing peak-hour traffic noise levels at receiver locations near existing roadways, TNM input files were developed for such locations. Noise model predictions were validated by using the traffic counts obtained at subject noise monitoring locations in the TNM files, as described in **Appendix C**. Existing peak-hour traffic volumes were then input in the validated TNM files to predict existing peak-hour traffic noise levels at receiver locations in the vicinity of US-23, US-52, and Lucasville-Minford Road. **Table 4** summarizes the peak-hour traffic noise levels at receivers in close proximity to existing traffic.

TABLE 4
Existing Peak-hour Traffic Noise Levels (Leq, dBA)

Location	Description	Peak-hour Noise Level	Approach/Exceed NAC?
1	627 Fairgrounds Road	61	NO
4	Behind house at end of Indian Drive	53	NO
6	Next to 41 JoEtta Road	63	NO
9	Next to 1054 Lucasville-Minford Rd.	62	NO
11	Front Yard of the Chaney Residence	61	NO
13	Beside 2658 Lucasville-Minford Rd.	62	NO
45	At Alley Chiropractic Clinic on Ohio River Rd.	72	YES

G. Future Noise Environment, Impacts, and Abatement

1. Traffic Noise Impacts

To predict future traffic noise levels throughout the project area, future (2028) traffic volume and truck percentage data were compiled from the ODOT provided traffic data for the Portsmouth Bypass**. Appendix D** shows the future peak-hour traffic data used in the noise analysis.

The TNM program was used to calculate future (2028) (Build) traffic noise levels in terms of peak-hour L_{eq}. The 60 sites representing residential receiver locations were analyzed for both Feasible Alternatives. **Table 5** compares the future Build traffic noise levels to the NAC and existing noise levels at the selected receiver locations and summarizes the type of noise impact expected at each receiver location.

Table 5

Existing and Future (2028) Peak-Hour Noise Levels (in dBA) – Portsmouth Bypass Hill and Valley Alternatives

Noise Receiver Location	Section/Feasible Alternative	Existing Noise Level	Predicted Future (2028) Noise Level	Impact Type
1	Section1/Hill	61	*	*
H1	Section1/Hill	44	*	*
3	Section1/Hill	46	*	*
H2	Section2/Hill	47	58	**~**
H3	Section2/Hill	44	54	Substantial Increase
N6	Section2/Hill	43	57	~
N7	Section2/Hill	52	54	**~**
N8	Section2/Hill	59	59	Substantial Increase
H5	Section3/Hill	55	**66**	Substantial Increase
N11	Section3/Hill	56	64	~
16	Section3/Hill	45	52	~
N12	Section4/Hill	40	61	Substantial Increase
N13	Section7/Hill	41	62	Substantial Increase
H6	Section7/Hill	64	61	~
44	Section8/Hill	50	**68**	Both
41	Section9/Hill	54	64	Substantial Increase
42	Section9/Hill	52	65	Substantial Increase
43	Section9/Hill	50	**66**	Both
H8	Section9/Hill	54	64	Substantial Increase
H9	Section10/Hill	47	65	Substantial Increase
2	Section1a/Valley	58	65	~

Table 5

Existing and Future (2028) Peak-Hour Noise Levels (in dBA) – Portsmouth Bypass Hill and Valley Alternatives

Noise Receiver Location	Section/Feasible Alternative	Existing Noise Level	Predicted Future (2028) Noise Level	Impact Type
3	Section1a/Valley	46	60	Substantial Increase
4	Section1a/Valley	53	**68**	Both
5	Section1a/Valley	51	**66**	Both
6	Section1a/Valley	63	65	**~**
7	Section1a/Valley	59	**68**	Sound Level
7a	Section1a/Valley	57	65	~
8a	Section1a/Valley	52	60	**~**
V2	Section1a/Valley	46	65	Substantial Increase
9	Section2/Valley	62	63	~
10	Section2/Valley	62	63	~
11	Section2/Valley	61	63	~
12	Section2/Valley	53	57	~
12a	Section2/Valley	53	65	Substantial Increase
13	Section2/Valley	62	64	~
V3	Section3/Valley	46	**66**	Both
V4	Section3/Valley	47	63	Substantial Increase
V5	Section3/Valley	44	61	Substantial Increase
18	Section3/Valley	49	**69**	Both
20	Section4/Hill + 3/Valley	62	65	Sound Level
21	Section4/Hill + 3/Valley	56	**66**	Both
22	Section5/Hill + 3/Valley	51	**72**	Both
23	Section6/Hill + 4/Valley	48	**68**	Both
24	Section6/Hill + 4/Valley	48	62	Substantial Increase
24a	Section6/Hill + 4/Valley	58	62	~
26	Section5/Valley	56	**69**	Both
27	Section5/Valley	58	**67**	Sound Level
29	Section6/Valley	43	**69**	Both
30	Section6/Valley	56	**67**	Both
31	Section6/Valley	56	**66**	Both
32	Section6/Valley	52	64	Substantial Increase
33	Section7/Valley	56	**69**	Both
34	Section7/Valley	56	**68**	Both
35	Section7/Valley	48	52	~
35a	Section7/Valley	43	58	Substantial Increase

Table 5

Existing and Future (2028) Peak-Hour Noise Levels (in dBA) – Portsmouth Bypass Hill and Valley Alternatives

Noise Receiver Location	Section/Feasible Alternative	Existing Noise Level	Predicted Future (2028) Noise Level	Impact Type
V6	Section8/Valley	43	*	*
37	Section8/Valley	48	*	*
38	Section8/Valley	45	*	*
39	Section10/Hill + 9/Valley	53	*	*
45	Section9/Valley	**72**	*	*

Bold noise levels approach or exceed the FHWA/ODOT NAC.
* Indicates interchange location where data is unavailable to complete.
~ Indicates noise level does not exceed NAC and there is no substantial increase over existing levels.
Substantial increase = a 10-dBA increase over existing sound level.
Sound level = exceeds the FHWA/ODOT NAC.
Both = Sound level exceeds the NAC and is higher than the existing sound level by 10-dBA or more.

From the data in **Table 5**, projected future (2028) peak-hour traffic noise levels, at homes nearest the proposed Portsmouth Bypass, for both Feasible Alternatives, would result in noise impacts.

2. Traffic Noise Abatement

Potential traffic noise abatement measures which may be considered for the project, include the following:

- Construction of noise barriers within the proposed right-of-way
- Modifying the proposed horizontal and/or vertical alignment of the roadway
- Acquisition of property to serve as a buffer zone to adversely impacted receptors
- Modifying speed limits
- Restricting truck traffic
- Noise insulation of public use or non-profit institutional structures, such as churches and public schools

Of the above mitigation measures, the noise barrier option is usually the most practical choice. The Portsmouth Bypass has undergone a very detailed grading exercise to develop acceptable vertical and horizontal alignments. Therefore, additional modification of roadway horizontal or vertical alignments for the purpose of noise reduction is not practical for the project. Most areas adjacent to the proposed bypass are relatively under-developed. Acquiring private property to act as buffer zones is not seen as a practical means of mitigation. For existing impacted users, berms or other barriers would be necessary to mitigate noise. Earthen berms will increase displacement impacts. Lowering speed limits or restricting truck traffic would be inconsistent with the project purpose since, to some degree, this project is an effort to re-route truck traffic away from downtown Portsmouth. Noise insulation of public use or non-profit institutional structures could work for churches and public schools within the project area, if deemed necessary.

FHWA TNM was used to determine the noise level reduction provided by noise barriers located within the proposed right-of-way for each Feasible Alternative. TNM calculates barrier insertion loss by accounting for variables such as distance from source to barrier, distance from barrier to receiver, source and receiver heights and barrier height, and shielding from other structures and terrain features. Per standard assumptions, effective heights of automobiles, medium trucks and heavy trucks are at pavement level, 0.6 meters (2 feet) and 2.4 meters (8 feet) above the road, respectively. Receiver height is assumed to be about 1.5 meters (5 feet) above the ground.

Noise barriers within the proposed right-of-way were modeled based on the locations of residential areas exposed to future peak-hour noise levels approaching or exceeding the NAC, or experiencing a substantial increase over existing noise levels, or both. Recommended barrier locations and heights were determined using the barrier perturbation feature of TNM and based on the barriers meeting the following requirements: 1) achieving a minimum 3 to 5 dBA noise reduction, and (2) where possible, reducing peak-hour noise level below the NAC or below substantial increase.

The barriers evaluated are listed below. **Figure 2** shows the location of the Alternatives and sections referenced. Station numbers are also referenced (Station 0+00 is the project's south termini, at US- 52).

Hill Alternative

Section 2: Barrier H2-1: Follows the eastbound lanes of the bypass extending from Station 756+00 to Station 737+60. The total length of Barrier 1 is 1,848 feet.

Section 3: Barrier H3-1: Follows the eastbound lane of the bypass extending from Station 600+00 to 589+00. The total length of this barrier is 1,088 feet.

Barrier H3-2: Follows the westbound lanes extending 1,511 feet from Station 606+00 to Station 592+00.

Section 4: Barrier H4-1: Follows the westbound lanes for 2,699 feet. Beginning at station 500+00 and ending at station 540+00.

Section 5: Barrier H5-1: Follows the westbound lanes as it crosses Swauger Valley Road. It starts at Station 458+00 and ends at Station 465+00. Total length of this barrier is 698 feet.

Barrier H5-2: Follows the eastbound lanes as it crosses Swauger Valley Road. It starts at Station 464+00 and ends at station 454+00. Total length of this barrier is 993 feet.

Section 6: Barrier H6-1: Follows the westbound lanes for 2,535 feet crossing Shumway Hollow Road and ending before Crossing Blake Hollow Rd. The barrier begins at Station 370+00 and extends to station 395+00.

Section 7: Barrier H7-1: Follows the westbound lanes stretching from station 283+00 to 243+00. The barrier is 4,357 feet in length.

Section 8: Barrier H8-1: Follows the eastbound lanes as it crosses Stout Hollow Road. The length of this barrier is 1,906 feet and begins at station 190+00 and ends at station 171+00.

Section 9: Barrier H9-1: Follows the eastbound lanes as it crosses the Little Scioto River. Length of the barrier is 2,404 feet and it begins at Station 140+00 and ends at Station 116+00.

Barrier H9-2: Follows the westbound lanes as they cross the Happy Hours Addition community. The length of this barrier is 2,404 feet and begins at station 121+00 and ends at station 143+00.

Valley Alternative

Section 1a: Barrier V1a-1: Stretches 595 feet from Station 927+00 to 921+00 as it follows the westbound lanes.

Barrier V1a-2: Stretches 1,323 feet from Station 919+00 to 906+00 as it follows the westbound lanes.

Barrier V1a-3: Stretches 2,601 feet from Station 837+00 to 810+00 as it follows the westbound lanes.

Barrier V1a-4: Stretches 6,490 feet from Station 899+00 to 834+00 as it follows the westbound lanes.

Section 2: Barrier V2-1: Stretches 684 feet from Station 765+00 to 758+00 as it follows the eastbound lanes.

Section 3: Barrier V3-1: Extends for 2,910 feet. Follows the eastbound lanes from station 661+00 to station 632+00.

Barrier V3-2: Extends for 1,605 feet. Follows the westbound lanes from station 650+00 to station 634+00.

Barrier V3-3: Extends for 900 feet. Follows the eastbound lanes from station 629+00 to station 620+00.

Barrier V3-4: Extends for 3,082 feet. Follows the eastbound lanes from station 598+00 to station 567+00.

Barrier V3-5: Extends for 1,390 feet. Follows the eastbound lanes from station 529+00 to station 515+00.

Section 4: Barrier V4-1: Follows the westbound lanes and is 1,605 feet. It begins at station 432+00 and ends at station 463+00.

Section 5: Barrier V5-1: Extends for 1,400 feet. Beginning at station 313+00 and ending at station 327+00.

Barrier V5-2: Extends for 1,503 feet. Beginning at station 309+00 and ending at station 324+00.

Section 6: Barrier V6-1: Stretches for 1,400 feet. Follows the eastbound lanes from station 231+00 to station 227+00.

Barrier V6-2: Stretches for 1,100 feet. Follows the westbound lanes from station 214+00 to station 225+00.

Barrier V6-3: Stretches for 1,097 feet. Follows the eastbound lanes from station 235+00 to station 246+00.

Barrier V6-4: Stretches for 3,105 feet. Follows the westbound lanes from station 229+00 to station 260+00.

<u>**Section 7:**</u> Barrier V7-1: Stretches for 716 feet. Follows the westbound lanes from station 128+00 to station 135+00.

Barrier V7-2: Stretches for 1,277 feet. Follows the eastbound lanes from station 147+00 to station 160+00.

Barrier V7-3: Stretches for 1,523 feet. Follows the westbound lanes from station 171+00 to station 186+00.

Barrier V7-4: Stretches for 989 feet. Follows the eastbound lanes from station 178+00 to station 188+00.

Tables 6 and **7** show the noise reduction effects of the proposed noise barriers at the receiver locations affected by the barriers.

TABLE 6

Hill Alternative: Barrier Noise Level Reductions (in dBA)

Section of Bypass	Barrier #	Receiver Location	Without Barrier	With Barrier	Noise Level Reduction
Section 2	H2-1	H2	58	58	0
		N6	57	52	5
		H3	54	51	3
Section 3	H3-1	H5	66	61	5
	H3-2	H5	66	58	8
Section 4	H4-1	N12	61	54	7
		21	66	56	10
Section 5	H5-1	22	68	57	11
	H5-2	22	68	62	6
Section 6	H6-1	23	67	59	8
		24	62	57	5
Section 7	H7-1	N13	62	52	10
Section 8	H8-1	44	68	62	6
Section 9	H9-1	H8	64	58	6
		42	65	60	5
	H9-2	41	64	59	5
		43	66	59	7

TABLE 7

Valley Alternative: Barrier Noise Level Reductions (in dBA)

Section of Bypass	Barrier #	Receiver Location	Without Barrier	With Barrier	Noise Level Reduction
Section 1a	V1a-1	2	65	61	4
	V1a-2	3	60	54	6
	V1a-3	8a	60	52	8
	V1a-4	5	66	59	7
		6	65	59	6
		7	68	61	7
		7a	65	59	6
Section 2	V2-1	R-15 (tnm)	66	61	5
	V2-2	12A	65	58	7
		R-62 (tnm)	66	61	5
Section 3	V3-1	R-11 (tnm)	54	50	4
		R-14 (tnm)	66	59	7
	V3-2	R-4 (tnm)	64	59	5
		R-8 (tnm)	67	60	7
	V3-3	V-4	63	57	6
		R-36 (tnm)	61	56	5
	V3-4	V-5	61	54	7
		20	66	59	7
	V3-5	22	72	61	11
		R-87 (tnm)	62	53	9
Section 4	V4-1	23	54	49	5
		R-9 (tnm)	66	57	9
Section 5	V5-1	R-8 (tnm)	60	55	5
		R-9 (tnm)	63	57	6
	V5-2	26	68	62	6
		R-10 (tnm)	63	58	5
Section 6	V6-1	32	70	61	9
	V6-2	R-55 (tnm)	70	62	8
	V6-3	R-37 (tnm)	67	61	6
		R-38 (tnm)	69	61	8
	V6-4	29	69	56	13
		31	66	54	12
Section 7	V7-1	R-5 (tnm)	58	52	6
	V7-2	35A	58	53	5

TABLE 7
Valley Alternative: Barrier Noise Level Reductions (in dBA)

Section of Bypass	Barrier #	Receiver Location	Without Barrier	With Barrier	Noise Level Reduction
	V7-3	34	68	59	9
	V7-4	33	69	64	5

3. Barrier Cost Reasonableness Determination

ODOT policy requires that a determination of economic reasonableness of noise barriers be made before a final decision to build the barriers can be rendered. The policy provides guidance for determination of the overall reasonableness of noise abatement options. Based on the policy, noise barrier reasonableness should be determined by considering the amount of noise reduction provided, number of people protected, cost of abatement, views of impacted residents, and potential environmental impacts of noise barrier construction. The test for reasonableness is calculated by dividing the number of benefited residential units that receive a minimum of 3 to 5 dBA reduction in noise level into the estimated total cost of the noise barrier. If the cost is $25,000 per residence or less, the project is deemed reasonable. When estimating the cost of a barrier, a figure of $280 per lineal feet [or $17.50 per square feet ($188.40 per square meter)] was used. **Tables 8** and **9** summarize the reasonableness data based on the above discussion and a count of existing homes within the study area.

In this analysis, noise abatement is proposed for Barrier H9-2 located in Section 9 of the Hill Alternative and Barrier V1a-4 located in Section 1a of the Valley Alternative. Barrier H9-2 (see **Figure 4)** can provide noise abatement for the 108 residences living in the Highland Bend and Happy Hours Addition subdivisions. These are comprised of single family and mobile homes. Barrier V1a-4 (see **Figure 5**) can provide abatement for 138 residences living in the Tomlison Addition subdivision. These residences are comprised of single family homes and a Middle-School. All the remaining barriers in other sections of the Hill and Valley Alternatives were determined to not meet the cost requirement for reasonableness and therefore should not be pursued for noise mitigation. If pertinent parameters change substantially for any reason, the noise barriers evaluated in this analysis may be changed or eliminated from the final project design or other noise barriers may have to be evaluated. A final decision on noise abatement measures will be made upon public input and completion of the project design.

Opinions of the impacted residents will be a major consideration in reaching a final decision on the reasonableness of abatement measures to be provided. The opinions of these residents should be obtained through the ODOT public involvement process. Use of visual simulations to show impacts created by barriers is recommended.

Figure 4.

Figure 5.

TABLE 8
Hill Alternative: Barrier Cost Reasonableness Analysis

Section	Barrier #	Benefited Residences	Barrier Length (ft)	Barrier Area (sq.ft)	Total Barrier Cost	Cost per Benefited Residence	Reasonable?
2	H2-1	11	1,848	31,808	$1,073,700	$97,600	NO
3	H3-1	14	1,088	17,456	$475,800	$34,000	NO
3	H3-2	14	1,511	14,305	$673,300	$48,100	NO
4	H4-1	33	2,699	43,190	$1,410,300	$42,700	NO
5	H5-1	9	698	5,468	$291,100	$32,300	NO
5	H5-2	9	993	8,963	$435,200	$48,400	NO
6	H6-1	7	2,535	29,179	$1,219,600	$174,200	NO
7	H7-1	16	4,357	62,846	$1,835,700	$114,700	NO
8	H8-1	7	1,906	29,686	$1,052,900	$150,400	NO
9	H9-1	9	2,195	20,756	$977,800	$108,600	NO
9	H9-2	108	2,404	18,229	$992,000	$9,200	YES

TABLE 9
Valley Alternative: Barrier Cost Reasonableness Analysis

Section	Barrier #	Benefited Residences	Barrier Length (ft)	Barrier Area (sq.ft)	Total Barrier Cost	Cost per Benefited Residence	Reasonable?
1a	V1a-1	8	595	5,955	$270,900	$33,900	NO
1a	V1a-2	13	1,323	10,364	$551,900	$42,500	NO
1a	V1a-3	16	2,601	25,234	$1,170,000	$73,100	NO
1a	V1a-4	138	6,490	57,906	$2,830,700	$20,500	YES
2	V2-1	3	889	6,707	$366,400	$122,100	NO
2	V2-2	18	1,356	14,952	$641,300	$35,600	NO
3	V3-1	45	2,910	44,314	$1,590,300	$35,300	NO
3	V3-2	4	1,605	20,838	$813,800	$203,400	NO
3	V3-3	12	900	6,799	$370,800	$30,900	NO
3	V3-4	54	3,082	30,649	$1,398,700	$25,900	NO
3	V3-5	9	1,390	16,097	$671,000	$74,600	NO
3	V3-6	7	503	4,631	$222,200	$31,700	NO
4	V4-1	7	3,130	45,821	$1,677,700	$239,700	NO
5	V5-1	7	1,400	15,613	$665,000	$95,000	NO
5	V5-2	9	1,503	15,681	$695,600	$77,300	NO
6	V6-1	11	1,400	14,411	$644,000	$58,500	NO
6	V6-2	11	1,100	12,206	$521,600	$47,400	NO
6	V6-3	10	1,097	9,783	$478,400	$47,800	NO
6	V6-4	48	3,105	61,696	$1,949,000	$40,600	NO
7	V7-1	11	716	7,769	$336,300	$30,600	NO
7	V7-2	24	1,277	23,155	$762,500	$31,800	NO
7	V7-3	14	1,523	17,500	$733,400	$52,400	NO
7	V7-4	18	989	13,007	$504,200	$28,000	NO

Based on ODOT recommendation, barrier construction costs are assumed to be $17.50 per square foot.

1 A benefited residence is defined as any residential unit being provided a noise reduction of 3 dBA or more by the barrier regardless of whether the unit exceeds the NAC.

2 Includes an assumed cost of $1,000 per unit for obtaining temporary construction easements within private property.

H. Construction Noise

During the project construction phase, noise from construction activities would add to the noise environment in the immediate project area. Activities involved in construction would generate noise levels, as indicated in **Table 10**, ranging from 82 to 86 dBA at a distance of 30 meters (100 feet). Construction activities would be temporary in nature and are anticipated to occur during normal daytime working hours. Construction noise impacts could result in annoyance or sleep disruption, if nighttime operations occur or if unusually noisy equipment is used. Construction operations will adhere to any local construction noise ordinances.

TABLE 10
Construction Equipment Noise

Construction Phase	Loudest Equipment	Maximum Sound Level at 30 Meters (100 Feet) (dBA)
Clearing and Grubbing	Bulldozer, backhoe	83 dBA
Earthwork	Scraper, bulldozer	85 dBA
Foundation	Backhoe, loader	82 dBA
Base Preparation	Truck, bulldozer	85 dBA
Paving	Paver, truck	86 dBA

Source: U.S. Department of Transportation, 1977.

Noise would also be generated during the construction phase by increased truck traffic on some local area roadways associated with transport of heavy materials and equipment. This noise increase would be of short duration and would occur primarily during daytime hours.

Although construction noise impacts would be temporary, the following standard measures are recommended to minimize such impacts.

- Whenever possible, limit operation of heavy equipment and other noisy procedures to the daylight hours.
- Install and maintain effective mufflers on equipment.
- Locate equipment and vehicle staging areas as far from residential areas as possible.
- Limit unnecessary idling of equipment.

References

Code of Federal Regulations [CFR], Title 23 CFR Part 772 -- Procedures for Abatement of Highway Traffic Noise and Construction Noise. 1992.

Ohio Department of Transportation. Policy Number 21-001 (P), *Analysis and Abatement of Highway Traffic Noise,* dated September 2001.

Ohio Department of Transportation, Interoffice Communications, Office of Technical Services Certified Traffic Data, November 1, 1996 and June 25, 1999.

U.S. Department of Transportation. *Highway Construction Noise: Measurement, Prediction, and Mitigation*. 1977.

U.S. Department of Transportation, Federal Highway Administration. *FHWA Traffic Noise Model User's Guide. Report No. FHWA-PD-96-009*. Federal Highway Administration, Washington D.C., January 1998.

FHWA *Traffic Noise Model Technical Manual. Report No. FHWA-PD-96-010*. Federal Highway Administration, Washington D.C., February 1998.

Technical Advisory T6640.8A -- Guidance for Preparing and Processing Environmental and Section 4(F) Documents. 1987.

Appendix A
Acoustical Terminology

Acoustical Terminology

Ambient Noise (Level) - All-encompassing noise (level) at a given place and time, usually a composite of sounds from all sources near and far, including any specific source(s) of interest.

A-Weighted Sound Level (Abbreviated dBA or dB(A)) - Frequency weighted Sound Pressure Level approximating the frequency response of the human ear. It is defined as the sound level, in decibels, measured with a sound-level meter having the metering characteristics and a frequency weighting specified in the American National Standards Institute (ANSI) Specification for Sound Level Meters, ANSI S 1.4 - 1983. The A-weighting de-emphasizes lower frequency sounds below 1,000 Hz (1 kHz) and higher frequency sounds above 4 kHz. It emphasizes sounds between 1 kHz and 4 kHz. A-weighting is the most used measure for traffic and environmental noise throughout the world.

Decibel (Abbreviated dB) - A decibel is one-tenth of a Bel. It is a measure on a logarithmic scale that indicates the squared ratio of sound pressure to a reference sound pressure (unit for *sound pressure level*) or the ratio of sound power to a reference sound power (unit for *sound power level*).

Day-Night Noise Level (L_{dn}) - A noise level that takes into account all of the A-weighted noise energy from a source during 24 hours and weights the nighttime (10 p.m. to 7 a.m.) noise by adding 10 dBA during that period.

Existing Noise Levels - The noise, resulting from the natural and mechanical sources and human activity, considered to be usually present in a particular area.

L_{eq} - The equivalent steady-state sound level which, in a stated period of time, would contain the same acoustical energy as the time-varying sound level during the same period.

L_{max} - The highest sound pressure level in a specific time period.

Ln (Where n= 1-99; e.g. L_{10} , L_{50}) - The sound pressure level exceeded n percent of a specific time period. L_{10} is the level exceeded 10 percent of the time; L_{50} is the level exceeded 50 percent of the time.

Appendix B
Summary of Background Noise Level Measurement Data

Table B1

Summary of Background Noise Level Measurement Data

Location	**Date**	**Leq**	**Lmin**	**Lmax**	**L90**	**Source(s) of Noise**
1	19-Dec-02	58.3	43.1	67.5	*	Wind
H1	01-May-03	43.6	37	67.5	38.5	Birds
3	19-Dec-02	45.5	40.2	55.9	41.9	
H2	01-May-03	47.1	39.3	60.5	42.5	Birds, 2 train horns
H3	01-May-03	44.3	38.0	65.1	39.5	Dogs, birds
N6	08-Jan-03	42.6	35.1	62.8	37.0	
N7	08-Jan-03	52.4	36.2	72.8	37.5	Noisy neighbor, cars, wind
N8	08-Jan-03	59.1	32.6	73.3	34.0	Dogs, light traffic
H5	01-May-03	54.9	36.8	78.8	41.0	Lawn mower, birds, car horn, dogs
N11	09-Jan-03	55.7	34.5	67.6	43.5	Wind, heavy traffic
16	01-May-03	44.8	36.0	67.7	38.5	Dogs, wind
N12	09-Jan-03	39.8	29.7	58.7	31.0	1 car passes
N13	09-Jan-03	40.7	32.1	56.4	33.5	
H6	01-May-03	63.8	40.1	75.5	45.0	Wind, train goes by, birds
44	20-Dec-02	49.4	39.6	65.9	43.0	Wind, leaves
41	20-Dec-02	54.4	40.8	69.7	42.0	train goes by, wind
42	20-Dec-02	52.0	41.9	64.7	46.0	Wind
43	20-Dec-02	50.4	37.1	67.1	41.0	Wind
H8	01-May-03	53.7	41.7	72.7	43.0	Wind, plane, birds, construction
H9	01-May-03	47.2	41.2	61.2	43.0	Wind, lawn mower
2	19-Dec-02	58.0	48.2	77.4	*	Wind
3	19-Dec-02	45.5	40.2	55.9	41.9	
4	08-Jan-03	51.2	37.1	61	44.0	Church music, wind
5	08-Jan-03	50.9	41.1	62.3	43.5	Wind
6	08-Jan-03	60.0	42.2	74.6	48.0	train horn, helicopter
7	08-Jan-03	59.1	44.4	70.6	49.0	
7a	08-Jan-03	56.8	41.9	64	51.5	Wind
8a	08-Jan-03	51.7	40.2	62.9	45.5	train horn, wind
V2	01-May-03	46.4	33.7	65.6	36.0	Birds, Heavy trucks braking hard
9	08-Jan-03	60.5	41.6	72.6	49.5	Muffler less vehicles, wind
10	08-Jan-03	62.2	44.0	74.9	48.5	car started
11	19-Dec-02	59.9	41.5	72.5	*	Traffic, wind
12	08-Jan-03	53.1	38.1	72.3	43.5	Wind, train horn, heavy traffic
12A	09-Jan-03	53.1	31.5	64.8	38.0	Heavy traffic

Table B1

Summary of Background Noise Level Measurement Data

Location	Date	Leq	Lmin	Lmax	L90	Source(s) of Noise
13	01-May-03	58.2	34.7	74.2	38.0	Dogs, road construction, mowing
V3	01-May-03	46.4	33.5	68.7	35.5	Wind, birds, construction
V4	01-May-03	46.6	35.0	66.7	40.0	Wind, birds, loud truck
V5	01-May-03	43.7	32.6	63.3	37.0	Wind, birds, lawn mower
18	01-May-03	49.4	38.3	60.8	42.0	Wind, birds, electrical lines
20	09-Jan-03	61.6	38.9	73.9	44.5	Wind, airplane
21	09-Jan-03	55.7	36.4	68.9	42.5	Wind, dogs
22	09-Jan-03	50.8	36.1	70.7	39.0	Wind, leaves, truck, school bus
23	09-Jan-03	48.4	32.0	62.3	36.0	Airplanes, helicopter, roof work
24	09-Jan-03	47.6	31.0	67.6	33.5	Leaves, brush hog, plane taking off
24a	09-Jan-03	58.0	40.9	81.0	43.0	brush hog, airplane taking off
26	09-Jan-03	55.8	33.2	69.8	38.5	Dogs, trucks, train horn, leaves
27	09-Jan-03	58.2	34.8	74.1	42.0	Wind, leaves, heavy trucks, car
29	20-Dec-02	43.1	38.9	52.3	41.0	
30	20-Dec-02	56.0	40.6	69.3	44.0	
31	20-Dec-02	56.0	40.6	69.3	44.0	
32	20-Dec-02	52.4	40.2	73.2	42.0	Wind
33	20-Dec-02	55.8	40.4	71.0	45.0	Single plane, many cars, heavy trucks
34	20-Dec-02	55.8	40.4	71.0	45.0	Single plane, many cars, heavy trucks
35	20-Dec-02	48.1	39.1	56.5	42.0	
35A	20-Dec-02	42.7	42.7	59.2	45.5	
V6	01-May-03	43.2	37.8	52.3	39.5	Water splash, train horn, birds
37	20-Dec-02	47.7	42.2	57.6	43.5	Wind
38	20-Dec-02	44.7	42.3	53.0	43.0	Water spilling on rocks
39	20-Dec-02	53.3	44.9	61.0	48.0	train goes by, wind
45	20-Dec-02	69.7	54.7	78.3	*	Train pass by, traffic

Appendix C
Noise Model Validation at Receivers Near Existing Roadways

TNM input files for receiver locations where existing roadways dictate the noise conditions were developed using the existing roadway geometry, and surrounding terrain. Measured traffic noise levels, concurrent traffic counts, and observed vehicle speeds obtained during the noise monitoring effort were used to evaluate the accuracy of the TNM program in estimating traffic noise exposure at such locations. The summary of onsite traffic counts for each 15-minute measurement period at the receiver locations near existing traffic is included in **Table C1.**

TABLE C1
Onsite Traffic Counts

Location	Description	Autos	Medium Trucks	Heavy Trucks
1	Behind 627 Fairgrounds Road – Walters Residence – Monitoring Route 23	146	9	18
4	Behind Page Residence on Indian Drive – Lucasville-Minford Road	91	4	5
6	In front of 41 JoEtta Road – Gahm Residence – Monitoring Lucasville – Minford Road	71	3	5
7	In front of 28 Pleasant Drive	86	5	2
9	Next to 1054 Lucasville-Minford Road – Monitoring Lucasville-Minford Road	117	3	1
11	Front yard of the Chaney Residence – Monitoring Lucasville-Minford Road	115	2	2
13	Beside 2658 Lucasville-Minford Road – King Residence – Monitoring Lucasville-Minford Road	55	5	2
45	At Alley Chiropractic Clinic and 7142 Egbert Rd.			
	US Route 52	250	7	22
	Ohio River Road	99	4	1

Table C2 summarizes the noise levels obtained during the traffic noise measurements and their comparison to levels predicted by the TNM program. From the data in **Table C2**, it is apparent that differences between noise levels predicted by TNM and those measured in the field were generally within the acceptable range of ±3 dB. At locations where there were great discrepancies between the model results and the measured noise levels (Sites 4 and 13), site-specific shielding factors are the main reason for the large differences.

TABLE C2

Comparison of Measured and Predicted Traffic Noise Levels

Location	Description	Measured L_{eq} (dBA)	Predicted L_{eq} (dBA)	Difference (dBA)
1	627 Fairgrounds Road	58.3	58.3	0.0
4	Behind house at end of Indian Drive	51.2	61.0	+9.8
6	Next to 41 JoEtta Road	60.0	62.4	+2.4
7	28 Pleasant Drive	59.1	61.3	+2.2
9	Next to 1054 Lucasville-Minford Rd.	60.5	59.7	-0.8
11	Front Yard of the Chaney Residence	59.9	62.3	+2.4
13	Beside 2658 Lucasville-Minford Rd.	58.2	68.7	+10.5
45	At Alley Chiropractic Clinic on Ohio River Rd.	69.7	67.2	-2.5

Note: At locations where the noise model results vary from measurement results by more than 1 dBA, a K factor equal to the difference between predicted and measured noise levels is used for calculation of noise levels throughout the remainder of this analysis.

Appendix D
Existing (2002) and Future (2028) Traffic Data

TABLE D1
Existing (2002) and Future (2028) Peak-hour Traffic Volumes, Portsmouth Bypass

Roadway/Travel Direction	Autos	Medium Trucks	Heavy Trucks	Total
Existing (2002)				
US-23	1,174	49	99	1,322
US-52	1,766	29	91	1,886

TABLE D1
Existing (2002) and Future (2028) Peak-hour Traffic Volumes, Portsmouth Bypass

Lucasville-Minford Rd.	635	11	12	658
Future (2028)				
Portsmouth Bypass - Eastbound	1,560	62	156	1,778
Portsmouth Bypass - Westbound	1,560	62	156	1,778

Notes: Existing traffic volumes are based on the assumption that peak-hour traffic is 10% of average daily traffic (ADT).

Sources: ODOT Traffic Survey Report – Scioto County 2002

Appendix E
Photos of Noise Monitoring Locations

H2 receptor behind house.

House used for receptor H2.

H3 in front yard of home.

V5 near abandoned home.

V3 receptor in front yard of House.

House used for Receptor V3.

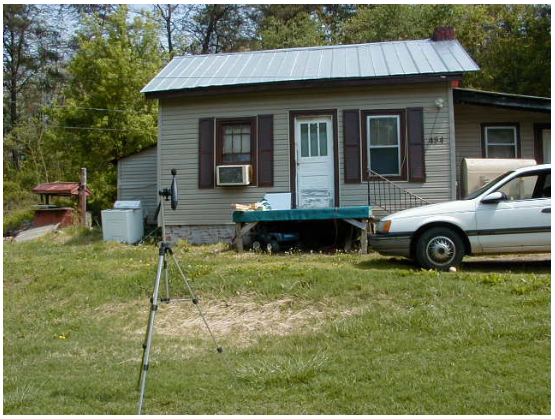
V4 receptor in Front yard of House.

House used for Receptor V4.

Receptor 18 behind barn and open field.

Receptor 18 behind barn.

H5 receptor in front yard.



House used for receptor H5