Total Reconstruction Milepost 125.6 to 127.3 and 128 to 133.5

Contract No. T-129.00T001-2

SOMERSET & BEDFORD COUNTY
PENNSYLVANIA

Preliminary Technical Noise Report

Revised for PennDOT Pub. 24 & 23CFR Part 772 Revisions

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PREPARED FOR:

The Pennsylvania Turnpike Commission

PREPARED BY:

JOHNSON, MIRMIRAN & THOMPSON
220 ST. CHARLES WAY, SUITE 200
YORK, PA 17402

PA TURNPIKE TOTAL RECONSTRUCTION MILEPOST 125.6-127.3 & 128-133.5
October 02, 2012

EXECUTIVE SUMMARY

The proposed project provides the reconstruction and widening of the Pennsylvania Turnpike between Milepost (MP) 125.6 to 127.3 and also between MP 128.0 and MP 133.5 in Allegheny Township and New Baltimore Borough in Somerset County and Juniata Township in Bedford County, Pennsylvania.

The existing roadway typical section of the Turnpike, east of Findley Street (MP 129.0), consists of two 12 ft. lanes in each direction with a 10 ft. median. There are two eastbound lanes and three westbound lanes west of Findley Street. East of Findley Street the Turnpike will be widened to three 12 ft. lanes in each direction with a 26 ft. median and 12 ft. outside shoulders. West of Findley Street, the Turnpike will consist of two eastbound lanes and three westbound lanes, with an 18 ft. median and 12 ft. outside shoulders.

Noise monitoring was performed in conformance with FHWA-PD-96-046, Measurement of Highway-Related Noise. Ambient readings were conducted using Metrosonics dB-308 or dB-3080 Universal Noise Analyzers. Each analyzer was calibrated at 102 dB(A) before tests were taken. Initial ambient monitoring consisted of performing 24-hour tests at two (2) distinct locations, followed by short term ambient readings taken at twenty-five (25) sites. The duration of each test was 20 minutes. Each site had simultaneous traffic counting performed.

The ambient monitoring was followed by TNM v2.5 noise modeling performed in accordance with the current United States Code of Federal Regulations, Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise, last revised July 13, 2010. Noise barriers were studied which would provide abatement in accordance with FHWA and PennDOT noise abatement criteria.

After determining eight (8) areas where mitigation is warranted several sound barrier designs were investigated for feasibility and reasonableness. Due to right-of-way constraints and the close proximity of residences to the Turnpike, earth berms were not feasible and noise barriers were considered to be the only feasible form of noise mitigation for this project. Noise barrier alignments were set based on the existing and proposed topography and impacted residence locations to provide the most cost-effective layout. When optimizing the height of the noise barriers, PennDOT noise barrier abatement design goals were used as well as consideration of feasibility and reasonableness criteria. Each of the eight (8) barriers was analyzed at constant heights varying from 8 ft. to 20 ft. Using the results of the constant height analysis the barriers were optimized to determine the most cost effective barrier while meeting the sound barrier abatement goals. A summary of the noise study findings are provided in **Table ES.1**.

The results show that two barriers are potentially warranted, feasible and reasonable using PennDOT criteria. The barriers are approximately 1,650 & 4,000 ft. long and are located along the Westbound Turnpike Mainline slightly east and west of the Findley Street Bridge and are laid out as a wall system to benefit residences within the Borough of New Baltimore, PA.

This report outlines the results of the detailed noise analysis performed as part of the preliminary design of the project and provides recommendation on the extent of noise abatement required to meet both FHWA and PennDOT noise guidelines.

Table ES.1 Noise Analysis Summary

Noise Study Area Description/Location & Barrier Number	Number of Impacted Receptors	Number of Impacted Equivalent Residential Units (ERU)	Number of Benefitted ERUs	Optimized Barrier Length (FT)	Ht. Above Ground (FT)	SF of Optimized Barrier	SF of Wall Per Benefitted ERU (SF/ERU)	Reasonable? (< 2000 SF/ERU?)
NSA-2 Southwest, Barrier No. 4 Turnpike Mainline EB, West of Findley Street	4	1.28	0.96	448	12 to 14, Avg = 12.22	5,478	5,778	No
NSA 2 Northwest - Barrier No. 5 Turnpike Mainline WB, West of Findley Street	2	2	32	1,650	8 to 20, Avg = 16.02	26,433	826	Yes
NSA 2 Northeast - Barrier No. 6 Turnpike Mainline WB, East of Findley Street	6	8	31.55	4,000	12 to 18, Avg = 13.58	54,300	1,721	Yes
NSA-2 Southeast, Barrier No. 7 Turnpike Mainline EB, East of Findley Street, West of Grasser Road	6	5.58	3	4,072	Constant 8.00	32,573	10,858	No
NSA 3 Northwest - Barrier No. 8 Turnpike Mainline WB between two Cider Road Bridges	2	3	5	3,000	8 to 16, Avg =12.6	37,799	7,560	No
NSA 3 Southwest - Barrier No. 9 Turnpike Mainline EB, between two Cider Road Bridges	9	23	10	2,900	10 to 16, Avg =12.66	36,700	3,670	No
NSA 3 Southeast - Barrier No. 10 Turnpike Mainline EB, East of Cider Road	2	2	1	550	8 to 12, Avg =10.73	5,900	5,900	No
NSA 3 Northeast - Barrier No. 11 Turnpike Mainline WB, East of Cider Road	2	1	1	900	8 to 10, Avg =8.34	7,502	7,502	No

Note: Square footage indicated is based on the optimized height from ground line to acoustical profile

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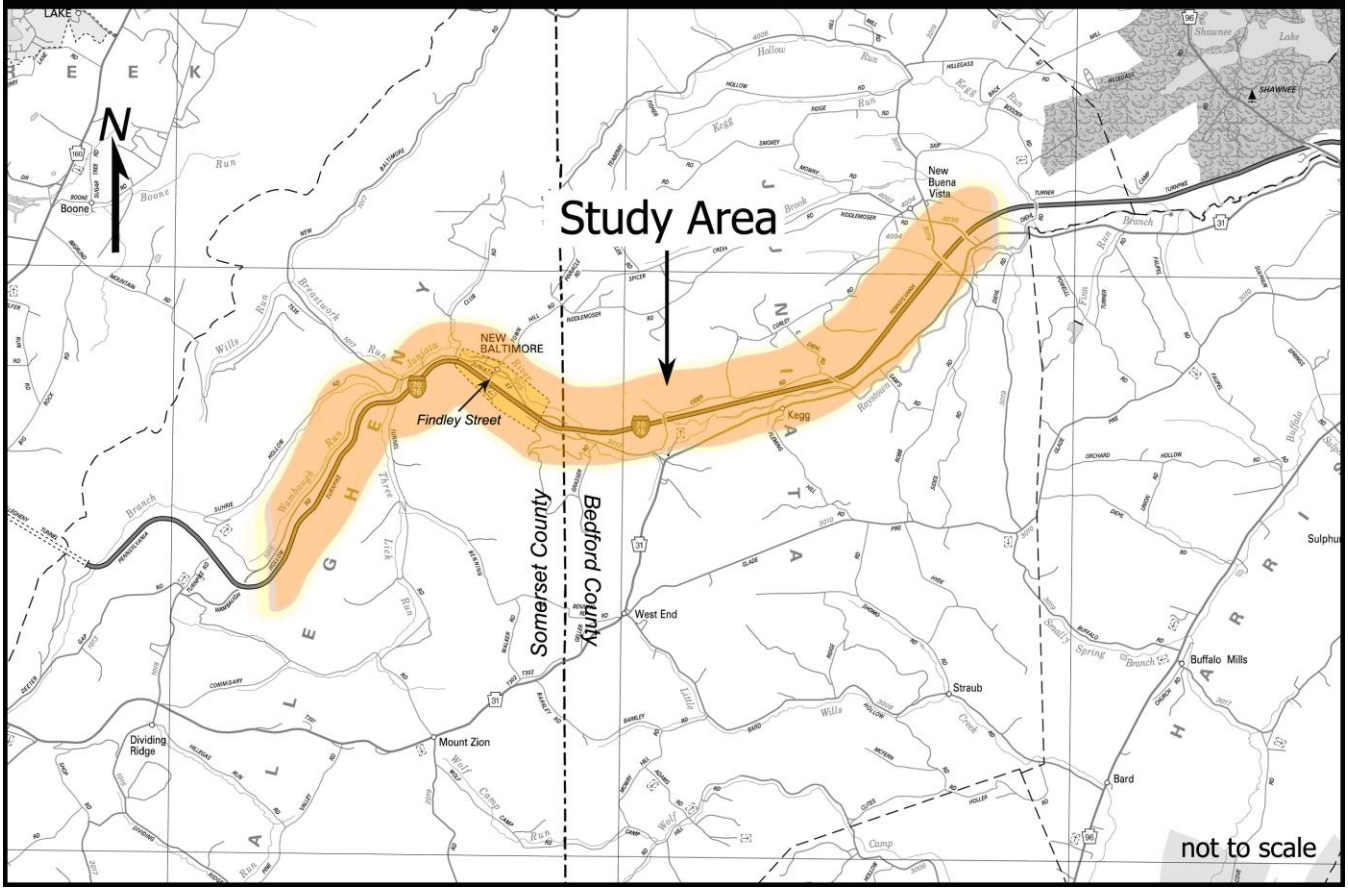
PA TURNPIKE TOTAL RECONSTRUCTION MILEPOST 125.6-127.3 & 128-133.5
October 02, 2012

SECTION 1 - INTRODUCTION

A. Background and Project Location

The project consists of the total reconstruction and widening of the Pennsylvania Turnpike between Milepost (MP) 125.6 to 127.3 and also between MP 128 and MP 133.5 in Allegheny Township and New Baltimore Borough in Somerset County and Juniata Township in Bedford County, Pennsylvania (**Figure 1.A**). In addition to the roadway reconstruction and widening, proposed improvements include the replacement of mainline structures and side road structures over the mainline.

Figure 1.A Study Area Location Map



The existing roadway typical section of the Turnpike east of Findley Street consists of two 12 ft. lanes in each direction with a 10 ft. median. There are two eastbound lanes and three westbound lanes west of Findley Street. East of Findley Street (MP 129.0), the Turnpike will be widened to three 12 ft. lanes in each direction with a 26 ft. median and 12 ft. outside shoulders. West of Findley Street, the Turnpike will consist of two eastbound lanes and three westbound lanes, with an 18 ft. median and 12 ft. outside shoulders.

B. Noise Sensitive Area Description

Residential Noise Sensitive Areas (NSAs) include single-family residences, single-family attached residences (townhouses), and multi-family residences (condominiums and apartments), motels and hotels located in neighborhoods adjacent to the PA Turnpike. Non-residential NSAs include recreation/meeting areas, playgrounds/trails, active sports areas, parks, schools, churches, libraries, offices, restaurants/bars, and hospitals/medical facilities located adjacent to the PA Turnpike.

Noise analysis locations throughout the study area are referred to as 'Receptors'. In this study, receptors have been labeled according to the following convention: '**M**' receptors were measured in the field with short-term 20 minute tests, '**T**' receptors were measured with long-term 24-hour tests and '**P**' receptors were not measured but only modeled in TNM v2.5 along with the 'M' and 'T' receptors for the 2040 build year. Refer to **Maps 1 – 5** and **Figure 1.B** for the specific location of NSA 1 through NSA 3, as described below.

NSA 1 – Mile Post 125.6 to 127.3 (Western Section represented by Receptors M-01 through M-02 and P-01) consists of single family residences along S.R. 1015 (Wambaugh Hollow Road) west of New Baltimore Borough. NSA 1 is also divided into North and South sections, with the split between the regions occurring at the Turnpike.

NSA 2 – Mile Post 128.0 to 130.9 (Middle Section represented by Receptors M-03 through M-019, T-01, P-02 through P-33, and P-44 through P-70) consists of single family residences, Saint John's Church, Saint John's Rectory (residence of parish priest), Saint John's Parish Hall Property and New Baltimore Sportsman Club baseball field in and around the Borough of New Baltimore. Some residences are along S.R. 1015/S.R. 3012 (Juniata Street). More specifically, NSA 2 is divided into quadrants (Northeast, Northwest, Southwest, and Southeast), which are separated using Findley Street (Mile Post 129.0) and the Turnpike. Refer to Section 3.C.4 for additional clarification on the NSA 2 quadrants and description.

NSA 3 – Mile Post 130.9 to 133.5 (Eastern Section represented by Receptors M-20 through M-25, T-02 and P-34 through P-43) consists of single family residences along S.R. 0031 (Allegheny Road), Cider Road and Egolf Road that parallel the Pennsylvania Turnpike. NSA 3 is also divided into quadrants (Northeast, Northwest, Southwest, and Southeast), with the split between the regions occurring at Turnpike and Cider Road.

The short-term and long-term monitored locations were selected along the project corridor with an attempt to represent the entire community as a whole. Monitored receptors were placed at the ends and in the middle of noise sensitive areas as well as in the first row and second row, where applicable. The long term monitoring sites (T-01 & T-02) and short term sites (M-01 to M-25) are shown in **Maps 1 through Map 5** and are described in **Table 1.A** below.

Figure 1.B NSA Location Map

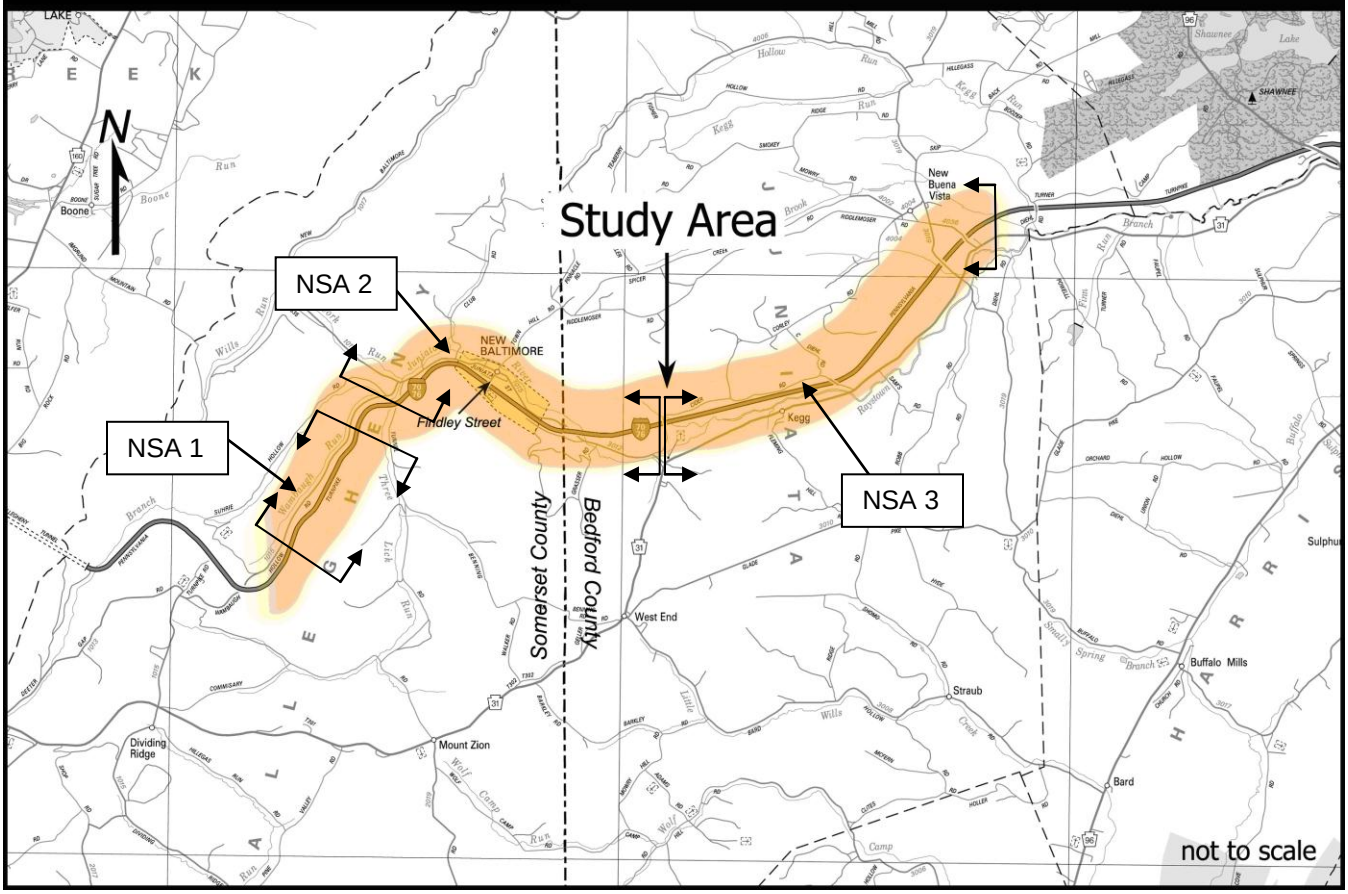


Table 1.A Monitored Receptor Location Description

Receptor Number	Residence Address or Property Description	Land Use Type	Location
T-01	105 Baltimore St.	Single-Family	Back Yard
T-02	2109 Allegheny Rd.	Single-Family	Back Yard
M-01	1002 Wambaugh Rd.	Single-Family	Back Yard
M-02	871 Wambaugh Rd.	Single-Family	Front Yard
M-03	112 Tunnel Rd.	Single-Family	Back Yard
M-04	195 Wambaugh Rd.	Single-Family	Front Yard
M-05	148 Washington St.	Single-Family	Front Yard
M-06	193 Carmel Dr.	Single-Family	Front Yard
M-07	245 Washington St.	Single-Family	Back Yard
M-08	167 Findley St.	Parish Hall Property	Basketball Court
M-09	311 Washington St.	Single-Family	Back Yard
M-10	Juniata St.	Athletic Field	Sideline
M-11	St. John's Church	Church	Front Yard
M-12	375 Juniata St.	Single-Family	Back Yard
M-13	416 Juniata St.	Single-Family	Front Yard
M-14	510 Juniata St.	Single-Family	Front Yard
M-15	563 Juniata St.	Single-Family	Back Yard
M-16	371 Will Road	Single-Family	Side Yard
M-17	158 New Baltimore Rd.	Single-Family	Front Yard
M-18	246 New Baltimore Rd.	Single-Family	Front Yard
M-19	367 New Baltimore Rd.	Single-Family	Back Yard
M-20	545 Cider Road	Single-Family	Front Yard
M-21	1792 Allegheny Rd.	Single-Family	Back Yard
M-22	1945 Allegheny Rd.	Single-Family	Back Yard
M-23	2076 Allegheny Rd.	Single-Family	Front Yard
M-24	2237 Allegheny Rd.	Single-Family	Back Yard
M-25	319 Egolf Road	Farmstead	Front Yard

C. Noise Abatement Criteria

The determination of traffic noise impacts is based on the relationship between the ambient noise levels and the established noise abatement criteria for the study area. The effects of noise are determined in accordance with the Federal Highway Administration guidelines as established by 23 Code of Federal Regulations (CFR), Part 772 and current PennDOT Policies. The Federal Noise Abatement Criteria (NAC) provided in **Table 1.B** are based on specific land uses and are used in determining areas that warrant noise abatement consideration.

Table 1.B Noise Abatement Criteria (NAC) Hourly A-Weighted Sound Level in Decibels [dB(A)]		
Land Use Activity Category	**Leq(h)[1]**	**Description of Activity Category**
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[2]	67 (Exterior)	Residential.
C[2]	67 (Exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails and trail crossings.
D	52 (Interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E[2]	72 (Exterior)	Hotels, motels, offices, restaurants/ bars, and other developed lands, properties or activities not included in A-D or F.
F	--------	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, ship yards, utilities (water resources, water treatment, electrical), and warehousing.
G	--------	Undeveloped lands that are not permitted.

1. Impact thresholds should not be used as a design standards for noise abatement purposes.
2. Includes undeveloped lands permitted for this activity category.

Based on field reconnaissance and deed research the identified active land uses along the corridor are as follows: single-family residences, cemeteries (one active, one historic inactive), a park/playground, a church, a parish hall, a restaurant/bar (with outdoor seating) and an athletic field. Per FHWA, any activity is considered to be "impacted" when traffic noise levels approach or exceed the decibel value as listed in the above table, or when the predicted noise levels are substantially higher than the existing ambient noise levels.

In defining the term "approach", PennDOT has adopted 1 dB(A) below the noise abatement criteria as the impact threshold and uses a 10dB(A) increase over existing noise levels to define a substantial increase.

PennDOT evaluates highway noise in two separate categories, Type 1 and Type 2. A Type 1 study is performed when new highways are constructed or existing highways are expanded. A Type 2 analysis is

performed along existing highways independent of improvements. This noise study involves proposed highway improvements, making this a Type 1 noise analysis.

D. Highway Noise Fundamentals

A discussion on Highway Noise Fundamentals is included, because it helps define many of the terms and criteria utilized in this report.

The extent to which individuals are affected by noise sources is controlled by several factors, including:

- The duration and frequency of sound
- The distance between the sound source and the receptor
- The intervening natural or man-made barriers or structures
- The ambient environment

The level of highway traffic noise depends primarily upon the following:

- The volume of traffic
- The speed of traffic
- The number of trucks in the flow of traffic

Generally, traffic noise is increased by heavier traffic volumes, higher speeds, and greater numbers of trucks. Consequently, the FHWA has established the following vehicle categories to use in traffic noise analysis:

- Heavy duty trucks, defined as vehicles having three or more axles
- Medium duty trucks, defined as vehicles with two axles and six wheels
- Automobiles, defined as vehicles with two axles and four wheels
- Buses
- Motorcycles

Heavy-duty trucks typically produce more noise than medium-duty trucks traveling at the same speed. Medium duty trucks, in turn, typically generate more noise than automobiles.

Traffic noise is measured and described according to FHWA guidelines, which prescribe the use of the hourly equivalent sound level [Leq (h)] as the primary descriptor for noise analysis. Leq (h) is defined as the equivalent steady state sound level, which in one hour contains the same acoustic energy as the time-varying sound level during the same one-hour period.

The unit of measure for the Leq is the "A-weighted" decibel [dB(A)]. The dB(A) scale de-emphasizes the very low and very high frequencies and emphasizes the middle frequencies, thereby closely approximating the frequency response of the human ear. **Table 1.C** provides examples of common outdoor noise levels and their respective noise level decibels. To place the noise levels into a context that some people can more easily relate to, **Table 1.C** also provides the equivalent common indoor noise levels.

Typically, noise level changes between 2 and 3 dB(A) are barely perceptible, while a change of 5 dB(A) is readily noticeable by most people. A 10 dB(A) increase is usually perceived as a doubling of loudness, and conversely, noise is perceived to be reduced by one-half when a sound level is reduced by 10 dB(A).

Table 1.C Common Outdoor and Indoor Noise Levels[1]

Common Outdoor Noise Levels	Noise Level Decibels [dB(A)]	Common Indoor Noise Levels
	110	Rock Band
Jet Fly Over at 1,000 ft.	100	Inside Subway Train (NY)
Gas Lawn Mower at 3 ft.		
Diesel Truck at 50 ft.	90	Food Blender at 3 ft.
Noisy Urban Daytime	80	Garbage Disposal at 3 ft. or Shouting at 3 ft.
Gas Lawn Mower at 100 ft.	70	Vacuum Cleaner at 10 ft.
Commercial Area		Normal Speech at 3 ft.
	60	
		Large Business Office
Quiet Urban Daytime	50	Dishwasher Next Room
Quiet Urban Nighttime	40	Small Theater, Large Conference Room (Background)
Quiet Suburban Nighttime		Library
	30	
Quiet Rural Nighttime		Bedroom at Night, Concert Hall (Background)
	20	
		Broadcast & Recording Studio
	10	Threshold of Hearing
	0	

1. Adapted from Guide on Evaluation and Attenuation of Traffic Noise, AASHTO-1974.

SECTION 2 – EXISTING HIGHWAY NOISE MEASUREMENTS

A. Introduction

Highway noise measurements were performed in conformance with the U.S. Department of Transportation FHWA's Measurement of Highway-Related Noise (FHWA-PD-96-046 May 1996). 24-hour and short-term (20-minute) noise measurements were conducted for this study.

Field data corresponding to this section of the report can be found in:

Appendix A – Noise Measurement Data
Appendix B – Traffic Count Data

B. Noise Measurement Data

Field measurements of ambient noise levels were performed to determine the existing (2006) noise levels and for use in calibrating the FHWA Traffic Noise Model. The Noise Testing Plan that was submitted and approved in June 2006 was followed. The noise measurements were conducted using Metrosonics dB 308 and Metrosonics dB 3080 noise analyzers. Calibration certificates for each piece of equipment are included in **Appendix G**. Both twenty-four hour and short-term (twenty-minute) measurements were performed.

The persons conducting the Traffic Noise Analysis are qualified as per PennDOT Pub. #24 and copies of Certificates of Training can be found in **Appendix H**.

1. 24-Hour Noise Measurements

Two 24-hour noise measurements were taken (T-01 & T-02) in the project area and the hourly equivalent sound levels, Leq(h), were calculated for each hour of the 24-hour noise measurements. The Leq(h) levels defined each 24-hour noise measurement site's peak noise hours and peak noise hour level. The peak noise hours may not occur at the peak traffic hour, but instead may occur when traffic volumes are lower, but the truck mix or vehicle speeds are higher. **Table 2.A** provides a summary of the peak noise levels for the two 24-hour noise measurements. A graph indicating hourly noise levels during each of the tests is shown in **Appendix A**. [Note: military time – e.g. 1300 = 1:00 pm]

Table 2.A 24-Hour Noise Measurement Summary

Receptor Number	Residence Address or Property Description	Land Use Type	Start Date & Time	Peak Hour	Peak Noise Hour Leq, dB(A)
T-01	105 Baltimore Street	Single Family	7/25/06, 1400	2000 - 2100	65
T-02	2109 Allegheny Road	Single Family	7/25/06, 1300	1600 - 1700	64

2. Short-term Noise Measurements

Twenty-five (25) short-term noise measurement receptors were analyzed. Two (2) short-term noise measurements (20-minute duration) were conducted at each receptor location within the three (3) NSAs between milepost 125.6 and milepost 133.5. The 20-minute tests were set up for 1-minute intervals in order to filter out any non-highway related noise (i.e. dog barking, horns, and airplanes) during the monitoring session. The 20-minute equivalent sound level, Leq (20-min), was calculated for each short-term noise measurement. **Table 2.B** summarizes the measured noise hour level for each of the short-term noise measurements. The level is rounded to the nearest whole decibel in accordance with PennDOT guidelines and has been adjusted to represent the noise level at the peak noise hour according to the 24-hour noise measurements. For example, receptor M-01 has a short-term field measurement noise level of 59 dB(A) between 9:20 A.M. and 9:40 A.M. The T-01 receptor 24-hour measurement noise level between 9:20 A.M. and 9:40 A.M. is 63 dB(A) and is 2 dB(A) lower than the peak noise level hour of 65 dB(A). Therefore, receptor M-01 is adjusted by the 2 dB(A) difference to an existing ambient peak hour noise level of 61 dB(A). The 24-hour site T-01 was used to adjust measured receptors in NSA 1 and NSA2 (M-01 to M-19) because these receptors were influenced mostly by the Turnpike Mainline. The 24-hour site T-02 was used to adjust measured receptors in NSA 3 (M-20 to M-25) because both the Turnpike Mainline and S.R. 0031 traffic influenced the noise levels. These adjusted short-term noise levels were used to assess existing ambient noise levels.

Appendix A contains data collected in the field. Short-term noise measurements (20-minute) were collected concurrently with classified traffic counts. Traffic counts were divided into five (5) vehicle classes: cars, large trucks, medium trucks, buses and motorcycles. The traffic counts were then used in Traffic Noise Model (TNM) calibration. The related data, tables and figures for the traffic monitoring sessions are located in **Appendix B**.

Table 2.B Short-Term Noise Measurement Summary

Receptor Number	Residence Address or Property Description		Land Use Type	Location	Date	Interval	Duration	Measured Noise Level Leq, dB(A)[1]
				NSA 1				
M-01	1002	Wambaugh Rd.	Single-Family	Back Yard	8/16/2006	0930-0940	10-min	61
M-01	1002	Wambaugh Rd.	Single-Family	Back Yard	8/16/2006	1400-1420	20-min	61
M-02	871	Wambaugh Rd.	Single-Family	Front Yard	8/16/2006	0920-0940	20-min	63
M-02	871	Wambaugh Rd.	Single-Family	Front Yard	8/16/2006	1400-1420	20-min	63
				NSA 2				
M-03	112	Tunnel Rd.	Single-Family	Back Yard	8/16/2006	0920-0940	20-min	Meter Malfunction
M-03	112	Tunnel Rd.	Single-Family	Back Yard	8/16/2006	1400-1420	20-min	60
M-04	195	Wambaugh Rd.	Single-Family	Front Yard	8/16/2006	0920-0940	20-min	61
M-04	195	Wambaugh Rd.	Single-Family	Front Yard	8/16/2006	1400-1420	20-min	59
M-05	148	Washington St.	Single-Family	Front Yard	8/16/2006	0920-0940	20-min	58
M-05	148	Washington St.	Single-Family	Front Yard	8/16/2006	1400-1420	20-min	57
M-06	193	Carmel Dr.	Single-Family	Front Yard	8/16/2006	1000-1020	20-min	64
M-06	193	Carmel Dr.	Single-Family	Front Yard	8/16/2006	1440-1500	20-min	63
M-07	245	Washington St.	Single-Family	Back Yard	8/16/2006	1000-1020	20-min	55
M-07	245	Washington St.	Single-Family	Back Yard	8/16/2006	1440-1500	20-min	54
M-08	167	Findley St.	Parish Hall	Court	8/16/2006	1000-1020	20-min	58
M-08	167	Findley St.	Parish Hall	Court	8/16/2006	1440-1500	20-min	57
M-09	311	Washington St.	Single-Family	Back Yard	8/16/2006	1000-1020	20-min	58
M-09	311	Washington St.	Single-Family	Back Yard	8/16/2006	1440-1500	20-min	55
M-10		Washington St.	Athletic Fld.	Sideline	8/16/2006	1000-1020	20-min	59
M-10		Washington St.	Athletic Fld.	Sideline	8/16/2006	1440-1500	20-min	56
M-11		St. John's Church	Church	Front Yard	8/16/2006	1040-1100	20-min	63
M-11		St. John's Church	Church	Front Yard	8/16/2006	1520-1540	20-min	63
M-12	375	Juniata St.	Single-Family	Back Yard	8/16/2006	1040-1100	20-min	67
M-12	375	Juniata St.	Single-Family	Back Yard	8/16/2006	1520-1540	20-min	66
M-13	416	Juniata St.	Single-Family	Front Yard	8/16/2006	1040-1100	20-min	64
M-13	416	Juniata St.	Single-Family	Front Yard	8/16/2006	1520-1540	20-min	64
M-14	510	Juniata St.	Single-Family	Front Yard	8/16/2006	1040-1100	20-min	72
M-14	510	Juniata St.	Single-Family	Front Yard	8/16/2006	1520-1540	20-min	72
M-15	563	Juniata St.	Single-Family	Back Yard	8/16/2006	1040-1100	20-min	72

Table 2.B Short-Term Noise Measurement Summary

Receptor Number	Residence Address or Property Description	Land Use Type	Location	Date	Interval	Duration	Measured Noise Level Leq, dB(A)[1]
M-15	563 Juniata St.	Single-Family	Back Yard	8/16/2006	1520-1540	20-min	72
M-16	371 Will Road	Single-Family	Side Yard	8/16/2006	1120-1140	20-min	74
M-16	371 Will Road	Single-Family	Side Yard	8/16/2006	1600-1620	20-min	74
M-17	158 New Baltimore Rd.	Single-Family	Front Yard	8/16/2006	1120-1140	20-min	68
M-17	158 New Baltimore Rd.	Single-Family	Front Yard	8/16/2006	1600-1620	20-min	68
M-18	246 New Baltimore Rd.	Single-Family	Front Yard	8/16/2006	1120-1140	20-min	64
M-18	246 New Baltimore Rd.	Single-Family	Front Yard	8/16/2006	1600-1620	20-min	65
M-19	367 New Baltimore Rd.	Single-Family	Back Yard	8/16/2006	1120-1140	20-min	57
M-19	367 New Baltimore Rd.	Single-Family	Back Yard	8/16/2006	1600-1620	20-min	59
NSA 3							
M-20	545 Cider Road	Single-Family	Front Yard	8/16/2006	1120-1140	20-min	61
M-20	545 Cider Road	Single-Family	Front Yard	8/16/2006	1600-1620	20-min	60
M-21	1840 Allegheny Rd.	Single-Family	Back Yard	8/16/2006	1200-1220	20-min	66[3]
M-21	1840 Allegheny Rd.	Single-Family	Back Yard	8/16/2006	1640-1700	20-min	63[3]
M-22	1945 Allegheny Rd.	Single-Family	Back Yard	8/16/2006	1200-1220	20-min	65[3]
M-22	1945 Allegheny Rd.	Single-Family	Back Yard	8/16/2006	1640-1700	20-min	64[3]
M-23	2076 Allegheny Rd.	Single-Family	Front Yard	8/16/2006	1200-1220	20-min	67[3]
M-23	2076 Allegheny Rd.	Single-Family	Front Yard	8/16/2006	1640-1700	20-min	65[3]
M-24	2237 Allegheny Rd.	Single-Family	Back Yard	8/16/2006	1200-1220	20-min	62[3]
M-24	2237 Allegheny Rd.	Single-Family	Back Yard	8/16/2006	1640-1700	20-min	63[3]
M-25	319 Egolf Road	Farm	Front Yard	8/16/2006	1200-1220	20-min	61[3]
M-25	319 Egolf Road	Farm	Front Yard	8/16/2006	1640-1700	20-min	61[3]
Total Number of Short-term Noise Measurements							50

LEGEND

Exceeds PennDOT NAC[2]

1. *All Noise Levels are shown as hourly equivalent sound levels (Leq[h]) with units in A-weighted decibels (dB[A]. These levels have been adjusted to the peak noise level using the corresponding 24-hour monitoring results. The Level is rounded to the nearest whole decibel in accordance with PennDOT guidelines.*
2. *Receptors where the existing (measured) noise levels equal or exceed 66 dB(A).*
3. *Noise from local traffic on S.R. 0031 is included in Leq value.*

C. Existing Conditions Results

The adjusted noise monitoring results show that five (5) of the twenty-five (25) tested receptors have existing noise levels that exceed the PennDOT NAC, representing eleven (11) residences. There are a few receptors that are close to the NAC at 2006 existing ambient conditions. Receptors M-21 & M-22 have existing noise levels at 66 dBA but are not counted at this time because the high noise levels during testing were from local truck traffic on S.R. 0031 (Allegheny Road) not the Pennsylvania Turnpike.

D. Existing Peak Hour Traffic Data

Classified traffic counts were conducted at the same time as the A.M. round of short-term noise measurements. Cars, heavy trucks, medium trucks, buses and motorcycles were all counted during the five (5) A.M. 20-minute Traffic Monitoring Sessions. The traffic count data is presented in **Appendix B** along with average speed for each session. Speeds were determined using a radar gun and represents the average tested speed.

Existing 2011 worst case peak hour traffic volumes were determined from information provided by the Turnpike in an email dated 8/16/2012. The vehicle fleet breakout percentages (cars, medium trucks and heavy trucks) were also provided by the Turnpike. The 2011 traffic volumes were extrapolated to 2012 in order to create a current year 'existing worst case' traffic scenario. See **Appendix D** for the Existing Worst Case Peak Hour Traffic that was used to model the existing worst case noise levels.

It should be noted that though the measurements were taken in 2006, the receptors listed are still valid. The two receptors that are proposed to be displaced due to construction impacts were not considered for noise abatement (M-06 and M-16).

SECTION 3 –PREDICTED HIGHWAY TRAFFIC NOISE ANALYSIS

A. Introduction

Worst case noise levels are predicted using TNM Version 2.5 for the following conditions: Existing, 2040 No-Build and 2040 Build. A calibrated TNM model of existing conditions is used to create the TNM runs predicting future conditions.

A Sound Barrier Analysis was conducted after the highway noise measurements were collected. The Sound Barrier Analysis is comprised of three parts:

1. TNM Model[1] Calibration
2. Sound Barrier Analysis TNM Model
3. Sound Barrier Design

B. TNM Model Calibration

The TNM model calibration verifies the validity of the TNM model by evaluating the model's ability to reproduce the measured noise levels under specific measured traffic conditions. Traffic data was collected in conjunction with the ambient noise measurements and inputted into TNM. If the TNM results of a run with counted traffic volumes and measured speeds produce noise level results within +/- 3 dB(A) of the measured noise levels, then the TNM model is considered calibrated.

After the Noise Measurements and Traffic Counts were obtained, a TNM Model was developed for the study area, inputting all pertinent roadways, terrain, and structural elements thought to be needed for adequately characterizing the study area's noise environment. Each Noise Measurement Receptor was accurately represented in the model by a TNM Receptor. The model was then calibrated by testing it under the appropriate traffic conditions encountered during the corresponding traffic monitoring session. PennDOT considers a TNM Model to be properly calibrated when the Modeled Noise Levels are within ±3 dB(A) of the Measured Noise Levels for the receptors. **Table 3.A** compares the Measured Noise Levels to the Modeled Noise Levels from the TNM Runs.

Table 3.A TNM Calibration Results

Traffic Monitoring Session	Receptor Number	Residence Address or Property Description		Measured Noise Level	Modeled Noise Level	Difference
TMS01	M-01	1002	Wambaugh Rd.	59	62	3
TMS01	M-02	871	Wambaugh Rd.	61	64	3
TMS01	M-03	112	Tunnel Rd.	59	62	3
TMS01	M-04	195	Wambaugh Rd.	59	61	2
TMS01	M-05	148	Washington St.	56	58	2
TMS02	M-06	193	Carmel Dr.	62	63	1
TMS02	M-07	245	Washington St.	53	55	2

[1] FHWA Traffic Noise Model® (TNM), Version 2.5

Table 3.A TNM Calibration Results						
Traffic Monitoring Session	**Receptor Number**	**Residence Address or Property Description**		**Measured Noise Level**	**Modeled Noise Level**	**Difference**
TMS02	M-08	167	Findley St.	56	57	1
TMS02	M-09	311	Washington St.	56	55	-1
TMS02	M-10		Washington St.	57	57	0
TMS03	M-11		St. John's Church	61	64	3
TMS03	M-12	375	Juniata St.	65	68	3
TMS03	M-13	416	Juniata St.	62	65	3
TMS03	M-14	510	Juniata St.	70	71	1
TMS03	M-15	563	Juniata St.	70	73	3
TMS04	M-16	371	Will Road	72	74	2
TMS04	M-17	158	New Baltimore Rd.	66	69	3
TMS04	M-18	246	New Baltimore Rd.	62	65	3
TMS04	M-19	367	New Baltimore Rd.	55	57	2
TMS04	M-20	545	Cider Road	60	62	2
TMS05	M-21	1840	Allegheny Rd.	65	64	-1
TMS05	M-22	1945	Allegheny Rd.	64	67	3
TMS05	M-23	2076	Allegheny Rd.	66	67	1
TMS05	M-24	2237	Allegheny Rd.	61	64	3
TMS05	M-25	319	Egolf Road	60	62	2

Note: *Receptor No. M-03 is calibrated using the PM measured noise level because the AM results were discarded due to meter malfunction.*

The measured noise levels are within three decibels of the modeled TNM 2.5 noise levels at each location and therefore the noise model is considered calibrated. Calibration results and TNM printouts are presented in **Appendix C.**

C. Predicted Noise Levels

1. General

Once the model was calibrated, an unlimited number of Modeled Receptors could be located virtually anywhere in the models, and so long as no further modifications were made to terrain or structural features, the model could be expected to predict valid noise levels at those receptors under whatever traffic conditions would be deemed appropriate for study. Therefore, in order to provide a fuller representation of the noise environment 71 new receptors were added to the 25 receptors[2] already in the model, thereby creating a total set of 96 receptors. The new modeled receptors referred to as "TNM Modeled Receptors" and specifically identified as P-01 through P-70 (shown on **Maps 6 through 15**).

[2] All 28 noise measurement receptors sites were added to the Calibration Model, even though calibration could only be checked at 25 receptors.

2. Predicted Traffic

Existing worst case peak hour traffic volumes were determined from information provided by the Turnpike in an email dated 8/16/2012. The vehicle fleet breakout percentages (cars, medium trucks and heavy trucks) were also provided by the Turnpike. These 2011 traffic volumes were then extrapolated to the design year 2040 by using the appropriate growth factors.

Appendix D contains the traffic volume and speeds used in the TNM 2040 No-Build and the 2040 Build analysis. This appendix includes traffic volume calculation spreadsheets as well as peak hour vehicle fleet breakout calculations.

3. Predicted Noise Level Results

Table 3.B compares the modeled worst case noise levels between the Existing Worst Case, 2040 No Build and 2040 Build. 'Highlight' (white background) in the Predicted Noise Level table indicates that receptor is impacted with predicted noise levels at or above 66 dB(A) and that a noise mitigation investigation is warranted.

All noise levels are rounded to the nearest whole decibel. The TNM results from the predicted noise level analysis are included in **Appendix E**. The corresponding 66 dB(A) 2040 Build Traffic Noise Contour is shown in **Section 7 – Maps No. 6 through 10**.

Noise levels were found to increase (1 - 11 dBA compared to existing worst case and 1-9 dBA compared to 2040 No-Build) at a majority of the receptors due to project widening and shifting of the roadway closer to receptors. In addition, the project is expected to decrease noise levels (2-6 dBA compared to existing worst case) at Receptors P-01, P-06, P-07, P-09, M-04 and M-05 due to shifting of the roadway away from receptors and at Receptor P-20 because of changes in terrain due to the widening of the highway.

Table 3.B Predicted Noise Levels

Receptor Number[1]	Address or Description		2012 Existing Worst Case Noise Level	2040 No Build Predicted Noise Level	Difference from Existing to No Build	2040 Build Predicted Noise Level	Difference from Existing to Build
NSA 1							
M-01	1002	Wambaugh Rd.	59	61	2	60	1
M-02	871	Wambaugh Rd.	60	62	2	62	2
P-01	821	Wambaugh Hollow Rd.	58	60	2	56	-2[6]
NSA 2							
M-03	112	Tunnel Rd.	59	60	2	61	3
M-04	195	Wambaugh Rd.	58	59	2	55	-2[6]
M-05	148	Washington St.	57	58	2	53	-4[6]
M-06	193	Carmel Dr.	60	62	2	**66**[2]	5
M-07	245	Juniata St.	52	54	2	55	3
M-08	167	Findley St.	55	57	2	59	3
M-09	311	Juniata St.	54	56	2	57	3
M-10[5]		Sportsman's Club	55	57	2	58	3
M-11		St. John's Church Rectory	61	63	2	**68**	6
M-12	375	Juniata St.	65	**67**	2	**67**	2
M-13	416	Juniata St.	62	64	2	65	3
M-14	510	Juniata St.	**68**	**70**	2	**71**	3
M-15	563	Juniata St.	**70**	**72**	2	**74**	5
M-16	371	Will Road	**72**	**74**	2	**74**[2]	2
M-17	158	New Baltimore Rd.	**67**	**69**	2	**69**	2
M-18	246	New Baltimore Rd.	64	65	2	**66**	2
M-19	367	New Baltimore Rd.	56	58	2	58	2
T-01	105	Baltimore St.	65	**67**	2	**68**	3
P-02	458	Wambaugh Hollow Rd.	55	56	2	57	2
P-03	385	Wambaugh Hollow Rd.	58	60	2	61	3
P-04	263	Wambaugh Hollow Rd.	61	63	2	63	2
P-05	225	Wambaugh Hollow Rd.	60	62	2	60	1
P-06	105	Wambaugh Hollow Rd.	59	60	2	55	-4[6]
P-07	110	Juniata Street	59	61	2	53	-6[6]
P-08	190	Juniata Street	57	59	2	58	1
P-09	173	Juniata Street	58	60	2	56	-1[6]
P-10	175	Juniata Street	58	60	2	60	2
P-11	135	Juniata Street	56	57	2	58	2
P-12	101	Baltimore Street	61	63	2	62	1
P-13	227	Juniata Street	52	54	2	55	3
P-14	250	Juniata Street	53	54	2	55	3
P-15	106	Baltimore Street	58	60	2	61	3
P-16	121	Baltimore Street	65	**67**	2	**68**	3
P-17	147	Herman Street	53	55	2	56	3

Table 3.B Predicted Noise Levels

Receptor Number[1]	Address or Description		2012 Existing Worst Case Level	2040 No Build Predicted Noise Level	Difference from Existing to No Build	2040 Build Predicted Noise Level	Difference from Existing to Build
P-18	285	Juniata Street	53	55	2	56	3
P-19	308	Juniata Street	47	49	2	50	2
P-20	189	Carmel Drive	59	61	2	56[2]	-3[7]
P-21	189	Carmel Drive	60	62	2	**66**	5
P-22		St. John's Church	59	61	2	**69**	**10**
P-23		St. John's Church	49	51	2	54	5
P-24	398	Juniata Street	59	61	2	63	4
P-25	441	Juniata Street	66	**68**	2	**70**	4
P-26	445	Juniata Street	**69**	**71**	2	**72**	3
P-27		Will Road	59	61	2	65	6
P-28	468	Juniata Street	**68**	**70**	2	**71**	3
P-29	371	Will Road (Reloc. M-16)	**68**	**69**	2	**72**	4
P-30	315	Will Road	61	63	2	**68**	6
P-31	102	New Baltimore Road	**68**	**70**	2	**72**[2]	3
P-32	178	New Baltimore Road	**67**	**68**	2	**69**	3
P-33	407	New Baltimore Road	53	55	2	55	2
P-44	189	Carmel Drive	61	63	2	**66**[2]	5
P-45	234	Juniata Street	55	57	2	57	2
P-46		St. John's Parish Hall	51	53	2	55	4
P-47		St. John's Parish Hall	53	55	2	57	4
P-48		St. John's Parish Hall	54	56	2	58	4
P-49		St. John's Parish Hall	54	56	2	57	3
P-50		St. John's Parish Hall	54	56	2	57	3
P-51		St. John's Parish Hall	56	57	2	59	3
P-52		St. John's Parish Hall	56	58	2	59	3
P-53		St. John's Parish Hall	55	56	2	57	3
P-54		St. John's Parish Hall	57	59	2	60	3
P-55		St. John's Parish Hall	56	58	2	60	3
P-56		St. John's Parish Hall	55	57	2	58	3
P-57		St. John's Historic Cem.	53	55	2	59	6
P-58		St. John's Historic Cem.	55	57	2	62	8
P-59		St. John's Historic Cem.	54	56	2	59	5
P-60		St. John's Historic Cem.	56	57	2	60	5
P-61		St. John's Historic Cem.	54	56	2	59	5
P-62		St. John's Historic Cem.	56	58	2	61	5
P-63		St. John's Active Cem.	53	55	2	59	6
P-64		St. John's Active Cem.	54	56	2	60	6
P-65		St. John's Active Cem.	54	56	2	60	6
P-66		St. John's Active Cem.	54	56	2	60	6
P-67		St. John's Active Cem.	55	56	2	61	6
P-68		St. John's Active Cem.	55	57	2	61	6

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Table 3.B Predicted Noise Levels

Receptor Number[1]	Address or Description		2012 Existing Worst Case Noise Level	2040 No Build Predicted Noise Level	Difference from Existing to No Build	2040 Build Predicted Noise Level	Difference from Existing to Build
P-69		St. John's Active Cem.	55	57	2	61	6
P-70		St. John's Active Cem.	56	58	2	62	6
P-71		St. John's Church Grds.	65	67	2	**71**	6
P-72		St. John's Church Grds.	65	67	2	**70**	5
P-73		St. John's Church Grds.	**66**	68	2	**77**	**11**
P-74		St. John's Church Grds.	60	62	2	64	4
NSA 3							
M-20	545	Cider Road	59	61	2	65	6
M-21	1840	Allegheny Rd.	65	66	1	**67**	2
M-22	1945	Allegheny Rd.	**66**	**68**	2	**70**	4
M-23	2076	Allegheny Rd.	66	**67**	1	**68**	2
M-24[3]	2237	Allegheny Rd.	62	64	2	**66**	3
M-25	319	Egolf Road	58	60	2	63	4
T-02	2109	Allegheny Rd.	**67**	**69**	2	**68**	2
P-34	430	Cider Road	**71**	**73**	2	**76**	5
P-35	636	Cider Road	64	**66**	2	**71**	6
P-36	1736	Allegheny Road	65	66	1	**66**	2
P-37	1794	Allegheny Road	63	64	1	**66**	3
P-38	1996	Allegheny Road	**66**	**68**	1	**68**	2
P-39	1993	Allegheny Road	**68**	**70**	2	**72**	4
P-40	2141	Allegheny Road	66	**68**	2	**69**	4
P-41[4]	116C	Diehl Road	64	**66**	2	**70**	5
P-41B[4]	116C	Diehl Road	63	**65**	2	**70**	7
P-42[3]	2237	Allegheny Road	66	**68**	2	**69**	4
P-43	2278	Allegheny Road	65	66	1	**66**	1

LEGEND

Warranted Receptor, > = 66dB(A) for 2040 design year or exceeds existing worst case traffic noise by 10dB(A) or more

1. *A Receptor Number beginning with "M" represents a short-term measured location, Receptor Number beginning with "T" represents a long-term measured location and a Receptor Number beginning with "P" represents a modeled receptor only.*
2. *Receptors M-06, M-16, P-20, P-31 & P-44 are proposed to be displaced due to construction impacts and are not considered for noise abatement.*
3. *Receptor M-24 and P-42 are on the same property, P-42 is used for barrier analysis.*
4. *Receptor P-41 & P-41B are on the same property. Both receptors are used for barrier analysis.*
5. *Receptor M-10 represents one residence and a baseball field.*
6. *2040 Build noise levels decrease for Receptor M-04, M-05, P-01, P-06, P-07 and P-09 because the proposed horizontal curve shifts away from them.*
7. *2040 Build noise levels decrease for Receptor P-20 because of the proposed terrain feature which breaks the line-of-site.*

4. Impact Analysis and Noise Abatement Warrants

PennDOT defines traffic noise impacts if the noise levels equal or exceed 66 dB(A) (Land Use Activity Category B & C), and 71 dB(A) (Land Use Activity Category E). For a Type I analysis, a noise study area warrants consideration of noise abatement if one of the following criteria is met:

- Predicted Highway Traffic Noise levels (for the design year) equal or exceed those outlined above, or
- Predicted Highway Traffic Noise levels are predicted to increase by 10 dB(A) or more over existing levels.

A total of 31 receptors, representing 47.16 Equivalent Residential Units (ERUs) along the project corridor have worst case traffic noise levels that equal or exceed 66 dB(A) in the 2040 Build Condition. The ERU value is a function of the "person-hours per year" of use of the site, expressed as a ratio to the "person-hours per year" of use by an average single-family dwelling in Pennsylvania. While the ERU value for a single-family residence is always one, ERU values for other sites will vary based on a variety of factors. For ERU calculations and relevant usage data, see **Appendix I**. Traffic noise levels are distributed as follows:

NSA 1 (North and South results summarized together) - (Western Section represented by Receptors M-01, M-02 and P-01) consists of single family residences along S.R. 1015 (Wambaugh Hollow Road) west of New Baltimore Borough. **Map No. 6** shows the predicted 2040 Build noise levels at the modeled receptors. There are no residences that warrant investigation of a noise barrier due to roadway improvements in the 2040 Build Condition. There are no receptors where the predicted future build level is at or above 66 dB(A). Predicted levels range from 56 dB(A) to 62 dB(A), with a maximum increase of 2 dB(A) from the existing worst case condition.

NSA 2 – (Middle Section, divided into 4 quadrants using the Turnpike and Findley Street as the dividers.)

•NSA 2 – Northwest Quadrant
This section is represented by Receptors M-03 through M-05, M-07, T-01, P-02 through P-17, and P-45. The quadrant consists of single family residences in and around the Borough of New Baltimore. Some residences are along S.R. 1015 (Juniata Street). **Map No. 7** shows the predicted 2040 Build noise levels at the modeled receptors and impacted residences are shaded "dark gray". In the Northwest Quadrant there are 2.0 ERUs, (represented by T-01 and P-16) that warrant investigation of a noise barrier due to roadway improvements in the 2040 Build Condition. Predicted levels range from 53 to 68 dB(A) in this study area, with a maximum increase of 3 dB(A) from the existing worse case condition. Mitigation alternates were evaluated in this area as Barrier 5 (See Section 4.D).

•NSA 2 – Northeast Quadrant
This section is represented by Receptors M-08 through M-10, M-12 through M-15, P-18, P-19, P-24 through P-26, P-28, P-31 and P-46 through P-56. The quadrant consists of single family residences in and around the Borough of New Baltimore, Saint John's Parish Hall

Playground/Picnic Area, and New Baltimore Sportsman Club baseball field. Some residences are along S.R. 1015 (Juniata Street). **Map No. 7 & 8** shows the predicted 2040 Build noise levels at the modeled receptors and impacted residences are shaded "dark gray". In the Northeast Quadrant there are 8.0 ERUs, (represented by M-12, M-14, M-15, P-25, P-26 and P-28) that warrant investigation of a noise barrier due to roadway improvements in the 2040 Build Condition It should be noted that receptor P-31 was excluded from the analysis because the residence it represented will be displaced due to construction impacts. Predicted sound levels for the remaining receptors range from 67 to 74 dB(A) in this study area, with a maximum increase of 5 dB(A) from the existing worse case condition. Mitigation alternates were evaluated in this area as Barrier 6 (See Section 4.E).

•NSA 2 – Southwest Quadrant

This section is represented by Receptors M-06, M-11, P-20, P-21, P-23 and P-71 through P-74. The quadrant consists of, Saint John's Church, and Saint John's Church Rectory. **Map No. 7** shows the predicted 2040 Build noise levels at the modeled receptors and impacted residences are shaded "dark gray". In the Southwest Quadrant there are 1.58 ERUs, (represented by M-11 and P-71 through P-74) that warrant investigation of a noise barrier due to roadway improvements in the 2040 Build Condition. It should be noted that receptors M-06, P-20, P-21, & P-44 are excluded from the analysis because the residences they represented will be displaced due to construction impacts. Predicted sound levels for the remaining receptors range from 54 to 77 dB(A) in this study area, with a maximum increase of 11 dB(A) from the existing worse case condition at receptor P-74. Mitigation alternates were evaluated in this area as Barrier 4. (See Section 4.C)

•NSA 2 – Southeast Quadrant

This section is represented by Receptors P-22, P-27, P-29, P-30, P-32, P-33, and M-16 through M-19. The quadrant consists of single family residences around the Borough of New Baltimore, and the Saint John's Church Cemeteries. **Map No. 7, 8 & 9** shows the predicted 2040 Build noise levels at the modeled receptors and impacted residences are shaded "dark gray". In the Southeast Quadrant there are 5.58 ERUs, (represented by M-17, M-18, P-22, P-29, P-30, and P-32) that warrant investigation of a noise barrier due to roadway improvements in the 2040 Build Condition. It should be noted that receptor M-16 is excluded from the analysis because the residence it represented will be relocated due to construction impacts. Predicted sound levels for the remaining receptors range from 66 to 72 dB(A) in this study area, with a maximum increase of 10 dB(A) from the existing worse case condition. Mitigation alternates were evaluated in this area as Barrier 7. (See Section 4.F)

NSA 3 (North) – (Eastern Section, divided into quadrants, using Cider Road and the Turnpike as the dividers.)

•NSA 3 – Northeast Quadrant

This section is represented by Receptors P-41 & P-41B and consists of a single family residence along Cider Road to the north of the Turnpike. **Map No. 10** shows the predicted 2040 Build noise levels at the modeled receptors and impacted residences are shaded "dark gray". In this section there is one (1) ERU (represented by P-41/P41B) that warrants investigation of a noise

barrier due to roadway improvements in the 2040 Build Condition. The predicted sound levels is 70 dB(A) in this area with a maximum increase of seven (7) dB(A) from the existing worst case condition. Mitigation alternates were evaluated in this area as Barrier 11. (See Section 4.J)

•NSA 3 – Northwest Quadrant

This section is represented by Receptors P-34, M-20, and P-35 and consists of single family residences along Cider Road that parallels the Pennsylvania Turnpike. **Map No. 9** shows the predicted 2040 Build noise levels at the modeled receptors and impacted residences are shaded "dark gray". In this there are three (3) ERUs (represented by P-34 and P-35) that warrant investigation of a noise barrier due to roadway improvements in the 2040 Build Condition. Predicted sound levels range from 71 to 76 dB(A) in this area with a maximum increase of six (6) dB(A) from the existing worst case condition. Mitigation alternates were evaluated in this area as Barrier 8. (See Section 4.G)

•NSA 3 – Southwest Quadrant

This section (represented by Receptors M-21 through M-23, T-02, and P-36 through P-40) consists of single family residents along SR 0031 (Allegheny Road) that parallels the Pennsylvania Turnpike. **Map No. 9 & 10** shows the predicted 2040 Build noise levels at the modeled receptors and impacted residences are shaded "dark gray". In this section all 23 ERUs warrant investigation. Predicted sound levels range from 66 to 72 dB(A) in this study area with a maximum increase of four (4) dB(A) from the existing worse case condition. Mitigation alternates were evaluated in this area as Barriers 9. (See Section 4.H)

•NSA 3 – Southeast Quadrant

This section (represented by Receptors M-24, P-42, and P-43) consists of single family residents along SR 0031 (Allegheny Road) that parallels the Pennsylvania Turnpike. **Map No. 10** shows the predicted 2040 Build noise levels at the modeled receptors and impacted residences are shaded "dark gray". In this section 2 ERUs warrant investigation (represented by P-42 and P-43). Predicted sound levels range from 66 to 70 dB(A) in this study area with a maximum increase of four (4) dB(A) from the existing worse case condition. Mitigation alternates were evaluated in this area as Barriers 10. (See Section 4.I)

A TNM run was done for NSA 3 to assess the impact local road S.R. 0031(Allegheny Rd.) has on the adjacent properties. The 2040 Build TNM was run with zero vehicles on S.R. 0031 and then compared to the 2040 Build noise levels with traffic on both the Turnpike Mainline and S.R. 0031. **Table 3.C** compares the two TNM runs and clearly shows that the receptors on the south side of S.R. 0031 are influenced by S.R. 0031.

Table 3.C NSA 3, S.R. 0031 Local Road Assessment

Receptor Number	Residence Address or Property Description	2040 Build Predicted Noise Level	2040 Build Noise Level w/o Traffic on S.R. 0031	Difference
M-21	1840 Allegheny Rd.	68	65	3
M-22	1945 Allegheny Rd.	70	70	0
M-23	2076 Allegheny Rd.	68	65	3
M-24	2237 Allegheny Rd.	66	66	0
T-02	2109 Allegheny Rd.	69	69	0
P-36	1736 Allegheny Rd.	67	61	6
P-37	1794 Allegheny Rd.	67	65	2
P-38	1996 Allegheny Rd.	69	67	2
P-39	1993 Allegheny Rd.	72	72	0
P-40	2141 Allegheny Rd.	70	70	0
P-42	2237 Allegheny Rd.	70	70	0
P-43	2278 Allegheny Rd.	67	61	6

LEGEND

Influenced by S.R. 0031 Traffic

Impacts were found in NSA 3 along S.R. 0031 both with and without traffic on the local road. **Table 3.B** and impact mapping in this area (**Map No. 9 & No. 10**) used the results from the 2040 Build TNM run with traffic on S.R. 0031. Receptors on the south side of S.R. 0031 (M-21, M-23, P-36, P-38 and P-43) will not be used to help mitigate receptors between the Turnpike Mainline and S.R. 0031.

SECTION 4 – MITIGATION ALTERNATIVES

A. General

After determining areas where mitigation is warranted several sound barrier designs were investigated for feasibility and reasonableness. Due to right-of-way constraints and the close proximity of residences to the Turnpike, earth berms were not feasible and noise walls were considered to be the only feasible form of noise mitigation for this project.

Eight (8) sound barrier locations where noise abatement is warranted have been evaluated at the locations listed below. It should be noted that there are no Barriers 1, 2, or 3 because there were no warrants in NSA 1, and therefore, the Barrier numbers that were previously assigned to NSA 1 were not needed.

- Barrier 4 – NSA 2, (Southwest Quadrant) Eastbound Turnpike Mainline, West of Findley Street
- Barrier 5 – NSA 2, (Northwest Quadrant) Westbound Turnpike Mainline, West of Findley Street
- Barrier 6 – NSA 2, (Northeast Quadrant) Westbound Turnpike Mainline, East of Findley St. and West of the Raystown Branch of the Juniata River
- Barrier 7 – NSA 2, (Southeast Quadrant) Eastbound Mainline, East of Findley Street and West of Grasser Road
- Barrier 8 – NSA 3, (Northwest Quadrant) Westbound Turnpike Mainline, between the two Cider Road Bridges
- Barrier 9 – NSA 3, (Southwest Quadrant)Eastbound Turnpike Mainline, between the two Cider Road Bridges
- Barrier 10 – NSA 3, (Southeast Quadrant) Eastbound Turnpike Mainline, East of Cider Road
- Barrier 11 – NSA 3, (Northeast Quadrant) Westbound Turnpike Mainline, East of Cider Road

Noise barrier alignments were set based on the existing and preliminary proposed topography and impacted residence locations to provide the most cost-effective layout. The exact alignment location of any warranted, feasible and reasonable barriers will be determined during the Final Design process. When optimizing the height of the noise barriers, PennDOT noise barrier abatement design goals were used as well as consideration to feasibility and reasonableness criteria.

The Pennsylvania Turnpike Commission is committed to the construction of warranted, feasible and reasonable highway traffic noise abatement measures at the noise-impacted locations identified in **Table 3.B** contingent upon the following conditions: detailed noise analyses during the Final Design Phase; analysis and determination of the feasibility and reasonableness of highway traffic noise abatement measures methodology and criteria; community input regarding desires, types, heights and locations as well as aesthetic considerations; preferences regarding compatibility with adjacent land uses, particularly as addressed by officials having jurisdiction over such land uses; and safety and engineering aspects as related to the roadway user and the adjacent property owner. Final recommendations on the construction of any noise abatement measures(s) will be determined during the completion of the projects' final design and public involvement processes. Draft copies of the Warranted, Feasible and

Reasonable Worksheets can be found in **Appendix J** for each noise impacted area that warrants abatement.

1. Noise Barrier Abatement Goal Compliance

According to PennDOT Pub. No. 24, the following tiered noise barrier abatement goals should be used to govern the optimized barrier design.

- Reduce future Highway Traffic Noise 7 dB(A) or greater for at least one benefitted receptor.
- It is desirable, while conforming to the Maximum Square Footage of Abatement Per Benefitted Receptor value of 2000 (MaxSF/BR) criteria, to reduce by 7 db(A) ***or greater*** for additional impacted receptor sites, if justified by a "point of diminishing returns" evaluation. (The MaxSF/BR criterion replaces the previously used "Cost per Benefitted Receptor".)
- While conforming to the MaxSF/BR criteria, it is desirable to provide additional exterior insertion loss above the seven (7) dB(A) minimum if justified by a "point of diminishing returns'
- If possible, reduce future exterior noise levels to the low 60-decible range (60-63) for Category B and C receptors and the upper 60-decible range (65-68) for Category E receptors.
- If possible, reduce future Highway Traffic Noise levels back to existing levels.

2. Feasibility Criteria

To meet the PennDOT feasibility requirements for this project (7) seven acoustical and engineering parameters need to be considered. Each of the seven parameters is stated in the form of a question that can be answered with "yes" or "no". In order for a noise barrier to be "feasible", there needs to be a "yes" answer to all seven questions. The seven feasibility parameters are listed below in **Table 4.1**.

Table 4.1 PennDOT Feasibility Criteria

1. Can a Highway Traffic Noise reduction of at least 5 dBA be achieved at the majority of the impacted Receptor Units (i.e. 50% or greater)?
2. Can the noise barrier be designed and physically constructed at the proposed location?
3. Can the noise barrier be constructed without causing a safety problem?
4. Can the noise barrier be constructed without restricting access to vehicular to pedestrian travel?
5. Can the noise barrier be constructed in a manner that allows for required maintenance & operations?
6. Can the noise barrier be constructed in a manner that allows utilities to adequately function?
7. Can the noise barrier be constructed in a manner that allows drainage features to adequately function?
Source: Pub. No. 24, April 2011

3. Reasonableness Criteria

The reasonableness criteria for noise barrier evaluation are listed below in **Table 4.2**:

Table 4.2 PennDOT Reasonableness Criteria
1. Do at least 50% of benefitted receptor unit owners and renters desire the noise barrier?
2. Is the Square Footage Per Benefitted Receptor Evaluation equal to or less than 2,000 SF/BR?
3. Does at least one benefitted receptor receive a 7-dBA or greater noise reduction?
4. Does the barrier provide an insertion loss of at least 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation?
5. Does the barrier provide an insertion loss greater than 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation?
6. Does the barrier reduce future exterior levels to the low 60-decible range for Category B & C receptors and the upper 60-decible range for Category E receptors?
7. Does the barrier reduce design year noise levels back to existing levels?
Source: Pub. No. 24, April 2011

B. Design Discussion Overview

Each of the eight (8) barriers were analyzed at various constant heights ranging from 8 ft. to 20 ft. and then using the results of the constant height analysis the barriers were optimized to determine the most cost effective solution while meeting the sound barrier abatement goals. Graphs were made to show the square footage of abatement per benefited receptor unit (SF/BR) versus barrier area for each analyzed barrier. If the optimized barrier SF/BR point falls under the constant height data line then the proposed barrier is optimized.

The results show that two barriers (Barrier 5 & 6) are potentially warranted, feasible and reasonable using PennDOT criteria. The barriers are approximately 1,650 and 4,000 ft. long, respectively, and are located along the Westbound Turnpike Mainline, to the west and east of the Findley Street Bridge, such that the residences within the town of New Baltimore, PA are protected.

Refer to **Table 4.3** for a complete summary of noise levels in order of Receptor No., including existing year (2012), Build w/o barrier (2040), and Build w/barrier (2040) noise levels.

Table 4.3 Noise Level Summary Table

Receptor Number	Residence Address or Property Description		2012 (Existing Worst Case) Traffic Noise Levels, dB(A)	2040 Build Modeled Noise Level, dB(A)	2040 Noise Levels with Barrier, dB(A)	Noise Reduction due to Sound Barrier (Insertion Loss), dB(A)	Reasonable? (< 2000 SF Per Equivalent Residential Unit (ERU)?)
T-01	105	Baltimore St.	65.4	**68.3**	59.2	9	Yes
T-02	2109	Alleghney Rd.	66.7	**68.4**	63.6	5	No
M-01	1002	Wambaugh Rd.	59	59.9	---	Not Impacted	Not Warranted
M-02	871	Wambaugh Rd.	59.6	61.6	---	Not Impacted	Not Warranted
M-03	112	Tunnel Rd.	58.6	61.2	---	Not Impacted	Not Warranted
M-04	195	Wambaugh Rd.	57.6	55.2	---	Not Impacted	Not Warranted
M-05	148	Washington St.	56.5	53	50.7	2	Yes
M-06	193	Carmel Dr.	60.4	Property Acquisition			
M-07	245	Juniata St.	52.2	54.8	50.3	5	Yes
M-08	167	Findley St.	55.2	58.6	54.5	4	Yes
M-09	311	Juniata St.	54.2	56.7	51.8	5	Yes
M-10		Sportsman's Club	55.1	57.9	53.3	5	Yes
M-11		St. John's Church	61.2	**67.5**	63	5	No
M-12	375	Juniata St.	65.3	**67.4**	59.1	8	Yes
M-13	416	Juniata St.	61.9	65.2	58	7	Yes
M-14	510	Juniata St.	68.2	**71.4**	62.9	9	Yes
M-15	563	Juniata St.	69.8	**74.4**	63.8	11	Yes
M-16	371	Will Road	71.7	Property Acquisition			
M-17	158	New Baltimore Rd.	67.3	**69.2**	62.7	7	No
M-18	246	New Baltimore Rd.	63.5	65.5	63.1	2	No
M-19	367	New Baltimore Rd.	56.1	58.1	---	Not Impacted	Not Warranted
M-20	545	Cider Road	59.4	65.2	60.2	5	No
M-21	1840	Alleghney Rd.	64.7	**67.1**	66.9	0	No
M-22	1945	Alleghney Rd.	66	**70.1**	63.1	7	No
M-23	2076	Alleghney Rd.	65.6	**67.5**	65.7	2	No
M-24	2237	Alleghney Rd.	62.3	**65.7**	59.6	6	No
M-25	319	Egolf Road	58.3	62.6	---	Not Impacted	Not Warranted
P-01	821	Wambaugh Hollow Rd.	57.7	56.2	---	Not Impacted	Not Warranted
P-02	458	Wambaugh Hollow Rd.	54.5	56.5	---	Not Impacted	Not Warranted
P-03	385	Wambaugh Hollow Rd.	58	60.6	---	Not Impacted	Not Warranted
P-04	263	Wambaugh Hollow Rd.	60.8	63	---	Not Impacted	Not Warranted
P-05	225	Wambaugh Hollow Rd.	59.7	60.2	---	Not Impacted	Not Warranted
P-06	105	Wambaugh Hollow Rd.	58.5	55	---	Not Impacted	Not Warranted
P-07	110	Juniata Street	58.6	52.9	52.8	0	Yes
P-08	190	Juniata Street	57	58.4	51.6	7	Yes
P-09	173	Juniata Street	57.7	56.3	52.8	4	Yes
P-10	175	Juniata Street	58.1	59.8	53.3	7	Yes
P-11	135	Juniata Street	55.5	57.6	51.2	6	Yes
P-12	101	Baltimore Street	61.2	62.4	57	5	Yes
P-13	227	Juniata Street	52.4	54.9	48.4	7	Yes
P-14	250	Juniata Street	52.5	55	49.3	6	Yes
P-15	106	Baltimore Street	57.8	60.8	53.9	7	Yes
P-16	121	Baltimore Street	65.2	**68.3**	58.6	10	Yes
P-17	147	Herman Street	53.2	55.8	52.5	3	Yes
P-18	285	Juniata Street	53.4	56.4	57.4	5	Yes
P-19	308	Juniata Street	47.4	49.6	45.1	5	Yes
P-20	189	Carmel Drive	58.7	Property Acquisition			
P-21	189	Carmel Drive	60.3	Property Acquisition			
P-22		St. John's Church	59.1	**68.8**	68.3	1	No
P-23		St. John's Church	49	54.1	53.6	1	No
P-24	398	Juniata Street	59.1	63	56.4	7	Yes
P-25	441	Juniata Street	65.8	**70.1**	61.8	8	Yes
P-26	445	Juniata Street	69.3	**72.3**	62.9	9	Yes
P-27		Will Road	59.4	65.1	64.2	1	No

Table 4.3 Noise Level Summary Table

Receptor Number	Residence Address or Property Description		2012 (Existing Worst Case) Traffic Noise Levels, dB(A)	2040 Build Modeled Noise Level, dB(A)	2040 Noise Levels with Barrier, dB(A)	Noise Reduction due to Sound Barrier (Insertion Loss), dB(A)	Reasonable? (< 2000 SF Per Equivalent Residential Unit (ERU)?)
P-28	468	Juniata Street	67.9	**70.9**	62.4	9	Yes
P-29	371	Will Road (Relocated M-16)	67.5	**71.9**	67.3	5	No
P-30	315	Will Road	61.3	**67.5**	62.1	5	No
P-31	102	New Baltimore Road	68.3	Property Acquisition			
P-32	178	New Baltimore Road	66.5	**69**	65.6	3	No
P-33	407	New Baltimore Road	53.3	55.2	---	Not Impacted	Not Warranted
P-34	430	Cider Road	71.4	**76.1**	68.9	7	No
P-35	636	Cider Road	64.4	**70.5**	65.2	5	No
P-36	1736	Allegheny Road	64.7	**66.2**	66.2	0	No
P-37	1794	Allegheny Road	63.1	**66.3**	66.2	0	No
P-38	1996	Allegheny Road	66.4	**68.1**	65.8	2	No
P-39	1993	Allegheny Road	68.3	**72.2**	65.7	7	No
P-40	2141	Allegheny Road	65.7	**69.4**	64.5	5	No
P-41	116C	Diehl Road	64.3	**69.5**	62.5	7	No
P-42	2237	Allegheny Road	65.9	**69.4**	62.9	7	No
P-43	2278	Allegheny Road	65	**66.2**	65.8	0	No
P-44	189	Carmel Drive	61.3	Property Acquisition			
P-45	234	Juniata Street	54.9	57.3	51.3	6	Yes
P-46		Parish Hall	51.4	55.2	52.2	3	Yes
P-47		Parish Hall	53	56.7	52.6	4	Yes
P-48		Parish Hall	54.1	58	55.1	3	Yes
P-49		Parish Hall	54.1	57.4	51.4	6	Yes
P-50		Parish Hall	53.9	57.1	51.4	6	Yes
P-51		Parish Hall	55.6	59	54.6	4	Yes
P-52		Parish Hall	55.7	59.1	53.8	5	Yes
P-53		Parish Hall	54.6	57.4	52.1	5	Yes
P-54		Parish Hall	57.2	60.3	54.7	6	Yes
P-55		Parish Hall	56.4	59.6	53.6	6	Yes
P-56		Parish Hall	55.3	58	52.4	6	Yes
P-57		St. John's Historic Cem.	52.9	58.9	58.6	0	No
P-58		St. John's Historic Cem.	54.9	62.4	61.9	1	No
P-59		St. John's Historic Cem.	54	58.7	58.4	0	No
P-60		St. John's Historic Cem.	55.6	60.3	60.1	0	No
P-61		St. John's Historic Cem.	54.3	59.1	59	0	No
P-62		St. John's Historic Cem.	56	60.6	60.5	0	No
P-63		St. John's Active Cem.	53.4	59	58.8	0	No
P-64		St. John's Active Cem.	53.8	59.5	59.2	0	No
P-65		St. John's Active Cem.	54.1	59.9	59.7	0	No
P-66		St. John's Active Cem.	54.4	60.3	60	0	No
P-67		St. John's Active Cem.	54.5	60.5	60.3	0	No
P-68		St. John's Active Cem.	55.2	61.2	61	0	No
P-69		St. John's Active Cem.	54.9	61	60.8	0	No
P-70		St. John's Active Cem.	55.9	62.1	61.8	0	No
P-71		St. John's Church Grounds	65.3	**71.2**	64.6	7	No
P-72		St. John's Church Grounds	64.7	**70.1**	63.8	6	No
P-73		St. John's Church Grounds	66.3	**77.4**	72.2	5	No
P-74		St. John's Church Grounds	60.1	64.1	62.6	1	No

C. Barrier 4 Design

Barrier 4 was laid out to protect impacted receptors M-11, P-71, P-72 and P-73 on the Saint John's Church property and is located along the Eastbound Turnpike Mainline, West of Findley Street. **Map No. 12** shows the location of Barrier 4. It begins approximately 4,967 ft. east of Tunnel Road and ends approximately 15 ft. west of the Findley Street Bridge. Currently, the alignment is set at the top of the proposed cut slope along the realigned Turnpike Mainline.

The optimized barrier is 448 ft. long, ranges in height from 12 ft. to 14 ft., and has an average height of 12.2 ft. A minimum of 5 dB(A) noise level reduction can be achieved at three of the impacted receptors. Because Barrier 4 can reduce the highway traffic noise of at least 5 dB(A) at the majority of the impacted Receptor Units (i.e., 50% or greater), Barrier 4 does meet the feasibility criteria.

Appendix I shows the equivalent residential unit (ERU) calculations for the Saint John's Church lawn property. Each of the five receptors on the church property is divided by the total ERUs of 1.58 (1.0 for parish priest residence and 0.58 for outdoor church use) so each receptor represents 0.32 ERUs for the barrier analysis.

There are a total of 0.95 benefitted ERUs (Equivalent Residential Units) and therefore the Square Footage of Abatement Per Benefitted Receptor (SF/BR) value is calculated to be 5,778 SF/BR. Because this is greater than the 2,000 SF/BR maximum value, Barrier 4 **is feasible**, but it **is not reasonable**.

Table 4.A shows the 2040 Build Predicted Noise Levels, with and without a Barrier 4, the insertion losses attained and the barrier design data for each constant height barrier analyzed and the optimized barrier. **Figure 4.A** shows the Noise Barrier Analysis SF/BR Summary chart and **Table 4.B and 4.C** shows the Policy Feasibility and Reasonableness Evaluation for the optimized barrier.

Table 4.A Barrier 4, Noise Barrier Analysis Summary

Receptor Number[1] (Units Represented)	2040 Build Predicted Noise Level [2]	Barrier Height and Insertion Loss[5]											
		8 ft. Constant Height		12 ft. Constant Height		16 ft. Constant Height		18 ft. Constant Height		20 ft. Constant Height		Optimized Height 12-14 ft. (Ave 12.22 ft.)	
		Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]
M-11(0.32)	65.7	65.0	1	63.9	2	62.8	3	62.5	3	62.2	4	63.9	2
P-23(0.05)	54.1	52.4	2	52.1	2	50.4	4	50.0	4	49.8	4	53.7	0
P-71(0.32)	71.2	64.6	7	63.5	8	62.6	9	62.4	9	62.0	9	64.6	7
P-72(0.32)	70.1	65.2	5	63.8	6	62.7	7	62.4	8	62.0	8	63.8	6
P-73(0.32)	77.4	75.4	2	73.6	4	71.2	6	70.9	7	70.8	7	72.2	5
P-74(0.32)	64.1	62.6	1	61.9	2	60.9	3	60.6	3	60.2	4	62.6	1
Barrier Length (Ft.)		498		498		498		498		498		448	
Area (Square Ft.), from TNM		3,987		5,981		7,975		8,972		9,968		5,478	
Total Number of Benefitted ERUs (5 dBA)		0.63		0.63		0.95		0.95		0.95		0.95	
Square Ft. per Benefitted Receptor (SF/BR)		6,309		9,464		8,412		9,464		10,515		5,778	

LEGEND

Impacted[2]

1. *A Receptor Number beginning with "M" represents a short-term measured location, Receptor Number beginning with "T" represents a long-term measured location and a Receptor Number beginning with "P" represents a modeled receptor only.*
2. *Impacted receptors are those that that warrant the investigation of noise abatement due to noise impacts. This occurs where the predicted noise levels meet any of the following criteria:*
   - *Predicted Highway Traffic Noise levels equal or exceed 66 dB(A).*
   - *Predicted Highway Traffic Noise substantially exceed (by 10 dB(A) or more) the existing Highway Traffic Noise levels.*
3. *IL: Insertion Loss.*
4. *Square footage indicated is based upon its length and its height from the finished ground elevation at the base of the barrier to its top elevation (acoustical profile line).*
5. *Noise values, comparisons, and insertion losses are calculated to the tenth of a dB(A) and then rounded for presentation purposes.*

Figure 4.A Barrier 4, Noise Barrier Analysis: Square Footage of Abatement Per BR Unit

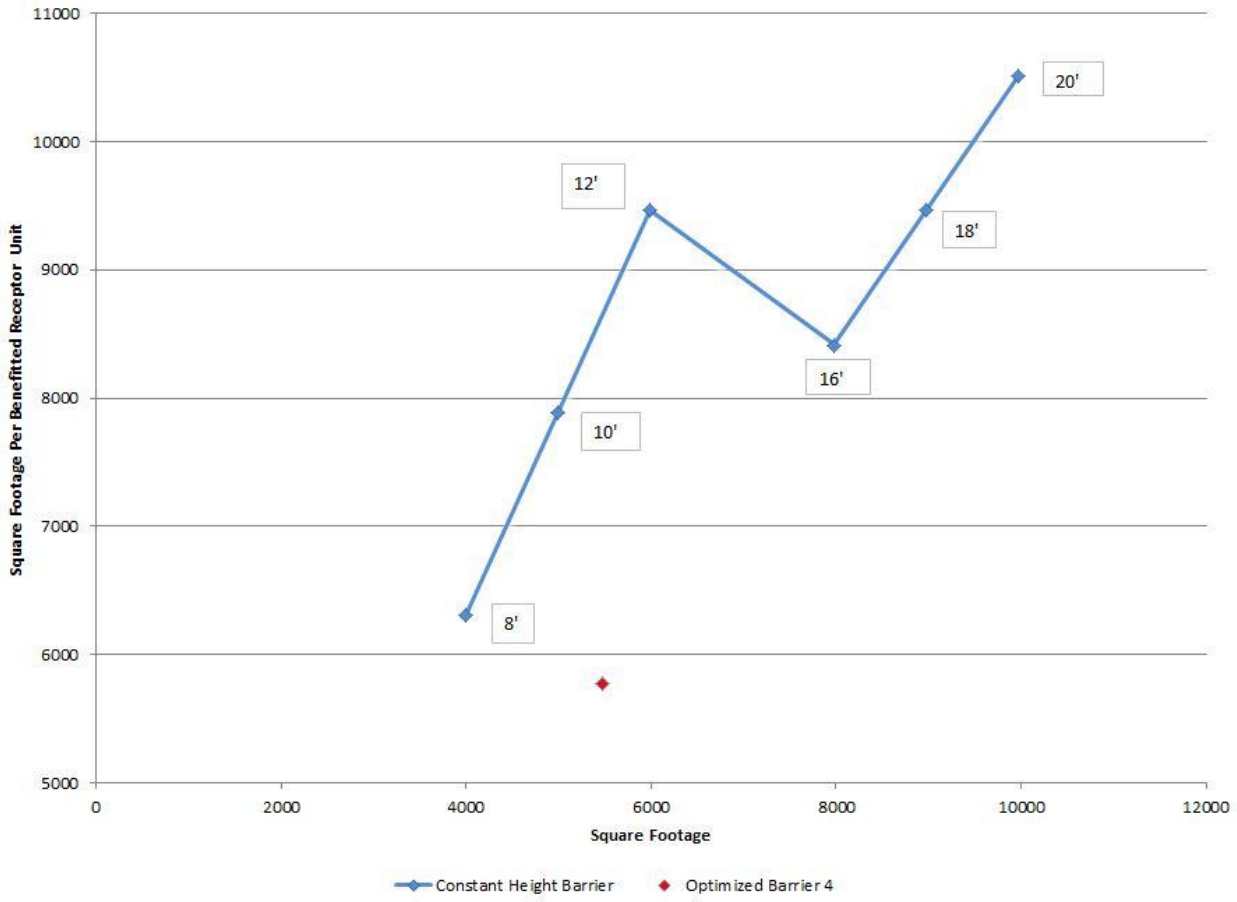

Table 4.B Optimized Barrier 4, Policy Feasibility Criteria Evaluation	
Feasibility Criteria	
1.	Can a Highway Traffic Noise reduction of at least 5 dB(A) be achieved at the majority of the impacted Receptor Units (i.e. 50% or greater)? **(YES)**
2.	Can the noise barrier be designed and physically constructed at the proposed location? **(YES)**
3.	Can the noise barrier be constructed without causing a safety problem? **(YES)**
4.	Can the noise barrier be constructed without restricting access to vehicular to pedestrian travel? **(YES)**
5.	Can the noise barrier be constructed in a manner that allows for required maintenance & operations? **(YES)**
6.	Can the noise barrier be constructed in a manner that allows utilities to adequately function? **(YES)**
7.	Can the noise barrier be constructed in a manner that allows drainage features to adequately function? **(YES)**
Source: Pub. No. 24, April 2011	**(YES)/(NO)** –Answer for this Turnpike Reconstruction Project

Table 4.C Optimized Barrier 4, Policy Reasonableness Criteria Evaluation
Reasonableness Criteria
1. Do at least 50% of benefitted receptor unit owners and renters desire the noise barrier? **(Unknown)**
2. Is the Square Footage Per Benefitted Receptor Evaluation equal to or less than 2,000 SF/BR? **(NO)**
3. Does at least one benefitted receptor receive a 7dB(A) or greater noise reduction? **(YES)**
4. Does the barrier provide an insertion loss of at least 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(NO)**
5. Does the barrier provide an insertion loss greater than 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(NO)**
6. Does the barrier reduce future exterior levels to the low 60-decible range for Category B & C receptors and the upper 60-decible range for Category E receptors? **(NO)**
7. Does the barrier reduce design year noise levels back to existing levels? **(YES)**
Source: Pub. No. 24, April 2011 *Note: All "Unknown" criteria will be determined during final design.*

D. Barrier 5 Design

Barrier 5 was laid out to protect the Borough of New Baltimore with impacted receptors T-01 and P-16 and is located along the Westbound Turnpike Mainline, West of Findley Street, **Map No. 12** shows the location of Barrier 5. It begins approximately 12 ft. west of the Findley Street Bridge and ends approximately 4,000 ft. east of Tunnel Road. The alignment is set four (4) ft. off of the proposed edge of shoulder along the realigned Turnpike Mainline. Currently, the noise barrier is located within the required clear zone limits for the roadway design speed. Therefore, proposed concrete traffic barrier would be needed to protect the wall from vehicular impact. During final design consideration will be made to determine if the wall can be placed outside the clear zone.

The optimized barrier is 1,650 ft. long, ranges in height from 8 ft. to 20 ft., and has an average height of 16.02 ft. The square footage of abatement equals 26,433 SF. A minimum of nine (9) dB(A) noise level reduction can be achieved at the impacted receptors, meeting the feasibility criteria in this area. All noise reduction values for Barrier 5 assume that Barrier 6 is in place since these barriers work together to protect the Borough of New Baltimore. Barrier 5 and Barrier 6 are separate barriers because of the location of Findley Street.

There are a total of thirty-two (32) benefitted ERUs (Equivalent Residential Units) and therefore the Square Footage of Abatement Per Benefitted Receptor (SF/BR) value is calculated to be 826 SF/BR, Barrier 5 does meet the reasonableness criteria. Therefore, Barrier 5 **is potentially feasible and reasonable**.

Table 4.D shows the 2040 Build Predicted Noise Levels, with and without a Barrier 5, the insertion losses attained and the barrier design data for each constant height barrier analyzed and the optimized barrier. **Figure 4.B** shows the Noise Barrier Analysis Cost/dB(A)/Unit Protected Summary chart and **Table 4.E & 4.F** shows the Policy Feasibility and Reasonableness Evaluation for the optimized barrier.

This barrier alignment is preliminary; during the Final Design process the exact alignment, location and heights will be determined and feasibility and reasonableness will be analyzed again at that time.

Table 4.D Barrier 5, Noise Barrier Analysis Summary

Receptor Number[1] (ERU)	2040 Build Predicted Noise Level [2]	Barrier Height and Insertion Loss[5]											
		8 ft. Constant Height		10 ft. Constant Height		14 ft. Constant Height		18 ft. Constant Height		20 ft. Constant Height		Optimized Height 8-20 ft. (Ave 16.02 ft.)	
		Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]
T-01 (1)	68.3	63.5	5.0	61.8	7.0	60.1	8	59.1	9	58.4	10	59.2	9
M-05 (3)	53.0	49.6	3.0	48.8	4	47.8	5	47.2	6	47.5	6	50.7	2
M-07 (4)	54.8	52.7	2.0	51.8	3	51.2	4	50.1	5	49.6	5	50.3	5
P-07 (1)	52.9	52.4	1.0	52.0	1	51.9	1	51.8	1	51.8	1	52.8	0
P-08 (3)	58.4	54.5	4.0	52.5	6	50.4	8	49.8	9	49.5	9	51.6	7
P-09 (1)	56.3	54.7	2.0	54.3	2	53.2	3	52.6	4	52.5	4	52.8	4
P-10 (2)	59.8	55.6	4.0	54.6	5	53.2	7	52.6	7	52.0	8	53.3	7
P-11 (2)	57.6	54.0	4.0	52.5	5	50.3	7	49.7	8	49.0	9	51.2	6
P-12 (1)	62.4	59.2	3.0	58.4	4	57.0	5	56.4	6	55.8	7	57.0	5
P-13 (4)	54.9	52.5	2.0	50.7	4	49.1	6	47.8	7	47.2	8	48.4	7
P-14 (7)	55.0	52.5	3.0	51.2	4	49.2	6	48.3	7	48.1	7	49.3	6
P-15 (6)	60.8	56.7	4.0	55.8	5	54.7	6	53.7	7	53.1	8	53.9	7
P-16 (1)	68.3	64.1	4.0	62.1	6	60.5	8	58.9	9	58.2	10	58.6	10
P-17 (2)	55.8	54.4	1.0	53.8	2	53.2	3	52.1	4	51.6	4	52.5	3
P-45 (1)	57.3	54.5	3.0	52.7	5	50.7	7	49.7	8	49.2	8	51.3	6
Barrier Length (Ft.)		2,030		2,030		2,030		2,030		2,030		1,650	
Area (square ft.), from TNM[4]		16,240		20,300		28,420		36,539		40,599		26,433	
Total No. of Benefitted ERUs (5 dBA)		1		16		31		35		35		32	
Square Ft. Per Benefitted ERU (SF/BR)		**16,240**		**1,269**		**917**		**1,044**		**1,160**		**826**	

LEGEND

Impacted[2]

1. *A Receptor Number beginning with "M" represents a short-term measured location, Receptor Number beginning with "T" represents a long-term measured location and a Receptor Number beginning with "P" represents a modeled receptor only.*
2. *Impacted receptors are those that that warrant the investigation of noise abatement due to noise impacts. This occurs where the predicted noise levels meet any of the following criteria:*
   - *Predicted Highway Traffic Noise levels equal or exceed 66 dB(A).*
   - *Predicted Highway Traffic Noise substantially exceed (by 10 dB(A) or more) the existing Highway Traffic Noise levels.*
3. *IL: Insertion Loss.*
4. *Square footage indicated is based upon its length and its height from the finished ground elevation at the base of the barrier to its top elevation (acoustical profile line).*
5. *Noise values, comparisons, and insertion losses are calculated to the tenth of a dB(A) and then rounded for presentation purposes.*

Figure 4.B Barrier 5, Noise Barrier Analysis: Square Footage of Abatement Per BR Unit

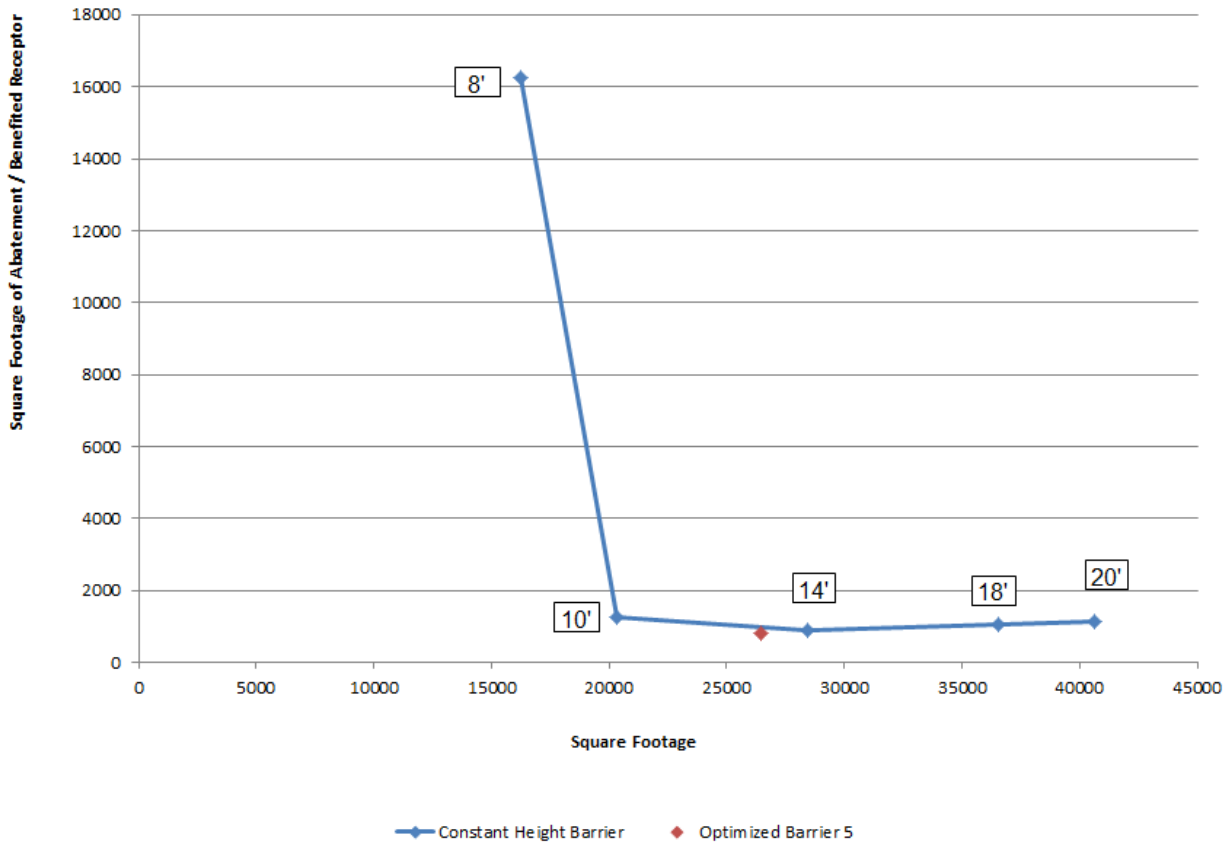

Table 4.E Optimized Barrier 5, Policy Feasibility Criteria Evaluation
Feasibility Criteria
1. Can a Highway Traffic Noise reduction of at least 5 dB(A) be achieved at the majority of the impacted Receptor Units (i.e. 50% or greater)? **(YES)**
2. Can the noise barrier be designed and physically constructed at the proposed location? **(YES)**
3. Can the noise barrier be constructed without causing a safety problem? **(YES)**
4. Can the noise barrier be constructed without restricting access to vehicular to pedestrian travel? **(YES)**
5. Can the noise barrier be constructed in a manner that allows for required maintenance & operations? **(YES)**
6. Can the noise barrier be constructed in a manner that allows utilities to adequately function? **(YES)**
7. Can the noise barrier be constructed in a manner that allows drainage features to adequately function? **(YES)**
Source: Pub. No. 24, April 2011 **(YES)/(NO)** –Answer for this Turnpike Reconstruction Project

Table 4.F Optimized Barrier 5, Policy Reasonableness Criteria Evaluation
Reasonableness Criteria
1. Do at least 50% of benefitted receptor unit owners and renters desire the noise barrier? **(Unknown)**
2. Is the Square Footage Per Benefitted Receptor Evaluation equal to or less than 2,000 SF/BR? **(YES)**
3. Does at least one benefitted receptor receive a 7dB(A) or greater noise reduction? **(YES)**
4. Does the barrier provide an insertion loss of at least 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(YES)**
5. Does the barrier provide an insertion loss greater than 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(YES)**
6. Does the barrier reduce future exterior levels to the low 60-decible range for Category B & C receptors and the upper 60-decible range for Category E receptors? **(YES)**
7. Does the barrier reduce design year noise levels back to existing levels? **(YES)**
Source: Pub. No. 24, April 2011 *Note: All "Unknown" criteria will be determined during final design.*

E. Barrier 6 Design

Barrier 6 was laid out to protect the Borough of New Baltimore with impacted receptors M-12, M-14, M-15, P-25, P-26, and P-28 and is located along the Westbound Turnpike Mainline, East of Findley Street and West of the Raystown Branch of the Juniata River. **Map No. 12 & 13** shows the location of Barrier 6. It begins approximately 690 ft. west of New Baltimore Road Bridge and ends approximately 30 ft. east of the Findley Street Bridge. The alignment is set four (4) ft. off of the proposed edge of shoulder along the realigned Turnpike Mainline. The barrier is mounted on a proposed retaining wall near receptors M-14 and P-28. Barrier 6 is laid out to meet a 645 ft. stopping sight distance which corresponds to a 65 mph design speed. The noise barrier is within the required clear zone limits for the roadway design speed. Therefore, concrete traffic barrier would be needed to protect the wall from vehicular impact.

The optimized barrier is 4,000 ft. long, ranges in height from 12 ft. to eighteen 18 ft., and has an average height of 13.57 ft. A minimum of eight (8) dB(A) noise level reduction can be achieved at the impacted receptors; therefore, meeting the feasibility criteria in this area. All noise reduction values for Barrier 6 assume that Barrier 5 is in place since these barriers work together to protect the Borough of New Baltimore. Barrier 5 and Barrier 6 are separate barriers because of the location of the proposed Findley Street Bridge.

There are a total of 31.55 benefitted ERUs (Equivalent Residential Units) and therefore the Square Footage of Abatement Per Benefitted Receptor (SF/BR) value is calculated to be 1,721 SF/BR. Because this value is less than the 2,000 SF/BR maximum value, Barrier 6 meets the reasonableness criteria and is therefore **potentially feasible and reasonable**.

Table 4.G shows the 2040 Build Predicted Noise Levels, with and without a Barrier 6, the insertion losses attained and the barrier design data for each constant height barrier analyzed and the optimized barrier. **Figure 4.C** shows the Noise Barrier Analysis SF/BR Summary chart and **Table 4.H and 4.I** shows the Policy Feasibility and Reasonableness Evaluation for the optimized barrier.

Table 4.G Barrier 6, Noise Barrier Analysis Summary

Receptor Number[1] (Units Represented)	2040 Build Predicted Noise Level [2]	Barrier Height and Insertion Loss[5]											
		8 ft. Constant Height		10 ft. Constant Height		14 ft. Constant Height		18 ft. Constant Height		20 ft. Constant Height		Optimized Height 12-18 ft. (Ave 13.57 ft.)	
		Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]
M-08(0.15)	58.6	55.9	3	55.4	3	54.4	4	53.7	5	53.4	5	54.4	4
M-09(6)	56.7	54.9	2	53.4	3	51.8	5	50.9	6	51	6	51.8	5
M-10(1.5)	57.9	56.2	2	54.9	3	53.0	5	52.0	6	51	7	53.3	5
M-12(1)	67.4	63.7	4	60.5	7	59.1	8	57.6	10	57	10	59.1	8
M-13(2)	65.2	60.6	5	60.0	5	57.1	8	55.6	10	55	10	58.0	7
M-14(2)	71.4	64.6	7	63.3	8	62.0	9	60.5	11	60	12	62.9	9
M-15(1)	74.4	69.4	5	67.9	7	64.3	10	62.3	12	62	13	63.8	11
P-18(2)	56.4	54.6	2	53.2	3	51.8	5	50.8	6	51	6	51.4	5
P-19(7)	49.6	48.4	1	47.2	2	45.2	4	44.2	5	44	6	45.1	5
P-24(4)	63.0	60.0	3	58.2	5	55.7	7	54.2	9	54	10	56.4	7
P-25(1)	70.1	63.4	7	62.1	8	60.9	9	59.5	11	59	11	61.8	8
P-26(1)	72.3	64.4	8	63.3	9	62.2	10	60.8	12	60	12	62.9	9
P-28(2)	70.9	64.0	7	62.8	8	61.7	9	60.2	11	60	11	62.4	9
P-46(0.15)	55.2	54.1	1	53.1	2	52.7	3	52.1	3	52	3	52.2	3
P-47(0.15)	56.7	54.7	2	53.9	3	53.0	4	52.1	5	52	5	52.6	4
P-48(0.15)	58.0	56.2	2	55.9	2	55.1	3	54.5	4	54	4	55.1	3
P-49(0.15)	57.4	53.4	4	52.7	5	51.3	6	50.3	7	50	8	51.4	6
P-50(0.15)	57.1	55.0	2	53.1	4	51.6	6	50.5	7	50	7	51.4	6
P-51(0.15)	59.0	56.0	3	55.6	3	54.5	5	53.6	5	53	6	54.6	4
P-52(0.15)	59.1	55.8	3	55.0	4	53.8	5	52.9	6	53	7	53.8	5
P-53(0.15)	57.4	55.2	2	53.6	4	52.1	5	51.1	6	51	7	52.1	5
P-54(0.15)	60.3	56.8	4	56.2	4	54.7	6	53.5	7	53	7	54.7	6
P-55(0.15)	59.6	56.0	4	55.1	5	53.6	6	52.6	7	52	8	53.6	6
P-56(0.15)	58.0	55.7	2	53.9	4	52.4	6	51.4	7	51	7	52.4	6
Barrier Length (Ft.)		5,350		5,350		5,350		5,350		5,350		4,000	
Area (square ft.), from TNM[4]		42,799		53,499		74,899		96,298		106,998		54,300	
Total Number of Benefitted ERUs (dBA)		9		14.3		24.7		32		32		31.55	
Square Ft. per Benefitted ERU (SF/BR)		**4,755**		**3,741**		**3,032**		**3,009**		**3,344**		**1,721**	

LEGEND

Impacted[2]

1. *A Receptor Number beginning with "M" represents a short-term measured location, Receptor Number beginning with "T" represents a long-term measured location and a Receptor Number beginning with "P" represents a modeled receptor only.*
2. *Impacted receptors are those that that warrant the investigation of noise abatement due to noise impacts. This occurs where the predicted noise levels meet any of the following criteria:*
   - *Predicted Highway Traffic Noise levels equal or exceed 66 dB(A).*
   - *Predicted Highway Traffic Noise substantially exceed (by 10 dB(A) or more) the existing Highway Traffic Noise levels.*
3. *IL: Insertion Loss.*
4. *Square footage indicated is based upon its length and its height from the finished ground elevation at the base of the barrier to its top elevation (acoustical profile line).*
5. *Noise values, comparisons, and insertion losses are calculated to the tenth of a dB(A) and then rounded for presentation purposes.*

Figure 4.C Barrier 6 Noise Barrier Analysis: Square Footage of Abatement Per BR Unit

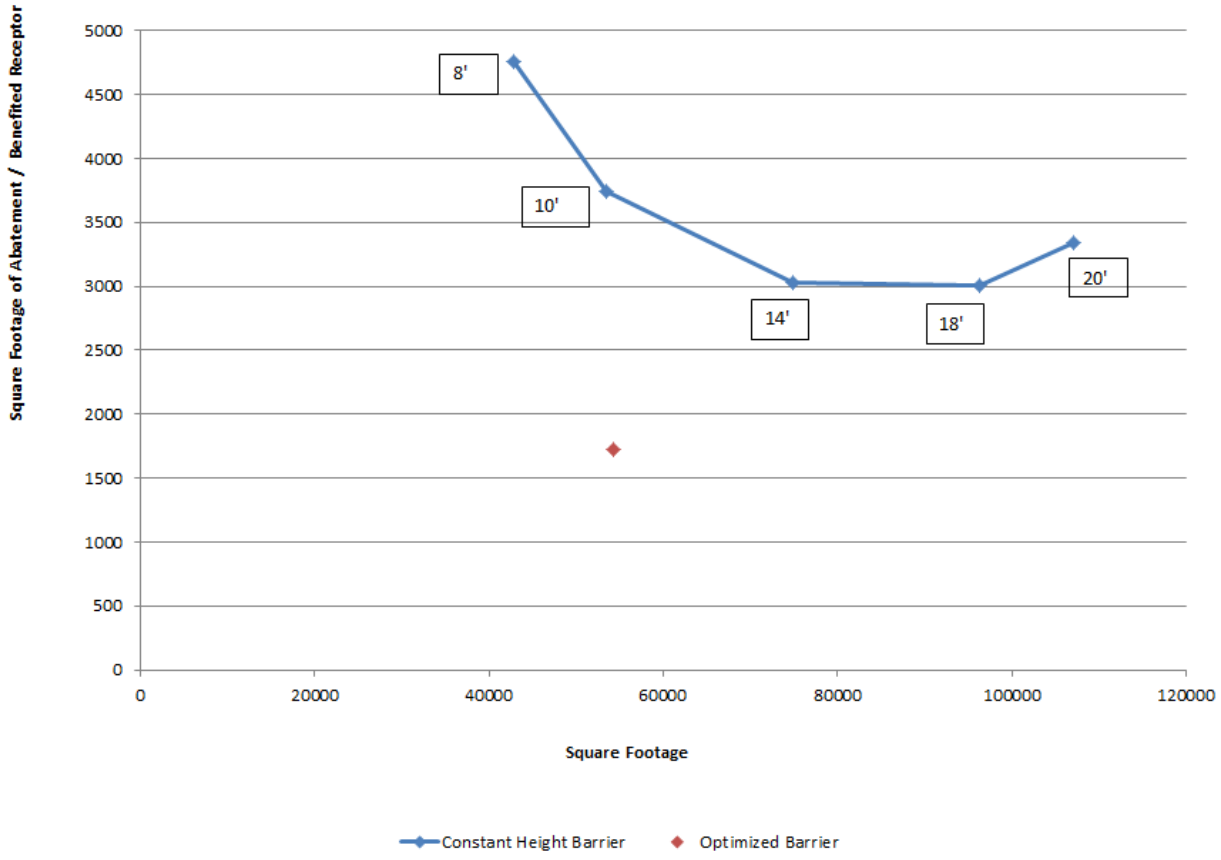

Table 4.H Optimized Barrier 6, Policy Feasibility Criteria Evaluation	
Feasibility Criteria	
1.	Can a Highway Traffic Noise reduction of at least 5 dB(A) be achieved at the majority of the impacted Receptor Units (i.e. 50% or greater)? **(YES)**
2.	Can the noise barrier be designed and physically constructed at the proposed location? **(YES)**
3.	Can the noise barrier be constructed without causing a safety problem? **(YES)**
4.	Can the noise barrier be constructed without restricting access to vehicular to pedestrian travel? **(YES)**
5.	Can the noise barrier be constructed in a manner that allows for required maintenance & operations? **(YES)**
6.	Can the noise barrier be constructed in a manner that allows utilities to adequately function? **(YES)**
7.	Can the noise barrier be constructed in a manner that allows drainage features to adequately function? **(YES)**
Source: Pub. No. 24, April 2011	**(YES)/(NO)** –Answer for this Turnpike Reconstruction Project

Table 4.I Optimized Barrier 6, Policy Reasonableness Criteria Evaluation	
Reasonableness Criteria	
1.	Do at least 50% of benefitted receptor unit owners and renters desire the noise barrier? **(Unknown)**
2.	Is the Square Footage Per Benefitted Receptor Evaluation equal to or less than 2,000 SF/BR? **(YES)**
3.	Does at least one benefitted receptor receive a 7dB(A) or greater noise reduction? **(YES)**
4.	Does the barrier provide an insertion loss of at least 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(YES)**
5.	Does the barrier provide an insertion loss greater than 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(YES)**
6.	Does the barrier reduce future exterior levels to the low 60-decible range for Category B & C receptors and the upper 60-decible range for Category E receptors? **(YES)**
7.	Does the barrier reduce design year noise levels back to existing levels? **(YES)**
Source: Pub. No. 24, April 2011 *Note: All "Unknown" criteria will be determined during final design.*	

F. Barrier 7 Design

Barrier 7 was laid out to protect impacted receptors M-17, M-18, P-22, P-29, P-30 and P-32 and is located along the Eastbound Turnpike Mainline, East of Findley Street and West of Grasser Road. **Map No. 12 & 13** shows the location of Barrier 7. It begins approximately 2,250 ft. east of the Findley Street Bridge and ends approximately 980 ft. east of the Raystown Branch of the Juniata River. The alignment is set at the top of the cut slope near the proposed Findley Street Bridge and then follows the cut line until it parallels the mainline. It is then set four (4) ft. off of the proposed edge of shoulder along the realigned Turnpike Mainline. The noise barrier is structure mounted with a maximum ten (10) ft. barrier height on the parapet of the S.R. 3012 bridge and the Raystown Branch of the Juniata River Bridge, near receptors M-17 and P-32. The noise barrier is within the required clear zone limits for the roadway design speed. Therefore, concrete traffic barrier would be needed to protect the wall from vehicular impact.

The optimized barrier is 4,072 ft. long with a constant height of 8 ft. A minimum of 5 dB(A) noise level reduction can be achieved at 3 of the 6 impacted receptors. Because Barrier 7 can reduce the highway traffic noise of at least 5 dB(A) at the majority of the impacted Receptor Units (i.e., 50% or greater), Barrier 7 does meet the feasibility criteria. All noise reduction values for Barrier 7 assume that Barrier 4 is in place since these barriers work together. Barrier 4 and Barrier 7 are separate barriers because of the location of Findley St. & Carmel Dr.

There are a total of three (3) benefitted ERUs (Equivalent Residential Units) and therefore the Square Footage of Abatement per Benefitted Receptor (SF/BR) value is calculated to be 10,858 SF/BR. Because this value is significantly greater than the 2,000 SF/BR maximum value, Barrier 7 **is feasible**, but it **is not reasonable**. Furthermore, even if it were somehow possible to benefit each and every ERU relevant to Barrier 7 *without increasing the wall area from the presented optimized barrier*, the SF/BR calculated value would drop to 4,811 SF/BR, and would still not be reasonable. Therefore, it is conclusive that there are no other optimized scenarios different than the one fully presented that will provide for a reasonable Barrier 7.

Table 4.J shows the 2040 Build Predicted Noise Levels, with and without a Barrier 7, the insertion losses attained and the barrier design data for each constant height barrier analyzed and the optimized barrier. **Figure 4.K** shows the Noise Barrier Analysis SF/BR Summary chart and **Table 4.L** shows the Policy Feasibility/Reasonableness Evaluation for the optimized barrier.

Table 4.J Barrier 7, Noise Barrier Analysis Summary

Receptor Number[1] (Units Represented)	2040 Build Predicted Noise Level [2]	Barrier Height and Insertion Loss[5]											
		8 ft. Constant Height		10 ft. Constant Height		14 ft. Constant Height		18 ft. Constant Height		20 ft. Constant Height		Optimized Height 8 ft. (Constant)	
		Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]
P-22(0.58)	68.8	68.3	1	68.1	1	67.8	1	67.8	1	67.7	1	68.3	1
P-57(0.003)	58.9	57.9	1	57.8	1	57.3	2	56.4	3	56.2	3	58.6	0
P-58(0.003)	62.4	61.9	1	61.7	1	61.5	1	61.0	1	60.8	2	61.9	1
P-59(0.003)	58.7	57.4	1	57.0	2	56.2	3	54.7	4	54.2	5	58.4	0
P-60(0.003)	60.3	59.2	1	58.5	2	57.9	2	56.6	4	56.2	4	60.1	0
P-61(0.003)	59.1	57.7	1	57.4	2	56.6	3	55.0	4	54.5	5	59.0	0
P-62(0.003)	60.6	59.5	1	58.8	2	58.1	3	56.7	4	56.3	4	60.5	0
P-63(0.021)	59.0	57.7	1	57.5	2	56.3	3	54.5	5	54.0	5	58.8	0
P-64(0.021)	59.5	58.0	2	57.8	2	56.1	3	54.6	5	54.2	5	59.2	0
P-65(0.021)	59.9	58.5	1	58.2	2	57.3	3	55.1	5	54.4	6	59.7	0
P-66(0.021)	60.3	58.9	1	58.6	2	56.7	4	55.1	5	54.6	6	60.0	0
P-67(0.021)	60.5	59.1	1	58.8	2	57.9	3	55.6	5	54.8	6	60.3	0
P-68(0.021)	61.2	59.7	2	59.4	2	57.7	4	55.7	6	55.1	6	61.0	0
P-69(0.021)	61.0	59.7	1	59.4	2	58.5	3	56.0	5	55.1	6	60.8	0
P-70(0.021)	62.1	60.6	2	60.2	2	58.7	3	56.3	6	55.6	7	61.8	0
P-27(1)	65.1	62.8	2	61.8	3	61.1	4	57.8	7	56.8	8	64.2	1
P-29(1)	71.9	66.4	6	65.7	6	61.7	10	59.5	12	58.8	13	67.3	5
P-30(1)	67.5	62.0	6	61.5	6	57.8	10	55.9	12	55.2	12	62.1	5
M-17(1)	69.2	62.7	7	61.5	8	60.2	9	58.9	10	58.4	11	62.7	7
P-32(1)	69.0	65.6	3	61.9	7	60.1	9	58.6	10	58.0	11	65.6	3
M-18(1)	65.5	63.0	3	62.6	3	60.5	5	59.8	6	59.6	6	63.1	2
Barrier Length (Ft.)		6,350		6,350		6,350		6,350		6,350		4,072	
Area (square ft.), from TNM[4]		50,799		63,499		88,898		114,298		126,997		32,573	
Total Number of Benefitted ERUs (5 dBA)		3		4		5		6.17		6.18		3	
Square Ft. per Benefitted Receptor (SF/BR)		**16,933**		**15,875**		**17,780**		**18,531**		**20,570**		**10,858**	

LEGEND

Impacted[2]

1. *A Receptor Number beginning with "M" represents a short-term measured location, Receptor Number beginning with "T" represents a long-term measured location and a Receptor Number beginning with "P" represents a modeled receptor only.*
2. *Impacted receptors are those that that warrant the investigation of noise abatement due to noise impacts. This occurs where the predicted noise levels meet any of the following criteria:*
   - *Predicted Highway Traffic Noise levels equal or exceed 66 dB(A).*
   - *Predicted Highway Traffic Noise substantially exceed (by 10 dB(A) or more) the existing Highway Traffic Noise levels.*
3. *IL: Insertion Loss.*
4. *Square footage indicated is based upon its length and its height from the finished ground elevation at the base of the barrier to its top elevation (acoustical profile line).*
5. *Noise values, comparisons, and insertion losses are calculated to the tenth of a dB(A) and then rounded for presentation purposes.*

Figure 4.D Barrier 7, Noise Barrier Analysis: Square Footage of Abatement Per BR Unit

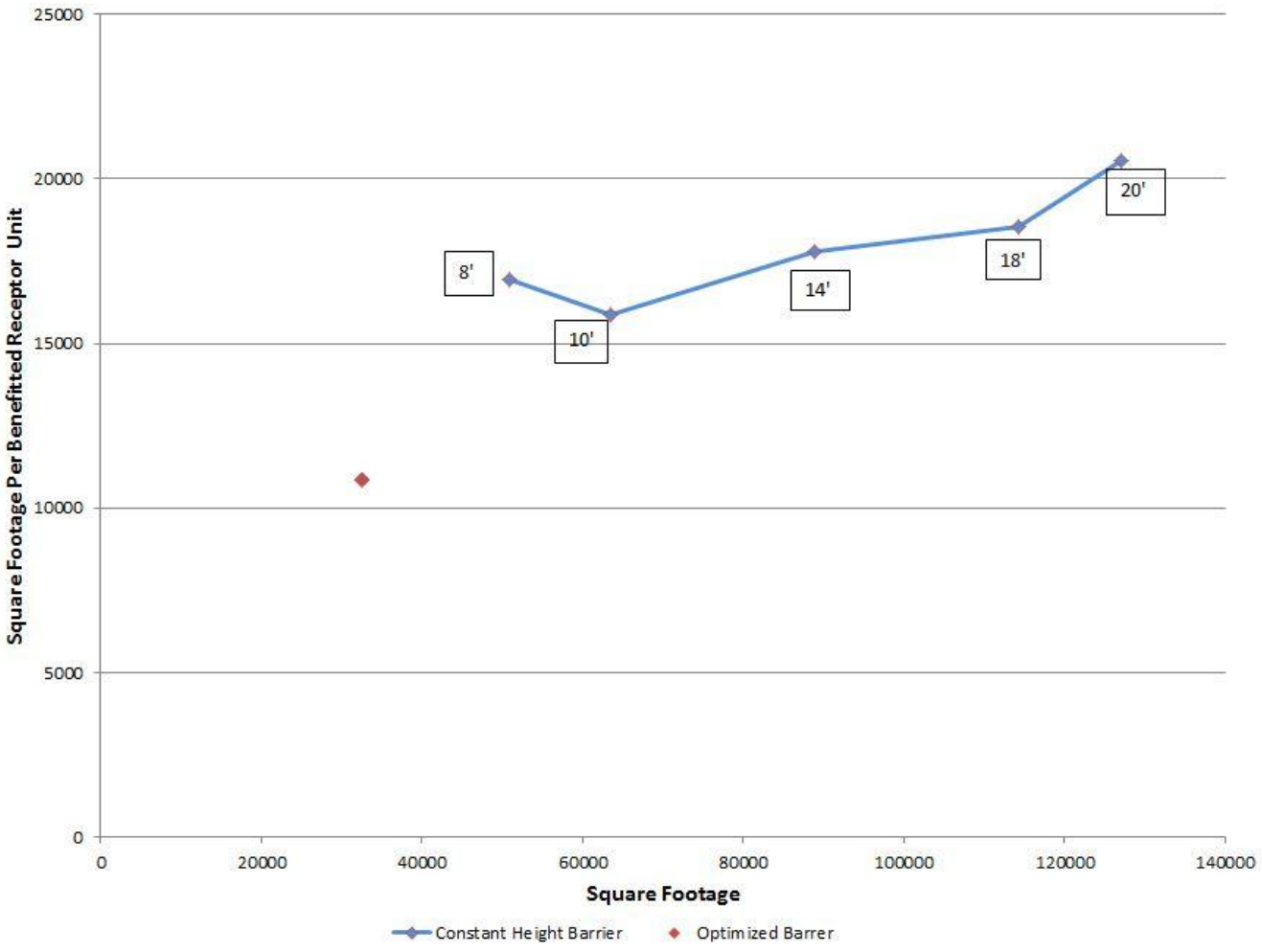

Table 4.K Optimized Barrier 7, Policy Feasibility Criteria Evaluation
Feasibility Criteria
1. Can a Highway Traffic Noise reduction of at least 5 dB(A) be achieved at the majority of the impacted Receptor Units (i.e. 50% or greater)? **(YES)**
2. Can the noise barrier be designed and physically constructed at the proposed location? **(YES)**
3. Can the noise barrier be constructed without causing a safety problem? **(YES)**
4. Can the noise barrier be constructed without restricting access to vehicular to pedestrian travel? **(YES)**
5. Can the noise barrier be constructed in a manner that allows for required maintenance & operations? **(YES)**
6. Can the noise barrier be constructed in a manner that allows utilities to adequately function? **(YES)**
7. Can the noise barrier be constructed in a manner that allows drainage features to adequately function? **(YES)**
Source: Pub. No. 24, April 2011 **(YES)/(NO)** –Answer for this Turnpike Reconstruction Project

Table 4.L Optimized Barrier 7, Policy Reasonableness Criteria Evaluation
Reasonableness Criteria
1. Do at least 50% of benefitted receptor unit owners and renters desire the noise barrier? **(Unknown)**
2. Is the Square Footage Per Benefitted Receptor Evaluation equal to or less than 2,000 SF/BR? **(NO)**
3. Does at least one benefitted receptor receive a 7dB(A) or greater noise reduction? **(YES)**
4. Does the barrier provide an insertion loss of at least 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(NO)**
5. Does the barrier provide an insertion loss greater than 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(NO)**
6. Does the barrier reduce future exterior levels to the low 60-decible range for Category B & C receptors and the upper 60-decible range for Category E receptors? **(NO)**
7. Does the barrier reduce design year noise levels back to existing levels? **(NO)**
Source: Pub. No. 24, April 2011 *Note: All "Unknown" criteria will be determined during final design.*

G. Barrier 8 Design

Barrier 8 was laid out to protect impacted receptors M-20, P-34 and P-35 and is located along the Westbound Turnpike Mainline, between the two Cider Road Bridges. **Map No. 14** shows the location of Barrier 8. It begins approximately 2,560 ft. west of the Kegg Maintenance Facility and ends approximately 900 ft. east of the Cider Road Bridge. The alignment is set four (4) ft. off of the proposed edge of shoulder along the realigned Turnpike Mainline. The noise barrier is within the required clear zone limits for the roadway design speed. Therefore, concrete traffic barrier would be needed to protect the wall from vehicular impact.

The optimized barrier is 3,000 ft. long, ranges in height from 8 ft. to 16 ft., and has an average height of 12.7 ft. A minimum of five (5) dB(A) noise level reduction can be achieved at all of the impacted receptors, meeting the feasibility criteria in this area.

There are a total of five (5) benefitted ERUs (Equivalent Residential Units) and therefore the Square Footage of Abatement Per Benefitted Receptor (SR/BR) value is calculated to be 7,560 SF/BR. Because this value is greater than the 2,000 SF/BR maximum value, Barrier 8 **is feasible**, but it **is not reasonable**.

Table 4.M shows the 2040 Build Predicted Noise Levels, with and without a Barrier 8, the insertion losses attained and the barrier design data for each constant height barrier analyzed and the optimized barrier. **Figure 4.E** shows the Noise Barrier Analysis SF/BR Summary chart and **Table 4.N & 4.O** shows the Policy Feasibility and Reasonableness Evaluation for the optimized barrier.

Table 4.M Barrier 8, Noise Barrier Analysis Summary

Receptor Number[1] (Units Represented)	2040 Build Predicted Noise Level [2]	Barrier Height and Insertion Loss[5]											
		8 ft. Constant Height		10 ft. Constant Height		14 ft. Constant Height		18 ft. Constant Height		20 ft. Constant Height		Optimized Height 8-16 ft. (Ave 12.6 ft.)	
		Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]
P-34(1)	76.1	74.4	2.0	72.7	3	70.3	6	65.5	11	64.1	12	68.9	7
M-20(2)	65.2	61.9	3.0	61.4	4	60.7	5	56.9	8	56.1	9	60.2	5
P-35(2)	70.5	66.2	4.0	65.7	5	63.6	7	60.8	10	60.0	11	65.2	5
Barrier Length (Ft.)		4,700		4,700		4,700		4,700		4,700		3,000	
Area (square ft.), from TNM[4]		37,600		47,000		65,800		84,600		94,000		37,799	
Total No. of Benefitted ERUs (5 dBA)		0		2		5		5		5		5	
Square Foot Per Benefitted Receptor (SF/BR)		**N/A**		**23,500**		**13,160**		**16,920**		**18,800**		**7,560**	

LEGEND

Impacted[2]

1. *A Receptor Number beginning with "M" represents a short-term measured location, Receptor Number beginning with "T" represents a long-term measured location and a Receptor Number beginning with "P" represents a modeled receptor only.*
2. *Impacted receptors are those that that warrant the investigation of noise abatement due to noise impacts. This occurs where the predicted noise levels meet any of the following criteria:*
   - *Predicted Highway Traffic Noise levels equal or exceed 66 dB(A).*
   - *Predicted Highway Traffic Noise substantially exceed (by 10 dB(A) or more) the existing Highway Traffic Noise levels.*
3. *IL: Insertion Loss.*
4. *Square footage indicated is based upon its length and its height from the finished ground elevation at the base of the barrier to its top elevation (acoustical profile line).*
5. *Noise values, comparisons, and insertion losses are calculated to the tenth of a dB(A) and then rounded for presentation purposes.*

Figure 4.E Barrier 8, Noise Barrier Analysis: Square Footage of Abatement Per BR Unit

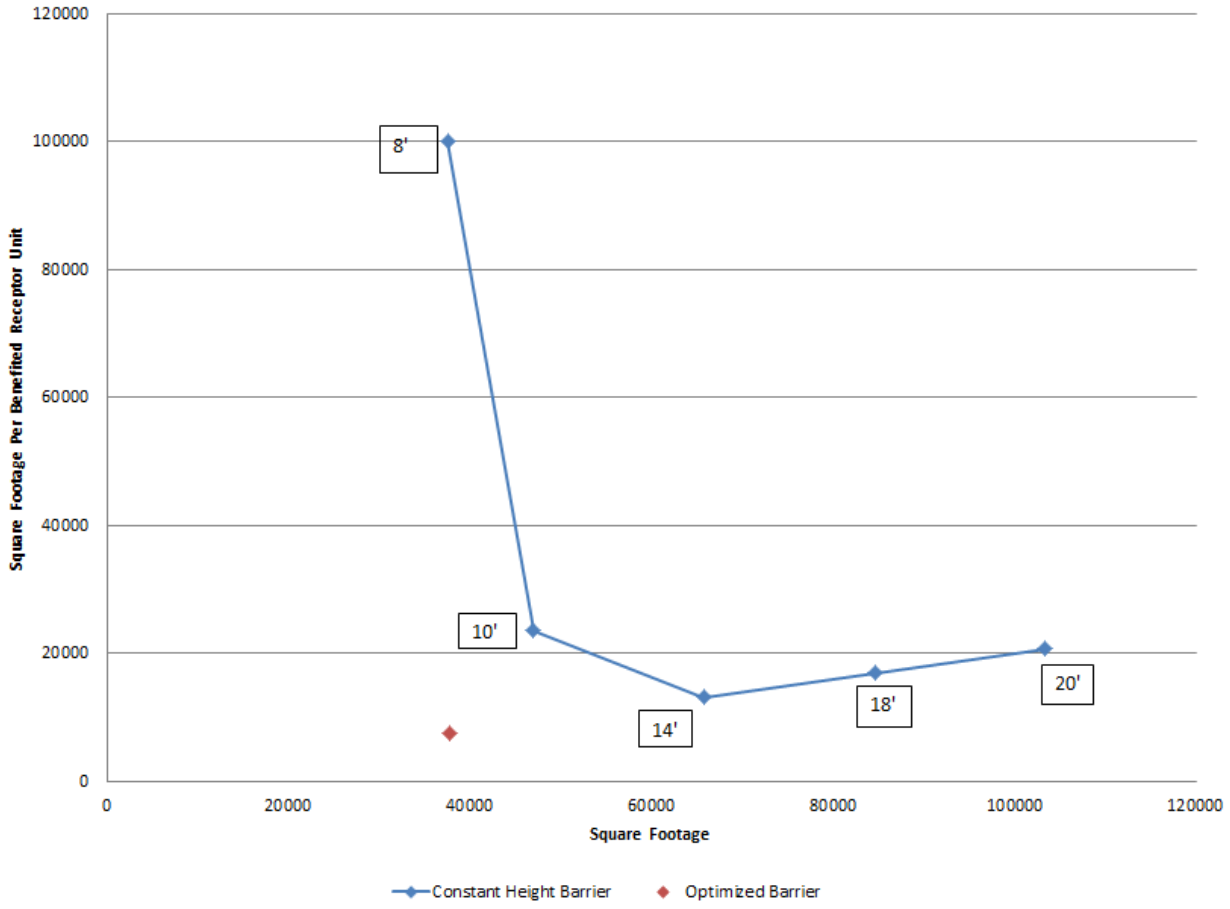

Table 4.N Optimized Barrier 8, Policy Feasibility Criteria Evaluation
Feasibility Criteria
1. Can a Highway Traffic Noise reduction of at least 5 dB(A) be achieved at the majority of the impacted Receptor Units (i.e. 50% or greater)? **(YES)**
2. Can the noise barrier be designed and physically constructed at the proposed location? **(YES)**
3. Can the noise barrier be constructed without causing a safety problem? **(YES)**
4. Can the noise barrier be constructed without restricting access to vehicular to pedestrian travel? **(YES)**
5. Can the noise barrier be constructed in a manner that allows for required maintenance & operations? **(YES)**
6. Can the noise barrier be constructed in a manner that allows utilities to adequately function? **(YES)**
7. Can the noise barrier be constructed in a manner that allows drainage features to adequately function? **(YES)**
Source: Pub. No. 24, April 2011 **(YES)/(NO)** –Answer for this Turnpike Reconstruction Project

Table 4.O Optimized Barrier 8, Policy Reasonableness Criteria Evaluation
Reasonableness Criteria
1. Do at least 50% of benefitted receptor unit owners and renters desire the noise barrier? **(Unknown)**
2. Is the Square Footage Per Benefitted Receptor Evaluation equal to or less than 2,000 SF/BR? **(NO)**
3. Does at least one benefitted receptor receive a 7dB(A) or greater noise reduction? **(YES)**
4. Does the barrier provide an insertion loss of at least 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(NO)**
5. Does the barrier provide an insertion loss greater than 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(NO)**
6. Does the barrier reduce future exterior levels to the low 60-decible range for Category B & C receptors and the upper 60-decible range for Category E receptors? **(NO)**
7. Does the barrier reduce design year noise levels back to existing levels? **(YES)**
Source: Pub. No. 24, April 2011 *Note: All "Unknown" criteria will be determined during final design.*

H. Barrier 9 Design

Barrier 9 was laid out to protect impacted receptors T-02, M-22, P-37, P-39 and P-40 and is located along the Eastbound Turnpike Mainline, between the two Cider Road Bridges. Impacted receptors M-21, M-23, P-36 and P-38 were not considered critical sensitive receptors or used in barrier design because they are located on the south side of the local road S.R. 0031 which is the dominate noise source at these receivers. **Map No. 15** shows the location of Barrier 9. The alignment is set four (4) ft. off of the proposed edge of shoulder along the realigned Turnpike Mainline. The noise barrier is within the required clear zone limits for the roadway design speed. Therefore, concrete traffic barrier would be needed to protect the wall from vehicular impact.

Barrier 9 analysis used the results from the 2040 Build TNM run with traffic on local road S.R. 0031 but receptors on the south side of S.R. 0031 (M-21, M-23, P-36 and P-38) were ignored and not used to layout or optimize the noise barrier along the Turnpike Mainline.

The optimized barrier is 2,900 ft. long, ranges in height from 10 ft. to 16 ft., and has an average height of 12.7 ft. A minimum of five (5) dB(A) noise level reduction can be achieved at the majority of the impacted receptors; therefore, the barrier meets the feasibility criteria in this area. Based on examination of the 26 ft. tall constant height barrier analysis, it was concluded that achieving a significant noise level reduction at receptor P-37 was not worthwhile and as such, was not pursued as part of the optimization.

There are a total of ten (10) benefitted ERUs (Equivalent Residential Units) and therefore the Square Footage of Abatement per Benefitted Receptor (SF/BR) value is calculated to be 3,670 SF/BR. Because this value is greater than the 2,000 SF/BR maximum value, Barrier 9 **is feasible**, but **not reasonable**.

Table 4.P shows the 2040 Build Predicted Noise Levels, with and without a Barrier 9, the insertion losses attained and the barrier design data for each constant height barrier analyzed and the optimized barrier. **Figure 4.F** shows the Noise Barrier Analysis SF/BR Summary chart and **Table 4.Q and 4.R** shows the Policy Feasibility and Reasonableness Evaluation for the optimized barrier.

Table 4.P Barrier 9, Noise Barrier Analysis Summary[6]

Receptor Number[1] (Units Represented)	2040 Build Predicted Noise Level [2]	Barrier Height and Insertion Loss[5]											
		8 ft. Constant Height		10 ft. Constant Height		14 ft. Constant Height		18 ft. Constant Height		20 ft. Constant Height		Optimized Height 10-16 ft. (Ave 12.7 ft.)	
		Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]
T-02 (2)	68.4	66.9	2.0	66.1	2	63.6	5	60.5	8	59.8	9	63.6	5
M-21 (4)	67.1	65.7	1.0	65.5	2	65.0	2	64.6	3	64.6	3	66.9	0
M-22 (3)	70.1	65.7	4.0	65.3	5	62.9	7	61.8	8	61.6	8	63.1	7
M-23 (2)	67.5	66.2	1.0	66.0	2	65.5	2	65.1	2	65.0	3	65.7	2
P-36 (3)	66.2	65.9	0.0	65.9	0	65.8	0	65.7	1	65.6	1	66.2	0
P-37 (3)	66.3	64.4	2.0	64.3	2	63.0	3	62.5	4	62.4	4	66.2	0
P-38 (1)	68.1	66.1	2.0	66.0	2	65.1	3	64.8	3	64.7	3	65.8	2
P-39 (3)	72.2	67.2	5.0	66.4	6	63.4	9	62.1	10	61.7	11	65.7	7
P-40 (2)	69.4	66.6	3.0	65.6	4	61.7	8	60.0	9	59.4	10	64.5	5
Barrier Length (Ft.)		4,882		4,882		4,882		4,882		4,882		2,900	
Area (square ft.), from TNM[4]		39,056		48,820		68,348		87,876		96,640		36,700	
Total No. of Benefitted ERUs (5 dBA)		3		6		10		10		10		10	
Square Ft. Per Benefitted Receptor (SF/BR)		**13,019**		**8,137**		**6,835**		**8,788**		**9,764**		**3,670**	

LEGEND

Impacted[2]

1. *A Receptor Number beginning with "M" represents a short-term measured location, Receptor Number beginning with "T" represents a long-term measured location and a Receptor Number beginning with "P" represents a modeled receptor only.*
2. *Impacted receptors are those that that warrant the investigation of noise abatement due to noise impacts. This occurs where the predicted noise levels meet any of the following criteria:*
   - *Predicted Highway Traffic Noise levels equal or exceed 66 dB(A).*
   - *Predicted Highway Traffic Noise substantially exceed (by 10 dB(A) or more) the existing Highway Traffic Noise levels.*
3. *IL: Insertion Loss.*
4. *Square footage indicated is based upon its length and its height from the finished ground elevation at the base of the barrier to its top elevation (acoustical profile line).*
5. *Noise values, comparisons, and insertion losses are calculated to the tenth of a dB(A) and then rounded for presentation purposes.*
6. *M-21, M-23, P-36 and P-38 are impacted by S.R. 0031 traffic and not used for design in barrier optimization.*

Figure 4.F Barrier 9, Noise Barrier Analysis: Square Footage of Abatement Per BR Unit

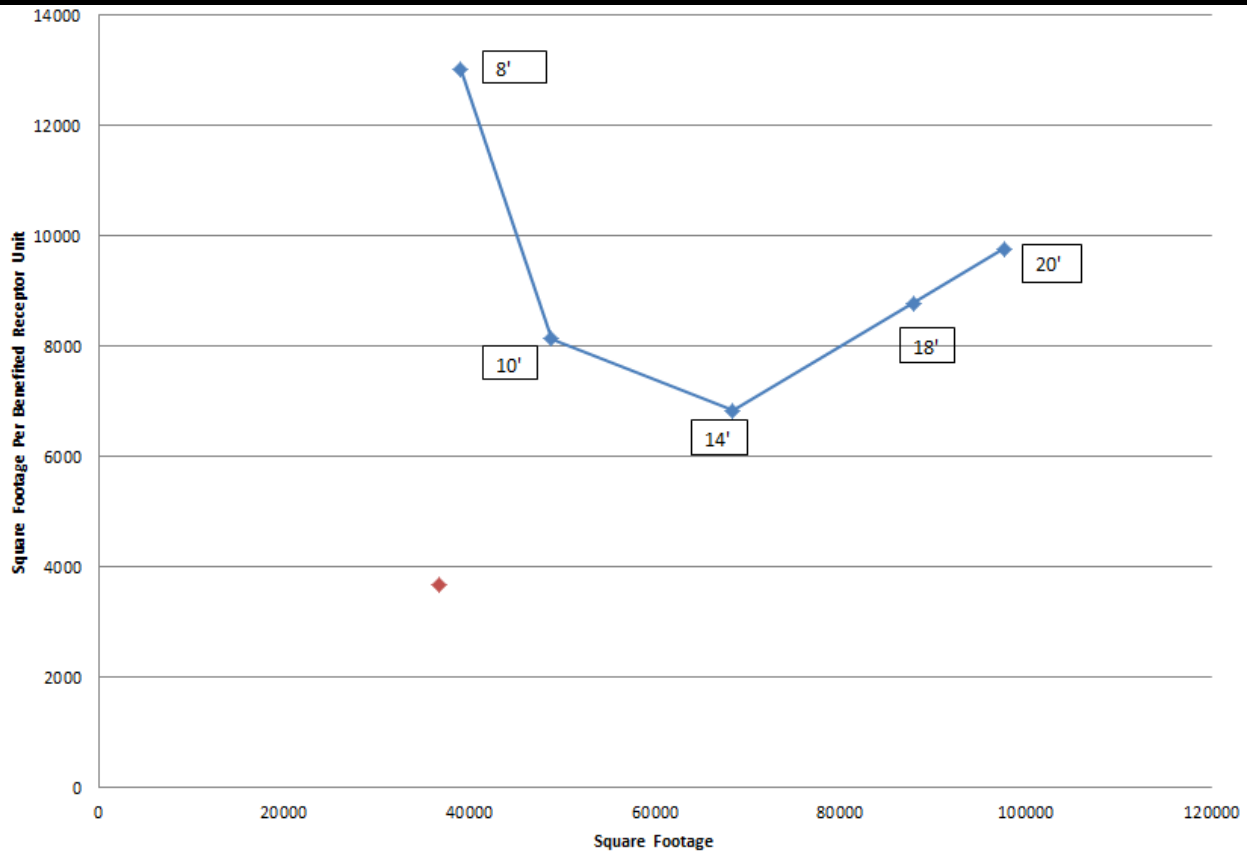

Table 4.Q Optimized Barrier 9, Policy Feasibility Criteria Evaluation	
Feasibility Criteria	
1.	Can a Highway Traffic Noise reduction of at least 5 dB(A) be achieved at the majority of the impacted Receptor Units (i.e. 50% or greater)? **(YES)**
2.	Can the noise barrier be designed and physically constructed at the proposed location? **(YES)**
3.	Can the noise barrier be constructed without causing a safety problem? **(YES)**
4.	Can the noise barrier be constructed without restricting access to vehicular to pedestrian travel? **(YES)**
5.	Can the noise barrier be constructed in a manner that allows for required maintenance & operations? **(YES)**
6.	Can the noise barrier be constructed in a manner that allows utilities to adequately function? **(YES)**
7.	Can the noise barrier be constructed in a manner that allows drainage features to adequately function? **(YES)**
Source: Pub. No. 24, April 2011	**(YES)/(NO)** –Answer for this Turnpike Reconstruction Project

Table 4.R Optimized Barrier 9, Policy Reasonableness Criteria Evaluation	
Reasonableness Criteria	
1.	Do at least 50% of benefitted receptor unit owners and renters desire the noise barrier? **(Unknown)**
2.	Is the Square Footage Per Benefitted Receptor Evaluation equal to or less than 2,000 SF/BR? **(NO)**
3.	Does at least one benefitted receptor receive a 7dB(A) or greater noise reduction? **(YES)**
4.	Does the barrier provide an insertion loss of at least 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(YES)**
5.	Does the barrier provide an insertion loss greater than 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(NO)**
6.	Does the barrier reduce future exterior levels to the low 60-decible range for Category B & C receptors and the upper 60-decible range for Category E receptors? **(NO)**
7.	Does the barrier reduce design year noise levels back to existing levels? **(YES)**
Source: Pub. No. 24, April 2011 *Note: All "Unknown" criteria will be determined during final design.*	

I. Barrier 10 Design

Barrier 10 was laid out to protect impacted receptors M-24 and P-42 that represent the single property at 2237 Allegheny Road located along the Eastbound Turnpike Mainline, West of Cider Road. Impacted receptor P-43 was not considered a critical sensitive receptor or used in barrier design because it is located on the south side of the heavily traveled S.R. 0031 and the noise levels are dominated by this local road. **Map No. 15** shows the location of Barrier 10. The alignment begins along the Turnpike emergency access ramp and then is set four (4) ft. off of the proposed edge of shoulder along the proposed Turnpike Mainline. The noise barrier is within the required clear zone limits for the roadway design speed. Therefore, concrete traffic barrier would be needed to protect the wall from vehicular impact.

Barrier 10 analysis used the results from the 2040 Build TNM run with traffic on local road S.R. 0031 but the receptor on the south side of S.R. 0031 (P-43) was ignored and not used to layout or optimize the noise barrier along the Turnpike Mainline.

The optimized barrier is 550 ft. long, ranges in height from 8 ft. to 12 ft., and has an average height of 10.7 ft. A minimum of seven (7) dB(A) noise level reduction can be achieved at the critically sensitive impacted receptor (P-42); therefore, meeting the feasibility criteria in this area.

There is a total of one (1) benefitted ERU (Equivalent Residential Unit and therefore the Square Footage of Abatement per Benefitted Receptor (SF/BR) value is calculated to be 5,900 SF/BR. Because this value is greater than the 2,000 SF/BR maximum value, Barrier 10 **is feasible**, but it **is not reasonable**.

Table 4.S shows the 2040 Build Predicted Noise Levels, with and without a Barrier 10, the insertion losses attained and the barrier design data for each constant height barrier analyzed and the optimized barrier. **Figure 4.G** shows the Noise Barrier Analysis SF/BR Summary chart and **Table 4.T & 4.U** shows the Policy Feasibility and Reasonableness Evaluation for the optimized barrier.

Table 4.S Barrier 10, Noise Barrier Analysis Summary

Receptor Number[1] (Units Represented)	2040 Build Predicted Noise Level [2]	Barrier Height and Insertion Loss[5]											
		8 ft. Constant Height		10 ft. Constant Height		14 ft. Constant Height		18 ft. Constant Height		20 ft. Constant Height		Optimized Height 8-12 ft. (Ave 10.7 ft.)	
		Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]
M-24 (0)[6]	65.7	61.0	5.0	59.7	6	58.6	7	57.6	8	57.2	9	59.6	6
P-42 (1)	69.4	64.5	5.0	63.2	6	61.9	8	60.8	9	60.4	9	62.9	7
P-43 (1)[7]	66.2	65.9	0.0	65.7	1	65.6	1	65.6	1	65.6	1	65.8	0
Barrier Length (Ft.)		650		650		650		650		650		550	
Area (square ft.), from TNM[4]		5,200		6,500		9,100		11,700		13,000		5,900	
Total No. of Benefitted ERUs (5 dBA)		1		1		1		1		1		1	
Square Ft. Per Benefitted Receptor (SF/BR)		**5,200**		**6,500**		**9,100**		**11,700**		**13,000**		**5,900**	

LEGEND

Impacted[2]

1. *A Receptor Number beginning with "M" represents a short-term measured location, Receptor Number beginning with "T" represents a long-term measured location and a Receptor Number beginning with "P" represents a modeled receptor only.*
2. *Impacted receptors are those that that warrant the investigation of noise abatement due to noise impacts. This occurs where the predicted noise levels meet any of the following criteria:*
   - *Predicted Highway Traffic Noise levels equal or exceed 66 dB(A).*
   - *Predicted Highway Traffic Noise substantially exceed (by 10 dB(A) or more) the existing Highway Traffic Noise levels.*
3. *IL: Insertion Loss.*
4. *Square footage indicated is based upon its length and its height from the finished ground elevation at the base of the barrier to its top elevation (acoustical profile line).*
5. *Noise values, comparisons, and insertion losses are calculated to the tenth of a dB(A) and then rounded for presentation purposes.*
6. *Receptor M-24 and P-42 are on the same property, P-42 is used for barrier analysis.*
7. *Receptor P-43 is impacted by SR 0031 traffic and is not used for design in barrier optimization.*

Figure 4.G Barrier 10, Noise Barrier Analysis: Square Footage of Abatement Per BR Unit

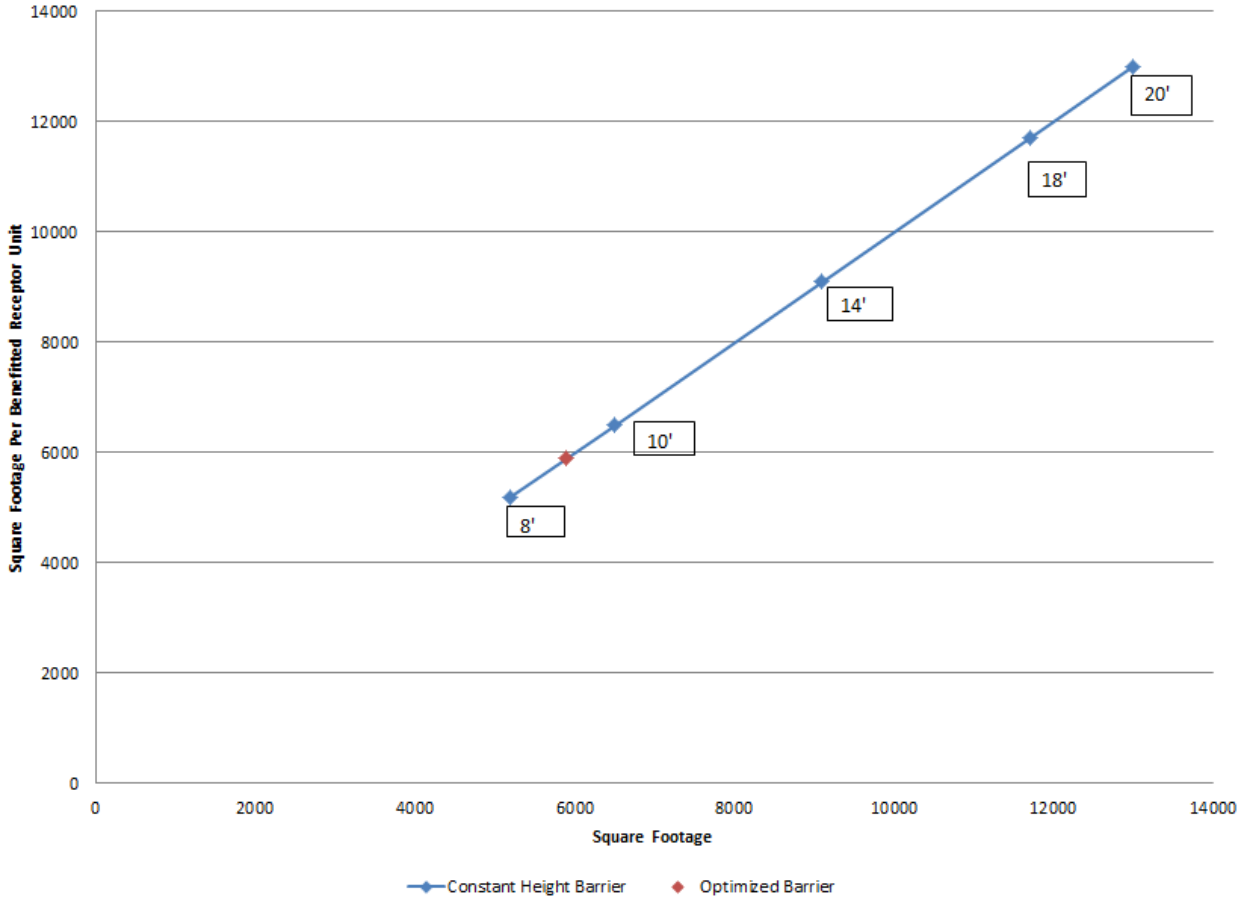

Table 4.T Optimized Barrier 10, Policy Feasibility Criteria Evaluation	
Feasibility Criteria	
1.	Can a Highway Traffic Noise reduction of at least 5 dB(A) be achieved at the majority of the impacted Receptor Units (i.e. 50% or greater)? **(YES)**
2.	Can the noise barrier be designed and physically constructed at the proposed location? **(YES)**
3.	Can the noise barrier be constructed without causing a safety problem? **(YES)**
4.	Can the noise barrier be constructed without restricting access to vehicular to pedestrian travel? **(YES)**
5.	Can the noise barrier be constructed in a manner that allows for required maintenance & operations? **(YES)**
6.	Can the noise barrier be constructed in a manner that allows utilities to adequately function? **(YES)**
7.	Can the noise barrier be constructed in a manner that allows drainage features to adequately function? **(YES)**
Source: Pub. No. 24, April 2011	**(YES)/(NO)** –Answer for this Turnpike Reconstruction Project

Table 4.U Optimized Barrier 10, Policy Reasonableness Criteria Evaluation	
Reasonableness Criteria	
1.	Do at least 50% of benefitted receptor unit owners and renters desire the noise barrier? **(Unknown)**
2.	Is the Square Footage Per Benefitted Receptor Evaluation equal to or less than 2,000 SF/BR? **(NO)**
3.	Does at least one benefitted receptor receive a 7dB(A) or greater noise reduction? **(YES)**
4.	Does the barrier provide an insertion loss of at least 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(NO)**
5.	Does the barrier provide an insertion loss greater than 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(NO)**
6.	Does the barrier reduce future exterior levels to the low 60-decible range for Category B & C receptors and the upper 60-decible range for Category E receptors? **(YES)**
7.	Does the barrier reduce design year noise levels back to existing levels? **(YES)**
Source: Pub. No. 24, April 2011 *Note: All "Unknown" criteria will be determined during final design.*	

J. Barrier 11 Design

Barrier 11 was laid out to protect the single residence at impacted receptor P-41 and is located along the Westbound Turnpike Mainline, West of Cider Road. **Map No. 15** shows the location of Barrier 11. It begins approximately 540 ft. east of the Cider Road Bridge and ends approximately 165 ft. from C. Diehl Road. The alignment is set four (4) ft. off of the proposed cut line, except for 64 ft. where the barrier parallels the realigned Turnpike Mainline to cross a culvert carrying an Unnamed Named Tributary to the Raystown Branch of the Juniata River. Barrier 11 is laid out to meet a 645 ft. stopping sight distance which corresponds to a 65 mph design speed. The noise barrier is within the required clear zone limits for the roadway design speed. Therefore, concrete traffic barrier would be needed to protect the wall from vehicular impact.

The optimized barrier is 900 ft. long, ranges in height from 8 ft. to 10 ft., and has an average height of 8.3 ft. A minimum of seven (7) dB(A) noise level reduction can be achieved at the impacted receptors; therefore, meeting the feasibility criteria in this area for the optimized barrier.

There is a total of one (1) benefitted ERU (Equivalent Residential Unit) and therefore the Square Footage of Abatement Per Benefitted Receptor (SF/BR) value is calculated to be 3,497 SF/BR. Because this value is greater than the 2,000 SF/BR maximum value, Barrier 11 **is feasible**, but it **is not reasonable**.

Table 4.V shows the 2040 Build Predicted Noise Levels, with and without a Barrier 11, the insertion losses attained and the barrier design data for each constant height barrier analyzed and the optimized barrier. **Figure 4.H** shows the Noise Barrier Analysis SF/BR Summary chart and **Table 4.W & 4.X** shows the Policy Feasibility and Reasonableness Evaluation for the optimized barrier.

Table 4.V Barrier 11, Noise Barrier Analysis Summary

Receptor Number[1] (Units Represented)	2040 Build Predicted Noise Level [2]	Barrier Height and Insertion Loss[5]											
		8 ft. Constant Height		10 ft. Constant Height		14 ft. Constant Height		18 ft. Constant Height		20 ft. Constant Height		Optimized Height 8-10 ft. (Ave 8.8 ft.)	
		Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]	Leq	IL[3]
P-41 (0.5)	69.5	62.5	7	61.6	8	59.9	10	58.6	11	57.4	12	62.5	7
P-41B(0.5)	70.2	63.8	6	61.6	8	61.1	8	59.9	10	58.7	12	63.5	7
Barrier Length (Ft.)		991		991		991		991		991		900	
Area (square ft.), from TNM[4]		7,929		9,911		13,876		17,841		19,823		7,502	
Total No. of Benefitted ERUs (5 dBA)		1		1		1		1		1		1	
Square Ft. Per Benefitted Receptor (SF/BR)		**7,929**		**9,911**		**13,876**		**17,841**		**19,823**		**7,502**	

LEGEND

Impacted[2]

1. *A Receptor Number beginning with "M" represents a short-term measured location, Receptor Number beginning with "T" represents a long-term measured location and a Receptor Number beginning with "P" represents a modeled receptor only.*
2. *Impacted receptors are those that that warrant the investigation of noise abatement due to noise impacts. This occurs where the predicted noise levels meet any of the following criteria:*
   - *Predicted Highway Traffic Noise levels equal or exceed 66 dB(A).*
   - *Predicted Highway Traffic Noise substantially exceed (by 10 dB(A) or more) the existing Highway Traffic Noise levels.*
3. *IL: Insertion Loss.*
4. *Square footage indicated is based upon its length and its height from the finished ground elevation at the base of the barrier to its top elevation (acoustical profile line).*
5. *Noise values, comparisons, and insertion losses are calculated to the tenth of a dB(A) and then rounded for presentation purposes.*

Figure 4.H Barrier 11, Noise Barrier Analysis: Square Footage of Abatement Per BR Unit

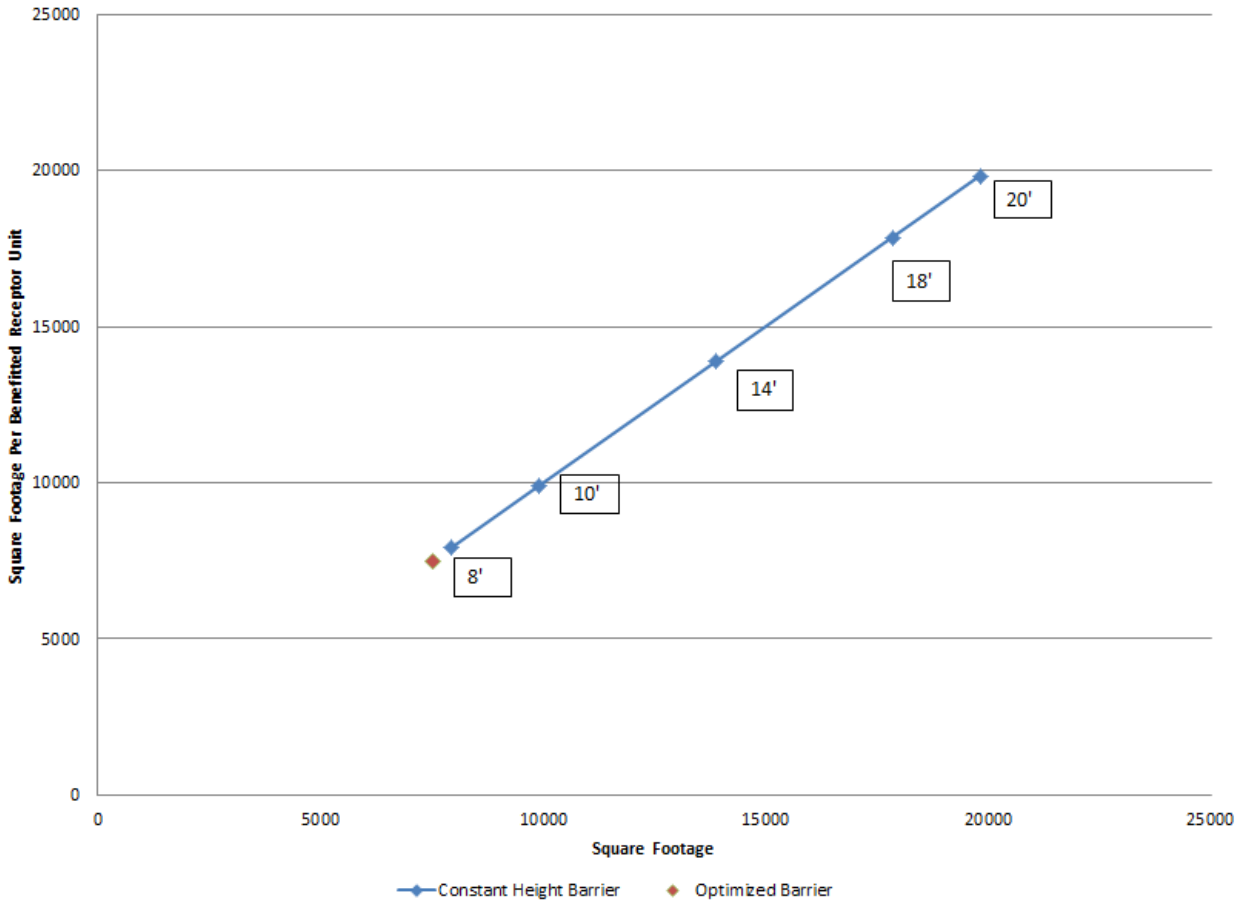

Table 4.W Optimized Barrier 11, Policy Feasibility Criteria Evaluation	
Feasibility Criteria	
1.	Can a Highway Traffic Noise reduction of at least 5 dB(A) be achieved at the majority of the impacted Receptor Units (i.e. 50% or greater)? **(YES)**
2.	Can the noise barrier be designed and physically constructed at the proposed location? **(YES)**
3.	Can the noise barrier be constructed without causing a safety problem? **(YES)**
4.	Can the noise barrier be constructed without restricting access to vehicular to pedestrian travel? **(YES)**
5.	Can the noise barrier be constructed in a manner that allows for required maintenance & operations? **(YES)**
6.	Can the noise barrier be constructed in a manner that allows utilities to adequately function? **(YES)**
7.	Can the noise barrier be constructed in a manner that allows drainage features to adequately function? **(YES)**
Source: Pub. No. 24, April 2011	**(YES)/(NO)** –Answer for this Turnpike Reconstruction Project

Table 4.X Optimized Barrier 11, Policy Reasonableness Criteria Evaluation	
Reasonableness Criteria	
1.	Do at least 50% of benefitted receptor unit owners and renters desire the noise barrier? **(Unknown)**
2.	Is the Square Footage Per Benefitted Receptor Evaluation equal to or less than 2,000 SF/BR? **(NO)**
3.	Does at least one benefitted receptor receive a 7dB(A) or greater noise reduction? **(YES)**
4.	Does the barrier provide an insertion loss of at least 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(NO)**
5.	Does the barrier provide an insertion loss greater than 7 dB(A) for more than 1 receptor while still conforming to the Max SF/BR value of 2,000 and a "point of diminishing returns" evaluation? **(NO)**
6.	Does the barrier reduce future exterior levels to the low 60-decible range for Category B & C receptors and the upper 60-decible range for Category E receptors? **(YES)**
7.	Does the barrier reduce design year noise levels back to existing levels? **(YES)**
Source: Pub. No. 24, April 2011 *Note: All "Unknown" criteria will be determined during final design.*	

K. Construction Impacts

During construction of the noise barriers and the Turnpike Mainline, the residences closest to the construction area will likely be impacted by construction noise as a result of the project. In order to minimize the impact to the residential community, all proposed construction will comply with applicable Federal, State and Local noise control regulations, as well as the Occupational Safety and Health Act of 1970. Where practicable, construction activity should be confined to time periods that will create a minimum amount of disturbance to the community.

The Contractor should use only equipment adapted to operate with the least possible noise, and should conduct his work so that annoyance to occupants of nearby property and the general public will be reduced to a minimum.

SECTION 5 – PUBLIC INVOLVEMENT

Every effort to involve the local officials and affected communities is being made throughout the Pennsylvania Turnpike Total Reconstruction (Milepost 128-133.5) preliminary and final design process. The PTC Public Meeting Guide document dated December 2011 and the PennDOT Publication No. 295 "Public Involvement Handbook" will be used as a guide for the public involvement process. The results of this Preliminary Technical Noise Analysis will be used to present to the public in October 2012 at the Open House Plans Display and feedback will be documented to be incorporated into the Final Design Technical Noise Report. All affected community voting will be conducted during Final Design using the procedures outlined in Publication No. 24 Section 6.4.

The Pennsylvania Turnpike Commission is committed to the construction of warranted, feasible, and reasonable Highway Traffic Noise Abatement measures at noise impacted locations, contingent upon the following conditions: detailed noise analyses conducted during the Final Design process; analysis and determination of the Feasibility and Reasonableness of Highway Traffic Noise Abatement measures, methodology and criteria; community input regarding desires, types, heights, locations, and aesthetic considerations; preferences regarding compatibility with adjacent land uses; and safety and engineering aspects as related to the roadway user and the adjacent property owner. During Final Design, the exact location, abatement types, aesthetic treatments and right-of-way requirements will be determined and will be a part of the final recommendation for Highway Traffic Noise abatement.

After the Open House Plans Display in October 2012 is completed and the Final Noise Analysis process begins. As part of the final analysis highway traffic noise studies will be performed for undeveloped lands in addition to the analysis that has already been done for the developed lands. At this time there is no future 'permitted' undeveloped land within the project study area, and therefore the analysis will only include a determination of the distance to the impact threshold for each land use activity category, which will then aid local planning officials.

SECTION 6 - REFERENCES

A. Title 23, United States Code of Federal Regulations, Part 772, (23 CFR) entitled Procedures for Abatement of Highway Traffic Noise and Construction Noise. National Archives and Records Administration – July 13, 2010.

B. Highway Traffic Noise Analysis and Abatement, Policy and Guidance. USDOT, FHWA – June, 1995.

C. Pennsylvania Department of Transportation Project Level Highway Traffic Noise Handbook. Revised Publication No. 24 – April, 2011.

SECTION 7 – MAPS

Maps 1 through 5 – Monitored Results – 2006 Existing Conditions

Maps 6 through 10 – Impact Analysis Maps, 2040 Build Conditions

Maps 11 through 15 – Noise Barrier Maps, 2040 Build Conditions